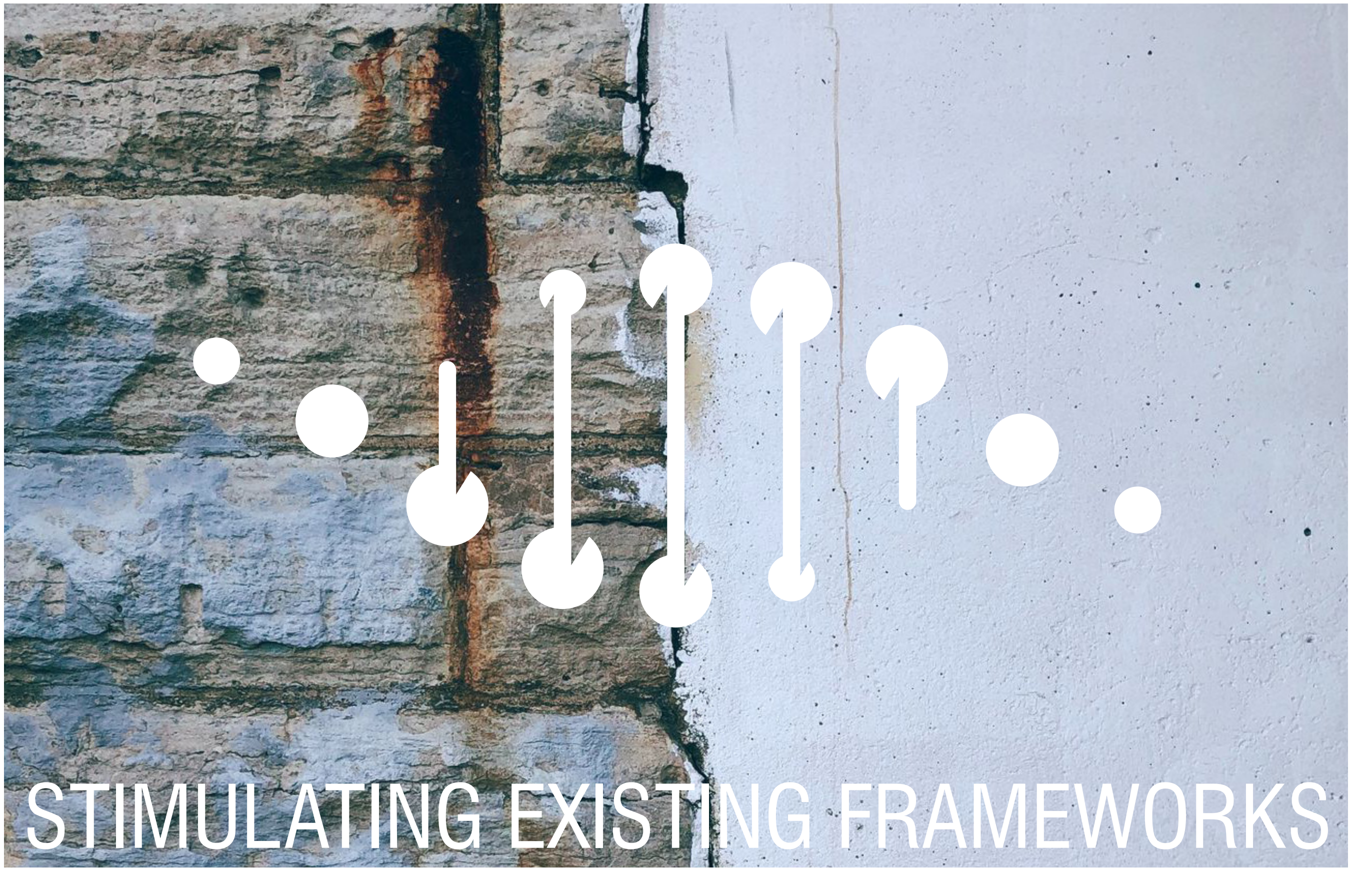

STIMULATING EXISTING FRAMEWORKS

STIMULATING EXISTING FRAMEWORKS .

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

by

Cooper D. Johnson

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

North Dakota State University Libraries Addendum

May 2021
Fargo, North Dakota

TABLE OF CONTENTS .

LIST OF TABLES AND FIGURES .

Figure 01 | *Kolstrand Building*, Image credited to [Graham Baba Architects]

THESIS ABSTRACT .

With existing architectural structures all over the world, an unlucky portion are often abandoned and demolished within time to be replaced by a newly constructed building. The reality of this, however, is the new construction buildings that are erected above the previous building locations aren't built to maintain a long life, the process of these new buildings is only wasting an opportunity that could have been taken to rivitalize these existing structures that have been sitting lifeless for years.

The theoretical premise in this design thesis, is how can an existing building be repurposed in a way that matches or exceeds the functionality and performance of a newly constructed building at the same geographical location, with the precaution of limiting demolition / construction additions to the existing structure? In efforts to answer this question, extensive qualitative, correlational and simulation research, with additional case study research will be conducted to format a design for a revitalized mixed-use entertainment establishment from an existing property owned through the Fargo Park District.

Figure 02 | *Demolished Building Materials*, Image credited to [Kaley Overstreet]

NARRATIVE OF THE THEORETICAL ASPECT OF THE THESIS .

It is a growing practice to renovate and add-on to existing projects within the career field of architecture, but this is usually dependent on the state of the existing buildings on a project-to-project basis. There are a multitude of existing buildings that have been abandoned for many years in nearly every city, it is an issue that many people do not have the courage to revive those buildings, as the extra work to do so may heavily exceed the process of removing it entirely to rebuild a new piece of architecture in its place.

With older buildings serving previous purposes of housing, refinerys, storage, etc., but now sit empty and abandoned while lining the streets of many cities and small towns, like Fargo and surrounding areas. The question that must be asked if many of these buildings are in the condition that is worth the effort to save them and bring new life? The underlying premise present in this design thesis is looking for how these existing buildings can be brought new life while providing the same performance of a newly constructed building. With the added question of what is the most balanced process to renovate these buildings? many of these properties are no where near up to building performance compared to newly constructed projects, with many having exterior damage compromising the seal from interior to exterior.

This thesis premise is aimed to find out the best balance between demolition and repurposing within an older building, rather than completely demolishing the existing project and having a completely new designed building place on top of its location. This is of importance within the context of these historical buildings because not only is it a waste of materials, time, and money, but these existing buildings have the potential to create unique architectural spaces that cannot be replicated elsewhere, without the precense of that specific architectural existence.

"In fact, the architectural character of the building that seeks the maintain of the building's authenticity, takes precedence over the type of use. However, if architectural reuse targets urban regeneration and sustainability, it would be an effective strategy to ensure the sustainability of historic buildings and encourage urban revitalization of the city (DJEBBOUR & BIARA, 2020)."

In order for this thesis premise to accurately compare a good balance to demolition and restoration, the process of the existing embodied energy within the materials must be analyzed and studied. This analysis of the embodied energy, construction emissions, and other factors that may influence the effectiveness of this process will be implemented in the research process to deem the best possible strategy to maintain the proposed design solution.

Figure 03 | *Site Visit*

THE PROJECT TYPOLOGY .

Currently the existing buildings of the selected project site is for conducting maintenance and providing storage for the Fargo Park District, which will be explored further into the proposal. However, with the intent of designing for pedestrian foot traffic, and the integration / connection with the site to the surrounding area, these factors will highly influnece the selected typology and will need a typology that will compliment these factors.

The intended project typology for this design thesis, through the revitalization of an existing architectural structure, will be a mixed-use entertainment establishment, as this typology is deemed a correct choice for the desired factors for this design solution.

This design typology will allow for the continuation of managment through the Fargo Park District with this property, transferring this development from a maintenance / storage facility to an entertainment venue with a brewpub, brewery & restaurant. With the addition of a large property left over from the site buildings, the opportunity for extensive site development is available in the addition of the existing building restoration. This will supplement the entertainment venue typology allowing for a large amount of pedestrian traffic around the site from the surrounding area.

MAJOR PROJECT ELEMENTS .

BREWPUB
- located within the existing building
- exterior seating spaces available
- street side location
- privately owned and operated space

BREWERY
- located within the existing building
- requires adequate ceiling height for equipment
- production for brewpub
- loading dock necessity
- privately owned and operated space

RESTAURANT
- located on street level
- shared connection to brewpub
- privately owned and operated space

BEER GARDEN
- located on exterior of site
- public space accessibly to brewpub / restaurant attendees

FARMER'S MARKET
- located on exterior of site
- separate from existing building

FARGO PARK DISTRICT OFFICES
- located near maintenance storage space
- several offices for management of spaces on site / events

STORAGE
- supplementary for spaces / uses of the site

PARKING AREA
- located separately from main building location
- supplementary of the site uses

EXTERIOR GATHERING SPACES
- supplementary of the brewery & boutique spaces
- located in proximity the farmers market space

USER / CLIENT DESCRIPTION .

USER GROUPS

Fargo Park District Employees / Maintenance	3 - 5 TOTAL
Brewpub / Brewery & Restaurant Employees	10 - 15 TOTAL
Farmers Market Employees	*1 - 2 TOTAL
Farmers Market Users	*1 - 50 TOTAL
Exterior Gathering Space Users	*1 - 20 TOTAL

CONSIDERATIONS

Office:
- extended parking
- lunch breaks
- break room spaces
- separation from remaining user groups

Brewpub / Brewery / Restaurant:
- extended parking
- restroom access
- loading dock requirements
- break room spaces
- storage
- seating [exterior & interior]

Farmers Market:
- parking
- storage
- street accessibility
- separate from building uses

** Varies on schedule / time of year*

INTERACTION NET .

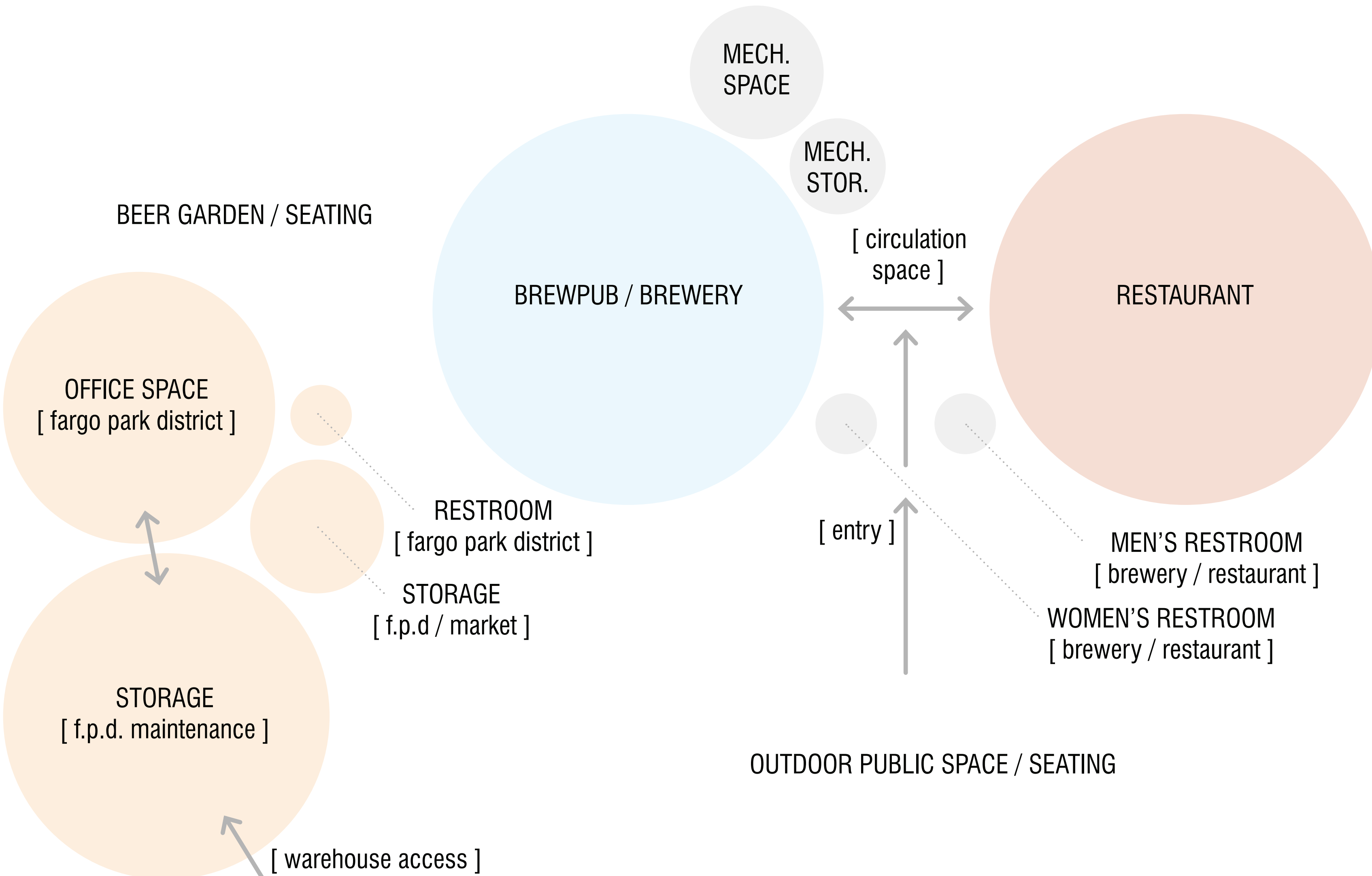


Figure 04 | *Interaction Net*

SPACE ALLOCATION TABLE .

EXISTING BUILDING SQUARE FOOTAGE

BUILDING 1 = ~10,360 SQFT
SPACE AVAILABE FOR A 2ND LEVEL = ~3,760 SQFT
BUILDING 2 = ~12,200 SQFT
BUILDING 3 = ~2,860 SQFT

TOTAL = 29,180 SQFT [EST. 30,000 SQFT FOR ESTIMATES]

ARCHITECTURAL SPACES	PERCENT ALLOCATION	SQUARE FOOTAGE [ROUGH ESTIMATES]
brewpub / brewery production	24 %	7,200 SQFT
restaurant	24 %	7,200 SQFT
storage [fargo park district maintenance]	18 %	5,400 SQFT
office space [fargo park district]	14 %	4,200 SQFT
mechanical space	5 %	1,500 SQFT
storage [brewery]	5 %	1,500 SQFT
storage [fargo park district / market]	4 %	1,200 SQFT
kitchen [restaurant]	2 %	600 SQFT
mechanical storage space	2 %	600 SQFT
misc. [brewery]	0.5 %	150 SQFT
men's restroom [brewery / restaurant]	0.5 %	150 SQFT
women's restroom [brewery / restaurant]	0.5 %	150 SQFT
restroom [fargo park district]	0.5 %	150 SQFT
outdoor public space / seating	n / a	n / a
exterior public space [market / events]	n / a	n / a
beer garden	n / a	n / a

** Square footage used for space allocation estimated from likely additions of space in final design added to existing square footage*
** changes may be present in final design to lead to variances in the information shown*

ADJACENCY MATRIX .

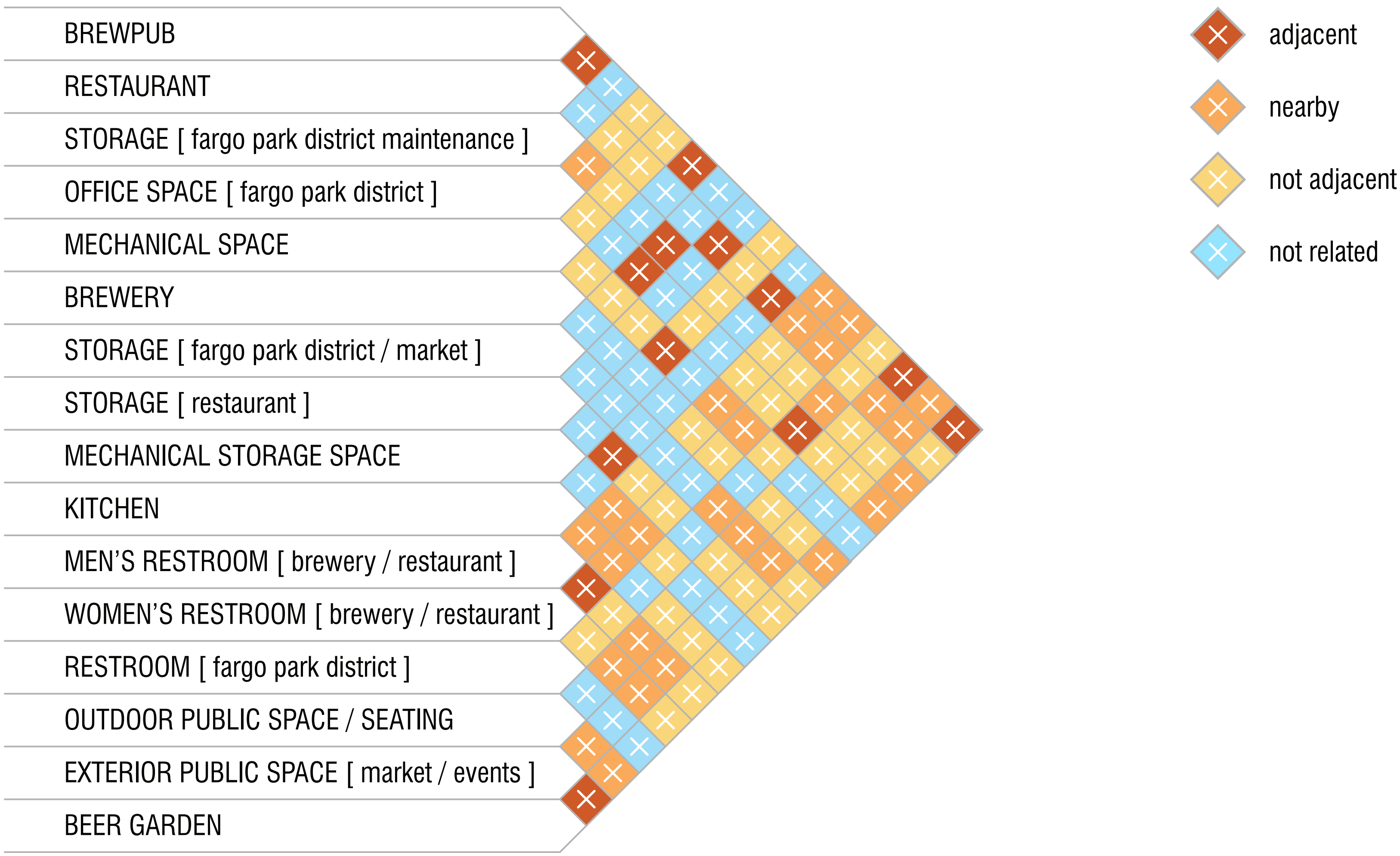


Figure 05 | *Adjacency Matrix*


Figure 06 | *Site Visit*

Figure 07 | City of *Fargo, North Dakota* [1202 7th Avenue North]

Figure 08 | *Downtown Fargo* [1202 7th Avenue North]

Figure 09 | *Proposed Site* [1202 7th Avenue North]

THE SITE .

The selected site for this project is located at 1202 7th Avenue North in Fargo North Dakota, currently acting as the Fargo Park District's maintenance and storage facility, is approximately 93,218 square feet (2.14 acres) of land area. Currently this site has three separate existing entities. The primary being the NE structure, the existing building of interest for this design proposal, being constructed roughly around 1918. The second building of the site is an expansion to the Western side of the property, and the third being another warehouse separated from the first two buildings, that lies at the Southern end of the property.

This site is of interest for this design proposal from the main historic existing building of the site. This building has a unique character and architectural elements that allows for the opportunity to create a unique architectural building for the surrounding area. What also makes this site particularily interesting is the fact of how large it actually is, with how little building footprint sits occupied per site area. This allows for a large opportunity for site development to supplement the existing buildings to create a cohesive area for the surrounding neighborhood, increasing the pedestrian traffic of the area to this site.

Figure 10 | *Site Visit*

Figure 11 | *Site Visit*

Figure 12 | *Site Visit*

Figure 13 | *Site Visit*

Figure 14 | *Site Visit*

Figure 15 | *Site Visit*

THE PROJECT EMPHASIS .

1. Existing buildings have the opportunity to create unique architectural spaces that cannot be replicated elsewhere without the same existing typology to do so.

As discussed earlier, and shown through the precedent research, existing buildings are not often taken down to allow for a new buildng to take its place, because these buildings provide an experience that is unique to that specific building. Great lengths will be taken to create the most functional design for the existing building in this design solution, so that the character of it is noticeable to the users.

2. Integration of sustainable design strategies into the existing building.

Sustainable design is important in any design project, however, with demolition taken into account, redistributing excess demolished material to newly design features will be an approach taken throughout this design solution.

3. Effective design to take notice of the embodied energy of the existing building materials, as well as the materials of any newly constructed additions.

Similar to the previous point, finding the balance between demolition and renovation will be important not to overly remove the existing buildings presence, from an economical and sustainable position.

GOALS OF THE THESIS PROJECT .

The academic, professional and personal goals of the project.

1. [*Academic*] Effectively compile the knowledge gained from the last four years, and the knowledge from the research phase to create a functional design solution.

2. [*Academic*] Create a design that fits within the site, an important factor within an adaptive reuse project design.

3. [*Academic*] Create a design solution that can educate others on the process of an adaptive reuse project.

4. [*Professional*] Increase proficiency in BIM software through development of design solution project.

5. [*Professional*] Understand the process of document existing site conditions for replicating in BIM software, through construction drawings and site analysis / documentation.

6. [*Professional*] Increase proficiency in communication with client personal for access to existing site, design solution possibilities, etc.

7. [*Personal*] Have enough topical knowledge of the adaptive reuse project to create a unique project design.

8. [*Personal*] Increase skills in certain BIM softwares, in rendering techniques, and / or modeling techniques.

Figure 16 | *Site Visit*

A PLAN FOR PROCEEDING .

Upon completion of this design proposal document, and the program phase of the thesis design solution, the next step will be to coordinate with the Fargo Park District to set up a schedule to gather information on the selected site. With this information, and through the process of searching for construction documents of the existing buildings, an accurate base model will be available at my disposal once developed, which is a necessity for this design project.

The theoretical premise must be developed an provided research to, in order to effectively manifest a design solution. Looking into other case studies of adaptive reuse projects, and researching the existing buildings and visiting the selected site will create a framework to understand the path to take in the design solution.

Researching the history of the existing building will be a large endevour required to understand what is required for renovation of the design solution. Through coordination with the Fargo Park District, and the City of Fargo alike, the process of searching for historical evidence and construction drawings is already underway.

Extensive site analysis will be required to create an accurate site depiction as mentioned earlier. The process of site documentation will be increasingly important if the existing construction documents cannot be sourced for the design solution's use. Through coordination with site owners, several visits will be required to analyze the site. Through conversation with the owners of the site, and further research of case studies, a basic programmic set of requirements may be found to set for this design solution.

DEFINITION OF RESEARCH METHODOLOGY .

Systematic set of methods used to arrive at a scientific research conclusion

1. Theoretical Premise

2. Topic research leading to discovery of new ideas and tools to help you answer related questions

3. Testing of new ideas and tools

4. Formulation of your own design options

5. Formulate those opinions into a proposed intervention

DOCUMENTATION OF THE DESIGN PROCESS .

DOCUMENTATION COMPILATION / Documentation creation

MEDIUM FOR DESIGN INVESTIGATION:
Computer representation
Hand sketching
Hand modeling

SOFTWARE FOR INVESTIGATION:
Autodesk Revit
Autodesk AutoCAD
Rhinoceros 5.0
Sketchup 2020
Google Earth Pro

SOFTWARE FOR REPRESENTATION:
Adobe Photoshop
Adobe Illustrator
Adobe Indesign

DESIGN PRESERVATION METHODS:
- Creation / investigation of representation
- Feedback from advisor(s)
- Research material documented
- notes / sketches preserved in sketch book, dated and referenced later
- Computer files backed up weekly via Google Drive
- Thesis book updated weekly as per schedule
- Drawings / diagrams created upon acquisition in references section

PUBLICATION OF MATERIAL:
Relevant material will be recorded and credited in final thesis book available:
1. *NDSU Institutional Respository*
2. *Hard cover book format*

DOCUMENTATION ORGANIZATION:
File Labeling: Year_Johnson_Thesis_Phase_Name
Example: 2020_Johnson_Thesis_Site Anaysis_Site Plan

Figure 17 | *Site Visit*

THESIS PROJECT SCHEDULE .

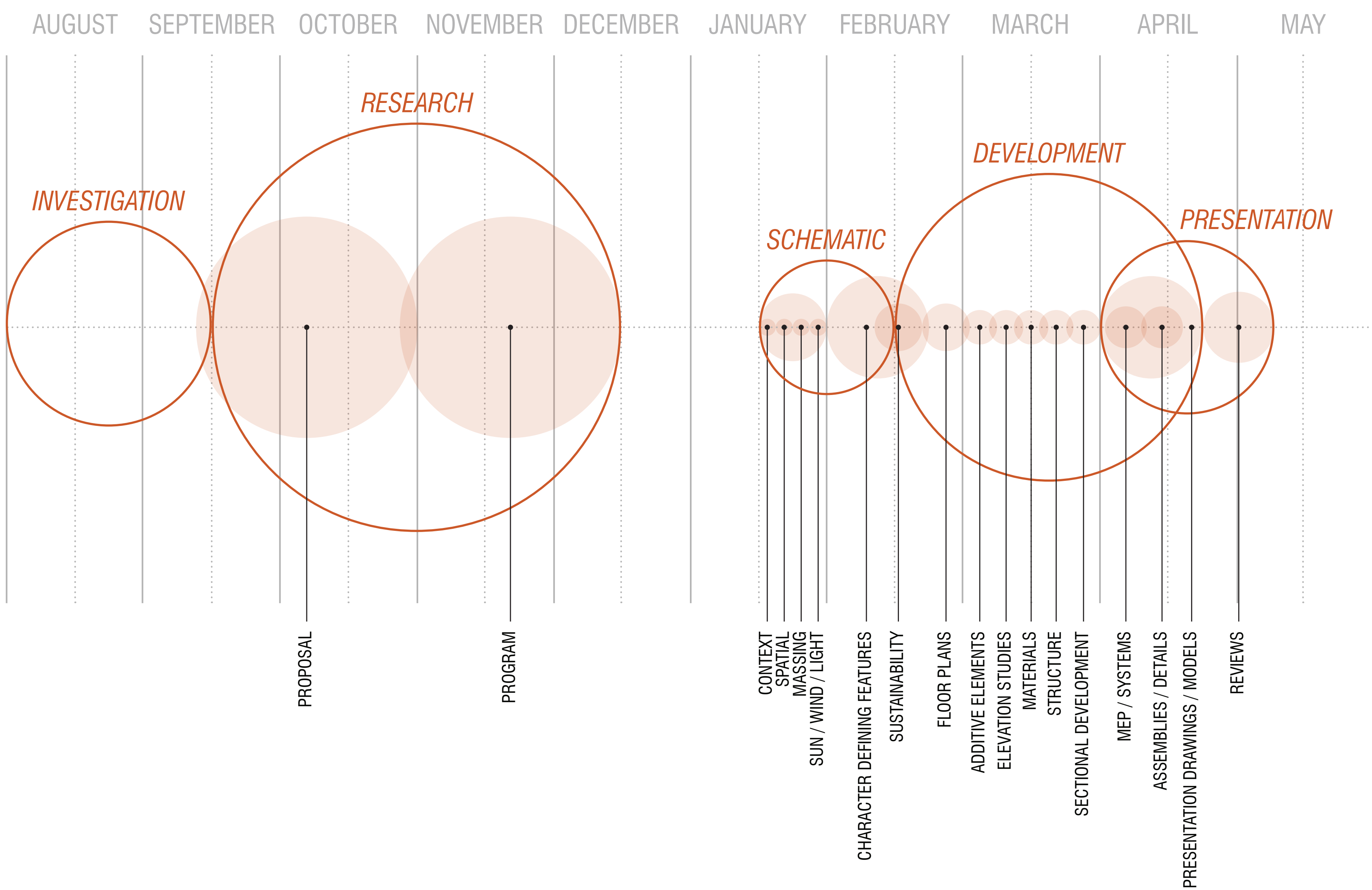


Figure 18 | *Thesis Project Schedule*

RESULTS FROM THEORETICAL PREMISE .

Throughout this research plan process, it was a necessity to search for articles that give a process to analyzing embodied energy of products, and how to quantify their values to influence the design process in an adaptive reuse setting. Through the several articles that were reviewed, many different processes have been internalized for possible future use in this design thesis, being processes such as conducting life cycle assessments and annualized embodied energy of materials, creating a modular design for more possible maintenance and renovation, the recycle and reuse of existing project materials, and conducting emergy analysis of the existing building being the few that were covered in the selected articles. On top of these methodologies to adaptive reuse, these articles also cover essential information towards answering the very question this design thesis aims to answer. To reiterate, this thesis question asks, how can an existing building be repurposed in a way that matches of exceeds the functionality and performance of a newly constructed building at the same geographical location, with the precaution of limiting unnecessary demolition and construction to the existing structure? The three scholarly articles reviewed for this thesis, were selected to get important information that aids in answering this question, through the form of adaptive reuse topic-based information, embodied energy analysis methods, and relative design strategies. These articles where chosen to answer broad expanses that an adaptive reuse project can cover, but they relate as one in the sense that they all provide information to support the concept that adaptive reuse strategies can significantly increase the sustainability and economic benefits a project can have.

ADAPTIVE REUSE STRATEGY

With this thesis being an adaptive reuse design solution, information on the process of this strategy was the most significant research needed for a broad sense of how it affects factors resulted from the building, such as economics, sustainability, and environmental impacts. With the built environment being responsible for a high portion of the worlds natural resource consumption, and producer of negative impacts on the environment, it is an important issue of implementing more adaptive reuse strategies in effort to minimize these effects. With limiting natural resource use being a significant reason for implementing adaptive reuse strategies, this limitation of the introduction of new materials into buildings allows for less impact on the environment compared to a new construction building. The opportunity of recycling and reusing materials through adaptive reuse projects is just another way to increase the sustainability and economic benefits of the project. This type of limitation furthermore reduces the amount of environmental impacts caused by an individual project from less extraction and manufacturing efforts needed to produce the new materials. Material selection for projects is often a deciding factor in the ability for the project to perform as time progresses, so selecting appropriate materials that provide that certainty is an important design decision during a project's design stages, whether adaptive reuse or new building construction. Adaptive reuse projects are often superior to new construction projects as they do find significantly more amounts of environmental "savings" through even minimal maintenance of building subsystems. With a decreased amount of energy needed for new construction materials and equipment, there are substantial benefits for adaptive reuse projects in terms of sustainability and economics. With economics being another important factor in the reasoning for the adaptive reuse strategy, as this type of project typology often leads to a significant decrease in project cost, as the process of renovation and preservation is often significantly cheaper than the process of a new building construction. As stated earlier, the process of reducing new materials into a project allows for a significantly cheaper project as adaptive reuse projects primarily focus on using an existing space for a new use. These types of projects are important for economic stimulation as in most cases adaptive reuse projects find themselves increasing property values of the building itself, neighboring buildings, while also increasing the amount of building usage which increases the amount of income this facility could have, especially compared to its economic opportunities given before the adaptive reuse implementation. One of the most significant factors of adaptive reuse, and more defining principles to measure the success of an adaptive reuse project, is the concept of embodied energy. In order to effectively understand how the embodied energy of a building impacts the environment, certain methodologies for embodied energy need to be conducted for an accurate analysis.

EMBODIED ENERGY METHODOLOGIES

With embodied energy analysis being an important process for analyzing adaptive reuse projects, certain types of methodologies are covered in the following articles for understanding this process, which are important for this design thesis as these types of processes will need to be conducted for getting a sustainable final design. Embodied energy is defined as being all the energy consumed through all life stages of a product or material. The most common process of quantifying embodied energy is through conducting a life cycle analysis of materials and/or building subsystems, which helps in defining the impact each subsystem has on both the cost of the building as well as the environmental impact it provides. A life cycle analysis process allows for certain design decisions to be made early in an adaptive reuse project, which can help decide which areas of the existing building should be maintained in effort to limit wasting the already present embodied energy. Another process that helps define the embodied energy of a project is its annualized embodied energy, which takes the embodied energy of a product and disperses it across that products lifespan to analyze the relationship between the two values to another parameter of the product such as its area or volume. This is important because if sustainability is a desired factor in the product or buildings design, having that embodied energy properly used and justified throughout the lifespan increases its sustainable efforts. Another process, "emergy", is defined a being a broad approach which compares the process of building construction, material circulation, as well as energy hierarchy. This process views buildings as the sum of their encompassed material's embodied energy values, and as the building progresses in its lifespan these embodied energy values disperse into the environment. This type of methodology takes into account the lifespan capability of a project, so it can be acknowledged that increased initial cost of a product of building does not matter, as long as that increased cost correlates to a more durable and dependent product, which would in turn increase the lifespan, canceling out the initial investment for said product. This type of methodology stimulates the idea of providing more thought to initial design decisions, and choosing higher quality, longer lifespan materials, as them being able to require less maintenance throughout their lifespan compared to a cheaper material creates a longer lifespan building, leading to less wasted embodied energy by the end of its lifespan.

RELATION TO THE THEORETICAL PREMISE

From analyzing these articles, it must be deciding on how they will affect the design process of this thesis solution. It is shown through the information provided that adaptive reuse projects provide a much more sustainable and economically friendly process compared to a new construction building, however, the processes to determine that true must be implemented to suggest the same outcome for this thesis design. The findings in these articles suggest that this thesis question to be true, the analysis of embodied energy in the existing structures must be conducted from processes like the ones described, in order to provide enough evidence that the final adaptive reuse process created a more sustainable design compared to a new construction building. By implementing these strategies in the design process, early design decisions will be able to be made to figure out which areas of the existing project site can be modified or maintained to create a efficient dispersal of the embodied energy present in the building.

LITERATURE REVIEW .

TITLE: *"A methodology to analyze the net environmental impacts and building's cost performance of an adaptive reuse project: a case study of the Waterloo County Courthouse renovations"*

AUTHOR(S): Benjamin Sanchez · Mansour Esnaashary Esfahani · Carl Haas

INTRODUCTION

This article published through *Environment Systems and Decisions* (2019) provides extremely valuable information that aids in supporting the questions that my thesis aims to answer. The question my thesis aims to answer requires information about factors of building construction processes, such as embodied energy of the materials present, environmental impacts of construction processes, economic impacts of these processes, and so on to be addressed for an absolute analysis to be performed. This article goes into research providing evidence on the sustainable efforts that adaptive reuse typologies can provide, in efforts to give a substantial set of background information to the reader before going into their specific adaptive reuse case study. The information provided within this article provides the answers to the specific factors that this thesis question requires and will be gone into greater detail further into this review. It should note that this article does not cover any strategies of an adaptive reuse project related to design specifically, only general information that can be specified to the adaptive reuse typology as a whole. This article provides a strong backing argument that adaptive reuse design of existing buildings is both a sustainable and economical method of construction that exceeds these factors in comparison to new building construction.

BACKGROUND

With buildings becoming more technologically advanced each year, the strategies to construct them require more effort, money, and in many cases more materials depending on the design. Unaware to many, the process of construction for buildings is a primary factor of natural resource consumption, as well as producing negative environmental impacts (Unalan et al. 2016; IPCC 2015; Huovila 2007; Kibert 2007 as cited in Sanchez et al., 2019, p. 419). With concern of the environment for many, only a select few look towards construction practices of buildings as a source of change for the better, as it is not one of the primarily targeted areas people point to for the source of environmental issues. Efficient use of natural resources is one of the most practical means in practicing sustainability in urban settlements (UNEP, 2016 as cited in Sanchez et al., 2019, p. 420). Langston et al. (2008), Unalan et al. (2016), and Liu et al. (2018) provide evidence being, "the building industry is responsible for around 30% of global annual Greenhouse Gas (GHG) emissions, 40% of energy consumption, 32% of world resource depletion, 12% of water consumption, and 40% of waste to landfill" (Sanchez et al., 2019, p. 420). Adaptive reuse projects are not often conducted in hopes of having a positive environmental impact, rather they are more often than not done because they provide a unique and historic space that would hopefully provide an increased desire for others to use the space. However, if these sorts of unique spaces are not desired for a project, a new building construction is often preferred to a renovated space. This, however, is not a trend that provides any benefit, because Mohamed et al. (2017), Conejos (2013), and Langston (2008) provide information of studies that recognize adaptive reuse project typologies of providing more sustainability and economic benefits compared to new construction. It is often looked over by advocates of an architectural project, which is why Sanchez et al. (2019) desire a strategy which is widely accepted that could serve the purpose of defining the very sustainable benefits an adaptive reuse project provides, displayed in a way that the general public could understand.

QUANTIFYING ADAPTIVE REUSE

With a process needed to conduct this study, a "Life Cycle Assessment" (LCA) was performed for each subsequent building system of an adaptive reuse building case study, to provide the relevance of each system to show the influence each had on the environmental impact and building cost due to adaptive reuse of the case study. This was then compared to new building construction to help in the aid of understanding the thought process that is present in adaptive reuse building projects (Sanchez et al., 2019, p. 420). This process provides a pathway that could be taken upon for the current project for this design thesis. By individually analyzing separate building systems, a process of elimination could take place to identify portions of the existing project that should be maintained to prevent unnecessary demolition that would increase environmental impacts. Through this process of the case study, Sanchez et al. (2019) have found the following …

> There is a significant amount of environmental savings through the adaptive reuse of the building structure, around 35-38% decrease for Primary Energy Demand (PED), Global Warming Potential (GWP), and Water Consumption (WC). It was also revealed in the budget analysis that there was around a 70% reduction of the bare construction cost and redistribution of the investment on materials and equipment. It is also shown that a decrease of the investment on construction materials, and an increase for equipment for this adaptive reuse case study, providing evidence for economic benefits of adaptive reuse resulting from a shift from resource-based economy towards a Circular Economy in the construction industry. (p. 420).

Through this analysis done to this case study, Sanchez et al. (2019) were able to show through their research, that there is a significant backing to the argument that adaptive reuse of buildings provides higher sustainability and economic benefits than those of new construction, even with only minimal preservation of a building through major subsystems like the building structure.

One of the largest factors present in the success of adaptive reuse projects is the conservation of embodied energy. Liu et al. (2018) states that, "The energy consumed in all the life cycle stages, excluding the operational stage, is collectively stated as embodied energy" (Sanchez et al., 2019, p. 421). One method to help aid the process of understanding and quantifying embodied energy of construction materials, as discussed briefly previously, is life cycle assessment (LCA). "LCA is stated as being a methodology that accounts for the materials and energy involved in a product or service along its life cycle, and then measures the associated environmental impacts. An LCA shall include definition of goal and scope, inventory analysis, impact assessment, and interpretation of results" (ISO, 1997 as cited in Sanchez et al., 2019, p.421). This type of integration and analysis of this design thesis' existing structures would allow for important decisions to be made early on in the design process, to determine which areas of the existing buildings would result in heavier environmental impacts compared to others if removed, leading to the decisions to maintain those elements in hopes of creating less embodied energy waste through the adaptive reuse process.

ECONOMICS OF ADAPTIVE REUSE

Economics is another large role that proves adaptive reuse a sustainable and practical architectural practice, as in nearly any case the cost to renovate the existing buildings costs less than the process of a new construction. Boyko et al. (2006) notes that adaptive reuse as its defined meets the standards of a sustainable practice as it covers the three pillars of sustainability, being social, economic, and environmental sustainability (as cited in Sanchez et al., 2019, p. 422). It can be said that any case of adaptive reuse aims to create a more pleasing architectural space compared to the existing conditions, all in hopes to create a more socially pleasing condition for society. Often cases of adaptive reuse show a rundown building in an economically struggling area, however the implementation of adaptive reuse integration of buildings typical for this typology increases the property value of the building as well as adjacent buildings within its proximity, enhancing their economic viability, while simultaneously increasing tourist attraction, leading to an increased income from these older historic buildings being converted to more desirable, economic opportunities (Aigwi et al., 2018; Esther Yakubu et al., 2017; Matthews et al., 2016 as cited in Sanchez et al., 2019, p. 422).

CONCLUSION FROM ANALYSIS

From analyzing this article, it gives a clear pathway of how adaptive reuse can provide sustainable and economic benefits compared to a new building construction. It is not a question that building construction is a large role in environmental and natural resource impact, so looking for strategies to combat the consequences should be at the forefront of every design, regardless if it is an adaptive reuse project or not. It is a large issue in the building industry today to create a building for a fixed period of time, only to playout the intended function within. However, with strategies such as adaptive reuse, it should be more common to construct buildings that can hold a longer life expectancy, in hopes that one day when the initial function within ends, that the building may be adapted to a new unrelated function, avoiding the unnecessary waste of resources used to create a new building, with another short life expectancy, only to repeat this cycle of waste. The study conducted in this article provides a very clear and impressive analysis of an adaptive reuse project, which is a process that could be replicated for this design thesis, in hopes of creating a similar outcome of success in terms of sustainability and economics. It was mentioned in this article, that the building industry would be much more sustainable and economically beneficial if it was based in a circular economy more-so than a resource-based economy. This idea will be present at all stages of the design development of this design thesis, posing the question of how can any demolished materials be repurposed into new design components to avoid the wasting of those resources, in efforts to create a more sustainable and economic design?

LITERATURE REVIEW .

TITLE: *"Analysis of embodied energy and product lifespan: the potential embodied power sustainability indicator"*
AUTHOR(S): Julian Fernando Ordoñez Duran · Josep M. Chimenos · Mercè Segarra · Paola Andrea de Antonio Boada · Joao Carlos Espindola Ferreira

INTRODUCTION

This article published through *Clean Technologies and Environmental Policy* (2020) goes into information about the embodied energy all products have, and how that energy and selection of materials may have a direct relationship on the products lifespan. After they cover the information related to this topic, they conduct a case study on the example of smart phones to produce information on their chosen process, which can be directly related and applied to products as large as buildings and their constructed materials. This article also covers various topics regarding embodied energy, such as life cycle assessment (LCA), annualized embodied energy (AEE), and certain aspects of product design that could lead to an increased lifespan of the products, such as analyzing possible opportunity costs when designing the products in hopes to create more reliability along the products lifespan. It should be reiterated that this article is not particular to building construction, and only mentions it only a few times, but is a broader respect for product design with everyday items. Regardless, the information analyzed in this article is more than capable to being translated into designing on buildings, either adaptive reuse or new building construction. It is an issue today that buildings are constructed with very short lifespans, only looking for the building to carry out the initial intended function, without any thought going into what happens after that function ends. This article gives many supporting methodologies to showcase that by providing a pathway for a new building construction to implement an adaptive reuse design in the future through significant early design process decisions, will allow for a more sustainable and economic building, creating longer lifespans in architecture.

BACKGROUND

As discussed before, a Life Cycle Assessment (LCA) is a common way to analyze and evaluate environmental issues that come along with products/materials, processes, or services (Cherubini et al., 2009 as cited in Ordoñez Duran, J.F. et al., 2020, p. 1056). Kasulaitis et al. (2015) states, "it (LCA) helps identify energy and materials used and emissions released to the environment and allows finding opportunities for environmental improvements" (Ordoñez Duran, J.F. et al., 2020, p. 1056). The implementation of an LCA is a viable means for guiding the process of determining sustainability, however, defining sustainability is not always a graspable task, which is why all possibilities must be analyzed so the maximum sustainability of a project may be reached. Such areas like product design decisions of the constructed materials selected for the product can cause environmental impacts, so it should always be a priority to have environmental impacts at the forefront of design decision making (Sofia et al., 2019; Vyhmeister et al., 2018 as cited in Ordoñez Duran, J.F. et al., 2020, pg. 1057). This is a fairly simple concept to grasp, especially if it's in the respect of reducing environmental impact, in any area of design, building industry alike. However, the reason why reducing environmental impact is rarely a primary area of concern in product design, is because in most cases it's true that it takes up more time and money to do so, which leads to quicker, cheaper, and less sustainable options to be settled for. Production of short lifespan and low energy consumption products may not be entirely sustainable, regardless if they require low energy consumption in their manufacture, which is often seen as environmentally friendly, however, this is not always the case (Bakker et al., 2014 as cited in Ordoñez Duran, J.F. et al., 2020, p. 1057). Smil (2016) states that determining the efficiency of a material use should be done through determining the energy consumed for the materials manufacture and distributing that energy consumed throughout the materials lifespan (Ordoñez Duran, J.F. et al., 2020, p. 1057). This type of thought process poses the concept that more thought and cost to design components of a product should be provided in early design stages, as in doing so, a longer lifespan product is produced. This process is especially important if the desired goal is to reach a sustainable product. In terms of this design thesis, as stated in the introduction, by providing this thought and commitment to sustainability and longevity early in the design process, a building with a longer lifespan may be produced, allowing for more opportunity and less issues in the future when converting the building through an adaptive reuse scenario.

During the design process of any given product, the material selection is often decided through institutions, based on nothing more than the experience and inspiration of the products designers (Mitchell and Walinga, 2017 as cited in Ordoñez Duran, J.F. et al., 2020, p. 1058). This is especially relevant in the building industry, where the designer has nearly all control in deciding materiality of the buildings construction, as long as factors like environment and budget allow it. In the building industry, it can become an issue where designers become too comfortable with a certain and sometimes outdated material, product, or construction method which have been surpassed by a more efficient replacement. This leads to buildings not being built to their full potential, which leads to the ability for a longer lifespan building to be less likely, only based on the comfort of the designer. This is also true in any other product design; the intention of the designer is what leads to the eventual lifespan and continuation of a product after its use decreases. Jahan et al. (2010, 2016) states that different characteristics such as cost, strength, toughness and elasticity are often compared to different materials to help the product designer in choosing the adequate material for its use, in order to satisfy the requirements of different stakeholders, which will lead to these materials affecting the products use (Ordoñez Duran, J.F. et al., 2020, p. 1058). As stated earlier, it is necessary to use the information of a products embodied energy and find the relationship between its embodied energy and how it is spread across the projected lifespan. One concept that helps define this, is the annualized embodied energy (AEE), which analyzes this relationship between the projected lifespan a product or building may have, a parameter it holds such as its area or volume, and the energy it requires to be maintained for that projected life expectancy (Hernandez and Kenny, 2010 as cited in Ordoñez Duran, J.F. et al., 2020, p. 1058). Sartori et al. (2012) states that with a larger initial investment into a building, better results may be achieved in terms of energy savings at the end of a buildings lifespan (Ordoñez Duran, J.F. et al., 2020, p. 1058).

This is an important concept to grasp, because as stated earlier, it is much often too common for design decisions to be made that save money, however it is also very common that just because a cheaper option is available and marketed as environmentally friendly, does not mean that is the case. If proper design decisions are made for a building, when the goal is to create a sustainable and economic building, these types of initial investments must be taken to ensure a long projected lifespan building, which will aid in the process of a possible adaptive reuse project in its future.

SOLUTIONS TO LONGER PRODUCT LIFESPANS

In any complex product, the design often requires multiple pieces to be incorporated together to create the final product, this can be noticed in the building industry, as many certain sub elements are needed to create a final building. One way this can be described, is modular design, which separates products into distinct components and sub-assemblies with standardized interfaces (Cooper et al., 2019). Ulrich and Tung (1991) state that implementing modular design into products can lead to a more simplified assembly/disassembly process, with improved serviceability and easier maintenance (Ordoñez Duran, J.F. et al., 2020, p. 1059). This previous statement sparks the question that should be analyzed for the built environment, being how can new construction buildings be designed to allow for easier maintenance or renovations can be made further into its lifespan? If a higher standard of modularity in architecture could be implemented in early design stages, there would be less issues in implementing adaptive reuse design once necessary for that building, which could lead to less costs and/or thought needed when this process begins. Nepal et al. (2007) states that, "modular architecture significantly enhances product development" (Ordoñez Duran, J.F. et al., 2020, p. 1059) which of course is descriptive for any product design, however this is still relative to the design of buildings. If buildings could more easily allow the replacement of building subcomponents over the span of its lifetime, while continuously updating the technology of the building it could be said that there would be no need for a new construction building to replace it, nor an adaptive reuse design to take place. Ordoñez Duran, J.F. et al. (2020) makes the comment that each module of a product has its own reliability, and this interaction between these modules reliabilities directly results in the products lifespan by the module holding the shortest lifespan (p. 1059). By translating this into architecture and continuing the concept of modularity, if continually maintaining a building throughout its lifespan and replacing near-end lifespan subsystems, it could be assumed the lifespan of the entire building would be increased a significant amount. That is why when products and buildings are in early design stages, if sustainability and longevity are important to the designers, the opportunity cost must be considered for those early decisions if they hope for a long lifespan project.

CONCLUSION FROM ANALYSIS

From analyzing this article, there are clear connections that can be made in the development of products, to the concepts of the building industry. With many projects today, the quicker and cheaper options of materials and services are often preferred as projects are always on a timeline. However, the concept of sustainability and longevity for that project is never given much thought in early design stages. If more early design decisions provided more opportunity for new construction buildings to provide a guided pathway for a possible adaptive reuse scenario toward the end of the building's lifespan, a much more sustainable project would have been accomplished. It is sadly the case that this never happens, as the cheap methods used to construct quick buildings in the shortest time possible, these buildings result in extremital deterioration much more quickly in the buildings lifespan, which could have been avoided if more care and thought was given in early design stages. This article provided some compelling information and analysis for product design, which will be able to be translated to the design of this adaptive reuse thesis solution. The concept of longevity will need to be constantly remembered throughout the design stages of this thesis, in hopes that the final design will allow for the already existing building to continue its lifespan in a sustainable and economic way.

LITERATURE REVIEW .

TITLE: *"Impact of building material recycle or reuse on selected emergy ratios"*
AUTHOR(S): N.Y. Amponsah · B. Lacarrière · N. Jamali-Zghal · O. Le Corre

INTRODUCTION

This article published through *Resources, Conservation and Recycling* (2012) goes into the process of analyzing embodied energy and the process of recycling materials from buildings into other implementations in new construction buildings or adaptive reuse projects in the goal of meeting some sense of sustainability. The information provided in this article gives additional knowledge that will aid in the design process of this design thesis to reach a sustainable and economic final design. With a methodology of recycling materials of existing projects for implementation to new construction, this will give a guided path to help in implementing any demolished areas of the selected project site for this design thesis to decrease the amount of material waste of the final design. In addition to this material recycling and embodied energy (emergy) information, the authors of this article conduct a case study of a building, giving a detailed process of looking at a building's subsystem emergy values, as well as giving information on how these values can be calculated. It should be noted that this article analysis will not cover these calculations and values for emergy, however this information will be set aside for implementation into the design process for this design thesis for an accurate process for obtaining a sustainable project. This article review gives a strong knowledge base to support the idea that recycling construction materials reduces the material waste, reduces the embodied energy of the materials, as well as increasing the amount of sustainability in any project that implements it.

BACKGROUND

As time progresses, the needs of society get more diverse, the population gets larger, and construction methods progress, the built environment requires more resources to produce adequate and technologically satisfying architectural spaces. Pulselli et al. (2007) states that nearly 40% of all material consumption of the world is secluded to the built environment, with about 30% of all energy use is spent by housing (Amponsah, N.Y. et al., 2012, p. 9). With this being such a significant source of the worlds resource consumption, it is a relevant issue that needs to be solved, posing the question of how can materials be more efficiently used in the built environment? One of the most obvious solutions is to implement the strategy of recycling building materials into new building construction. With this strategy being implemented more often around the world, the analysis to evaluate buildings and their environmental impacts through methods such as life cycle analysis (Guinée et al., 2001), emergy analysis (Odum, 1996), the ecological footprint (Rees and Wackernagel, 1994), and exergy analysis (Szargut et al., 1988) are adapted in order to reach an accurate consensus (Amponsah, N.Y. et al., 2012, p. 9). Through implementation of such analysis processes, they allow a project to be able to get accurate assessments of the projects components in order to determine the following paths of material management. From this article, Amponsah, N.Y. et al. covers the following …

> Kralj (2007) states that the use of these construction waste management techniques that rely on the reuse of recycled materials has been proven to provide economic benefits within construction industry. It is known that the strategy of reusing materials is done to prevent solid waste from going to landfills, as the reuse of materials significantly reduces the amount of raw material usage. Peuportier et al. (1996) states a significant amount of resources in industrialized countries are exploited through their building industries, with a lot of high quantities of raw materials being inputted, leading to a high energy required to produce and extract these materials. This is why it is important to implement the waste management techniques in effort to reduce the amount of energy needed to extract raw materials for new building construction. (p. 9).

When looking at this type of strategy for design, regarding this thesis solution, it must be asked where can these materials be recycled from? And what is to be done once removed from the existing building? If this design thesis aims to provide a sustainable and economic final design, any demolished materials in the adaptive reuse process should look for any possibility of reuse in the new design, in efforts to limit any unnecessary material waste as well as limiting new material introduction and its embodied energy into the design.

One analysis method mentioned, “emergy”, is presented by Odum (2002) as a “broad approach to the relationships of building construction with materials circulation and energy hierarchy”. In this approach, buildings are seen as a compact assortment of materials that gives the sum of the inputs during the building’s construction process. This assortment of materials then loses emergy as these materials depreciate across the buildings lifespan and disperse into the environment. Any new maintenance or renovation done to the building applies new inputs which stimulates the emergy flow into that building system (Amponsah, N.Y. et al., 2012, p. 10). This approach of emergy suggests that all processes of construction of a building influences the amount of embodied energy the building has throughout its lifetime, not just energy of the materials in the new construction phase. When looking at adaptive reuse in this fashion, it still yields sustainable efforts to the environment as any maintenance required to keep a building functioning effectively as time progresses shows a significant decrease of embodied energy as the lifespan of the building increases, compared to removing the entire building for a new construction building to replace it. If we were to look at buildings as continual improvement opportunities, instead of the current outlook we have today as buildings being expendable sets of spaces, there would be much more thought put into the recycle and reuse of natural resources for the built environment, giving much more dependable designs that could produce significantly longer lifespans than modern buildings can. Buranakarn (1998), Brown and Buranakarn (2003) suggest a set of indices for the evaluation of recycling patterns, and a materials capability to be recycled. These suggested emergy indices are used to measure the benefits of three recycling approaches can have on the environment, being material recycle, by-product use, and adaptive reuse or a material being recycled for a different purpose (Amponsah, N.Y. et al., 2012, p. 10). This type of distinction in the material reuse process continues the previous point of how any removed materials from this design’s thesis can be used.

The materials in a real-world setting could be transported offsite to be reused at a completely separate project, the material could be repurposed on the site in a similar purpose it was before the adaptive reuse process, or the material could be used in a completely different purpose than previously, through additional manufacturing of the material. All of these options will be offered in the design process, all depending on the design decisions on what possibilities any materials removed could be revitalized for in this design thesis. Pulselli et al. (2007) proposed the following

Another emergy methodology and set of indices to building construction, which considers for any environmental impacts a building may have through accounting for its main energy and material inflows within the construction process, possible maintenance, and use of the building. These indices include: the building emergy per volume which represents the ‘environmental cost’ of the building; the building emergy to money ratio which represents the ratio of total emergy used to money; building emergy per person, which represents the rate of emergy use of human systems with relation to buildings. (Amponsah, N.Y. et al., 2012, p. 10).

This is a diverse set of emergy indices that provide another pathway for this design thesis to develop an accurate analysis of the materials demolished, recycled, and reused into the final design, in hopes of obtaining a more sustainable project.

CONCLUSION FROM ANALYSIS

From analyzing this article, it gives several distinct methodologies for how embodied energy can be quantified for this design thesis through processes like material recycle and reuse. There are many instances during the construction process where care for demolished material is not a priority, and it is often the case that the material is left unusable after the process of demolition is complete, especially for materials that rely on structural and visual composure for its reuse. With all the material waste for adaptive reuse projects often being brought to landfills, it should be a priority to find ways for these materials to be used in the new design, especially if sustainability and cost-effective process are desirable for the project. When looking at the emergy of building materials, implementation of previous materials allows for this emergy to be more efficiently dispersed by the building construction throughout the lifespan it holds. By analyzing the emergy of the existing building, it can be analyzed how much of the material waste should be repurposed to progress towards a sustainable effort. Overall, this article analysis provided more opportunity to understand the many methodologies that can be used to understand the embodied energy of materials, and how to effectively communicate that energy into an adaptive reuse project.

PRECEDENT RESEARCH .

The following [3] case studies were selected and researched, each for a distinct reason which could be explored and expanded on within the next stage of the design solution. Each are a different project typology, ranging from office, residential and mixed-use.

- Studio 1334 / debartolo architects
- Nanchawan · Showu Tribe Homestay / The Design Institute of Landscape & Architecture China Academy of Art
- Kolstrand Building / Graham Baba Architects

Figure 19 | *Studio 1334,* Image credited to [Reohner + Ryan]

STUDIO 1334 . debartolo architects .

PROJECT TYPOLOGY: Office
LOCATION: Pheonix, Arizona, United States
SIZE: 5,005 sqft.

DISTINGUISHING CHARACTERISTICS

Studio 1334, from a vacant warehouse to an architectural studio. The owner-architect of this warehouse saw an opportunity to turn this 80-year-old warehouse into a space for creative problem solving. The ability for the firm to design this space to their desired needs, allowed for this open warehouse to become an expemplary exhibition of debartolo architect's work. With previous experience in adaptive reuse projects, debartolo architects had the chance to extend this list with their new location.

This adaptive reuse design shows the nature of refurbished buildings, that they do not need to remain the same function after this process, they can be crafted to house completely new and opposite uses from previous years. From mechanic shop, body shop, and storage facility, this warehouse on Van Buren Street has now been revitalized to a completely new function. It could be assumed the simple form of this building, a 50' x 100' rectangle, with a floor-to-ceiling height of 12', the interior space of this warehouse was completely open allowing for plenty of design opportunities.

EXISTING PROGRAM ELEMENTS:

- Open office spaces
- Collaborative work stations
- Conference spaces
- Material library
- Lounge space
- Break area
- Outdoor break area

RESEARCH FINDINGS

Like many other adaptive reuse projects, such as Studio 1334, the spaces within are given a new life. Studio 1334 had revitalized the exterior condition, as well as the entire interior office spaces.

Unlike some adaptive reuse projectes, however, this case study does not take the opportunity to expand on the existing, exterior shell of the building. This building case primarily uses the interior space to show a new life to the existing structure. However, with a small budget and projected construction time, the option to do so may have been voided.

Located in Pheonix, Studio 1334 is one of the many key pieces compiled in efforts to revive the city through adaptive reuse projects. While on Van Buren Street, many of the buildings within this strip require some attention with an apparent lack of architectural maintenence. As noted, debartolo architects very well could have removed this building, constructed a new office where the existing sat, or even went to a different area to do so. However, the purpose of this project was to bring back the life to this area, while simultaneously preventing the act of removing that history that comes with it.

It can be assumed that this effort is a success, the process of revitalizing existing architecture is much more rewarding than starting over from scratch. This process, as shown within Studio 1334, shows the example of how unique spaces can be created through the character left from the existing architecture.

ANALYSIS

Studio 1334, from open and abandoned warehouse to a detailed functional layout. With a brick exterior facade, and wood structural system, no major removal nor addition was required to create a functional piece of architecture. The existing structure provided enough durability for the architects to enhance the space only in terms of functionality, while not necessarily needed to be addressed in the form of the existing shell.

With a simple rectangular form, not much was needed to be done to increase the natural light within the open space, but an interesting conversion of one space into a partial outdoor area through a large opening in the building shell, only separated to the office spaces by a large glazed system. With the open floor plan and many opportunities for natural light penetration, a lively and cohesive collective of office spaces is created.

Figure 20 | *Studio 1334*, Floor Plan credited to [debartolo architects]

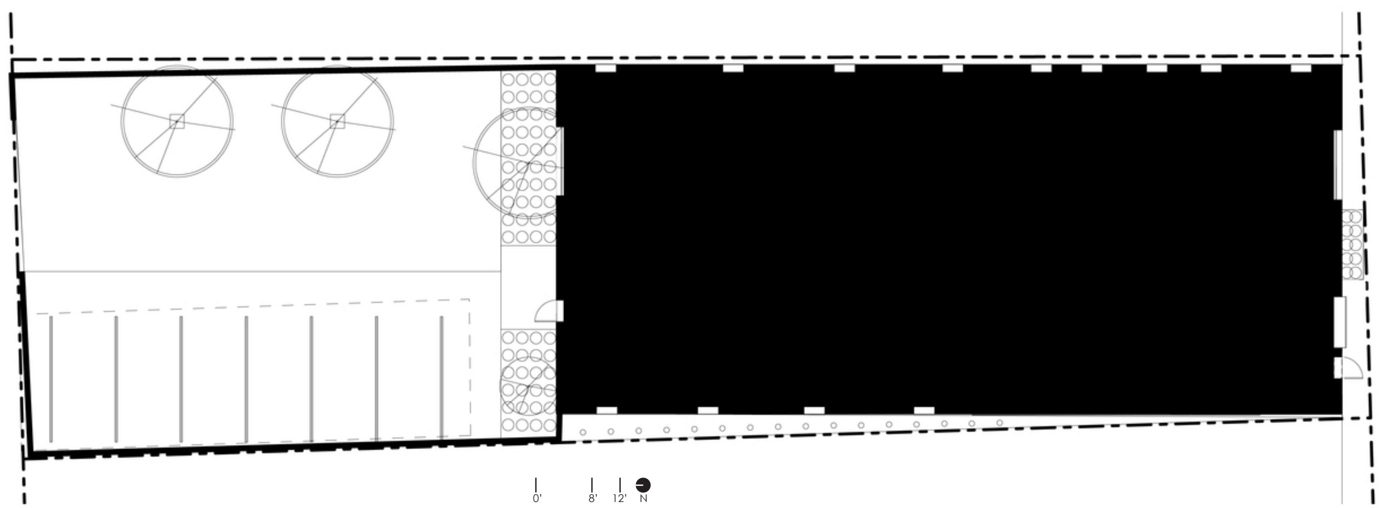


Figure 21 | *Studio 1334*, Site Plan credited to [debartolo architects]

Figure 22 | *Studio 1334*, Image credited to [Reohner + Ryan]

CONCLUSION

Studio 1334 gives an insight to how simplicity does not necessarily have to mean not interesting. Instead of looking at this existing structure as a barrier to the site that needed to be removed, debartolo architects saw the beauty of what it could be and created a set of spaces that may be more beneficial for them than a new constructed building may have given. This case study supports the basis of this design thesis proposal, that the revival of these old and abandoned buildings may create a very unique and impressionable piece of architecture.

Figure 23 | *Nanchawan · Shiwu Tribe Homestay*, Image credited to [Aoguan Performance of Architecture]

NANCHAWAN · SHIWU TRIBE HOMESTAY . The Design Institute of Landscape & Architecture China Academy of Art .

PROJECT TYPOLOGY: Hostel
LOCATION: Yichang, China
SIZE: 9,688 sqft.

DISTINGUISHING CHARACTERISTICS

It can be determined that the most distinguishing characteristic of this study would be the historic stone wall structure that comprises the majority of this buildings, or as it was, two buildings. From two historic masonry homes, to a connected piece of architecture through the practice of adaptive reuse. The stones that construct this structure are locally sourced, as the village for which this structure is placed in, is completely created by farmland and mountains, which the stone is sourced from.

A unique feature to this study is how the two existing masses are adjoined as one. A glass and steel structure is placed between the two stone houses connecting them through a entrance lobby and the staircase to circulate the hostel.

The shambly stone architecture is preserved through a replacement of the unsatisfied structure that was present before, as the stone facade is the driving factor to preserve the history of these two merged historic houses.

EXISTING PROGRAM ELEMENTS

- Entrance lobby
- Living room
- Suspended tea area
- Dining area
- Kitchen
- Linen room
- Public toilets
- hostel suites
- tatami / study space
- exterior patio / walkways

RESEARCH FINDINGS

Like many other adaptive reuse projects, there are certain elements of a building that the designer attempts to maintain to create the character of the building that is present in the existing structures. In this case, being the stone walls along the exterior of the buildings.

Unlike other adaptive reuse projects however, this project did an extensive replacement of the structure. The existing wooden structure was not sufficient in maintaining the stone walls integrity, so a steel frame structure was implemented to maintain that piece of the homes.

With the economically sourced stones of the landscape preserved in this study, the project responds well to the landscape as well and keeping the historic character that the two existing homes had with the remainder of the village.

ANALYSIS

As stated previously, part of the renovation needed within this study was the addition of a steel frame structure to supplement holding the integrity of the existing stone exterior walls.

A connection is made between the two existing homes, as a large-scale glass structure, which creates the entry, and houses the stairs for circulating the hostel.

Through reverse masonry techniques, large openings are added along the shell of the existing stone walls, providing plenty of natural light into the spaces. Openings are placed at nearly every space, leaving no area begging for light. The large glass structure adjoining the two existing homes allows for light to penetrate inwards from the center of the hostel.

To keep with the historical nature of the village, there is not many exterior additions done to this study, only the large glass space to connect the two homes as one. It could be assumed that the glass material was chosen to maintain the heirarchy of the two stone homes, keeping them visually distinct from one another.

Figure 24 | *Nanchawan · Shiwu Tribe Homestay*, Section credited to [The Design Institute of Landscape & Architecture China Academy of Art]

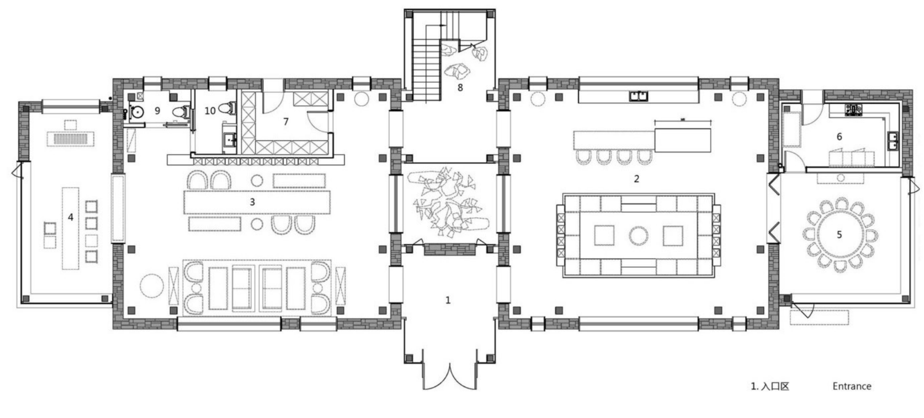


Figure 25 | *Nanchawan · Shiwu Tribe Homestay*, Floor Plan credited to [The Design Institute of Landscape & Architecture China Academy of Art]

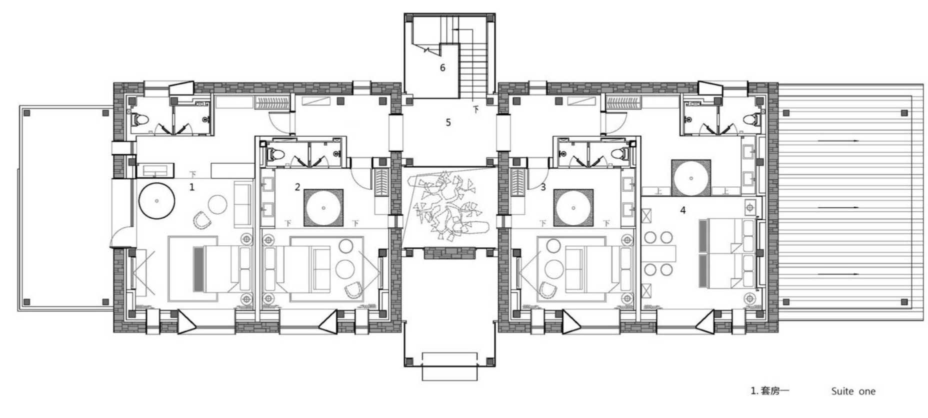


Figure 26 | *Nanchawan · Shiwu Tribe Homestay*, Floor Plan credited to [The Design Institute of Landscape & Architecture China Academy of Art]

Figure 27 | *Nanchawan · Shiwu Tribe Homestay*, Image credited to [Aoguan Performance of Architecture]

CONCLUSION

The concept that functionality does not start where historic strategies end comes to mind from this study. With the rough stone walls, being the primary focus of this study, being able to implement modern construction methods within that material was crucial for this studies success. It can be noticed that this study takes a more minimal outlook for the adaptive reuse process, mearly joining the existing homes together as one, and not doing to much to the exterior provided an outcome that preserves the historic value of the existing homes.

Figure 28 | *Kolstrand Building*, Image credited to [Graham Baba Architects]

KOLSTRAND BUILDING . Graham Baba Architects .

PROJECT TYPOLOGY: Restaurant, Office Building
LOCATION: Seattle, United States
SIZE: N / A

DISTINGUISHING CHARACTERISTICS

The Kolstrand Building, takes the adaptive reuse strategy to create a pedestrian friendly building from an existing industrial, historic building of the neighborhood of Ballard. The efforts of this study was to preserve the history of the existing building, while providing the functionality of a pedestrian friendly building.

With an addition compiled to the existing building renovation, careful planning had been taken place to maximize the efficiency of said addition both economically and sustainably. This addition also takes notice to creating the same form of functionality for pedestrian scale spaces, as aligned with the entirety of the design decisions made with this study.

EXISTING PROGRAM ELEMENTS

- [4x] commercial offices
- Outdoor deck
- Cafe / retail space
- [2x] restaurants
- [2x] sidewalk cafes
- wine storage
- storage

RESEARCH FINDINGS

This study of the Kolstrand Building takes similar efforts like most adaptive reuse projects, taking efforts to effectively limit unnecessary demolition and waste of the existing structures used in the project. Using and recreating project elements from existing and reclaimed materials from the renovation process, the Kolstrand Building effectively maximized the net embodied energy of the existing project until its final redesigned functionality.

The Kolstrand Buidlings is unique in this study however, from the fact of how it reorganizes the existing spaces for a new pedestrian friendly building for the newly designated functionality of the building. With the implementation of sidewalk cafes, the Kolstrand Building provides a greater connection between interior spaces with pedestrian streetside activity. This is one of the strategies that was implemented within the Kolstrand Building in efforts to break down its industrial structure to its pedestrian friendly design.

It can be acknowledged that the strategy to break up the existing building for a pedestrian scale project is the primary focus of this study. This effort was able to create a site that responds more effectively to the surrounding area, with the added benefit of preserving the history and authenticity of the existing structure.

ANALYSIS

Through the implementation of new windows in the western facade of the Kolstrand Building, which not only maintains the balance between existing and newly added materiality of the western facade, but are also analyzed and placed within the western facade in efforts to take the solar strategies into consideration.

In addition to the addition of these new glazing systems, the major addition of the rooftop deck creates a new massing that adds square footage to the project. This new construction added to the existing massing helps add to the strategy of creating a pedestrian friendly building.

Figure 29 | *Kolstrand Building*, Exterior Elevation credited to [Graham Baba Architects]

Figure 30 | *Kolstrand Building*, Section credited to [Graham Baba Architects]

Figure 31 | *Kolstrand Building*, Image credited to [Graham Baba Architects]

CONCLUSION

This study of the Kolstrand Building shows the strategy that there really is no limit to what can be done within an adaptive reuse project. This study does a lot of redesign through the addition of the rooftop spaces, which adds a new dimension to the project. It can be acknowledged that this type of strategy within the adaptive reuse methodology plays a key role in creating spaces with a very unique and influential charisma to them, and possibly a type that could not be replicated without the character of the existing building as a base to the project.

CASE STUDY & TYPOLOGICAL RESEARCH SUMMARY .

Out of the previouse three case studies, each were chosen so that no two shown any commonalities with each other. However, with them all being based from the fact they are adaptive reuse projects, they all show a different particular strategy that can be replicated within the design solution of this thesis premise. To reiterate, the theoretical premise of this design thesis proposal, is how can an existing building be repurposed in a way that matches or exceeds the functionality and performance of a newly constructed building at the same geographical location, with the precaution of limiting demolition / construction additions to the existing structure?

This premise was not affected from this beginning form of precedent research, shown by the previous case studies. As mentioned, all case studies were chosen to display the common theme of adaptive reuse, the primary nature of this proposal. Studio 1334, an abandoned storage warehouse revived into an architectural design studio; Nanchawan · Showu Tribe Homestay, a set of historic stone construction homes transformed into a modern living hostel; Kolstrand Building, the final case study that exhibits an old factory that underwent major renovations and additions to create a mixed-use facility.

The Studio 1334 case study showed the effect that not much needs to be done to completely transform the character and functionality of an interior space of an existing building. With no major additions used on this study, only interior transformations were required to create this new design studio, with any exterior renovations made, only providing visual improvements. The Studio 1334 case study directly supports the theortical premise of this proposal, because with the minor renovations done, and nearly no demolition required, the space of this existing warehouse was completely transformed to a new unique building. This building completely removed the need for a newly constructed office building, all that was needed for this design studio was waiting to be brought new life through renovation.

The Nanchawan · Showu Tribe Homestay case study shows a similar nature of the adaptive reuse strategy, one that puts an effort into maintaining the historical value of the existing architecture. With the unique and identifiable stone walls, matching the remaining village homes, these two homes were refurbished to create a hostel while maintaining the connection with the surrounding village. What is unique about this study, however, is the shear effort that was put into these two homes. A complete structural replacement was needed, with a new steel frame structure to replace the existing wood structure, which was not sufficient in holding the weight of the stone walls. This case study also maintains the standing of this proposals theoretical premise, showing that the work put into these existing structures is worth the effort, resulting in unique and historical architectural spaces.

The Kolstrand Building case study is a unique building that took efforts to minimize the waste of the renovation process, by implementing demolished materials into other areas of the renovation, an admireable strategy that is hoped to be replicated in this thesis design solution. The way that this case study differs from others is how it shows existing spaces do not have a limited typology for the renovated spaces that are possible. From a large warehouse, redesigned to a pedestrian friendly building, from effective spatial organization, and proper spaces created through architectural additions.

As stated earlier, each of these three case studies were chosen to show a diverse set of adaptive reuse projects, in effort to give a wider range of information for the precedent research of this design proposal. These case studies, as well as the further research of additional adaptive reuse case studies in the future, further affirm the desired theoretical premise of this design thesis proposal.

PROJECT JUSTIFICATION .

Through working in the architecture career field since starting my journey at North Dakota State University, through construction jobs and architectural internships, it has been noticed that there is a lack of care in terms of material demolition for adaptive reuse projects, or at least an opportunity to take more care in the matter within the architecture and building development field. I believe that while the world in which we reside provides a plentiful amount of natural resources for use to use to develop as a society, as well in the field of architecture, however it does not mean we should be wasteful in our practice of demolition and renovation of buildings we work on, but rather taking a more clinical approach to analyze how we redesign existing structures to minimize waste.

After finishing the undergraduate program through North Dakota State University, it is now time for me to display my knowledge of design which I have collected the last four years. This will also be a new project typology that I will be taking upon myself, being an adaptive reuse project, which will allow me to further diversify my portfolio from previous studio projects.

As the time approaches for me to start my professional career, and the likely-hood of many projects I will take part in the future being adaptive reuse oriented, the information and design solution strategies that could be gained from this project will be a significant piece of knowledge that could be re-used throughout my career to influence actual projects that the public will experience.

Throughout my education, there has been no area of the previous curriculum that allowed me to dive into project renovation and demolition. So, this project will allow me to research material embodied energy, as well as renovation practices to redesign an existing architectural structure, where this has not been covered previously through any project. Although I have had very minimal experience through project design for an adaptive reuse project, there is a lot more I have not experienced in the project. This project will give me valuable experience such as modeling an existing structure, phasing the project in design software, and figuring out integration of new additions to the existing structures.

It is increasing apparent for projects to be an adaptive reuse project. Many projects involve some sore of demolition and/or renovation during the construction phases unless the project so happens to take place on a completely barren site. The process of analyzing existing buildings/structures/materials should be further developed to further limit unnecessary waste from a project to maximize efficiency of the construction process, as the waste of these materials further increases the amount of emissions and labor that was put into the manufacturing and transportation of said materials.

With the existing shell of the buildings to hopefully be maintained completely, the economic standing of the project is very strong as it mainly lies in my hands on how the design is handled. Much of the project is already constructed it just matters on how much effort would need to be implemented on maintaining the existing materials as any addition construction elements to add onto and/or replace elements of the existing structures.

The justification of this project from an economic persepctive is that the current buildings are used as a glorified storage facility, only housing non-functional vehicles and old materials crammed into the spaces where the buildings are not even useable with their current state. With the given location of the site, renovating these buildings to a pedestrian friendly area would further stimulate the area of the site, as it currently lacks the pedestrian activity is desires.

These funds could be guaranteed from the current owners of the site, the Fargo Parks District, as it is intended for this project design to be theoretically be used for them to use the spaces as office space, and entertainment venue, and have leasable spaces for retail. Since the Fargo Parks District often hosts events in the area it would be justified that this sort of facility would benefit them more than a large storage facility for items that are no longer useful for their operations.

This sort of project would be justified through an investment, that the Fargo Parks District would fund this project in efforts for them to use this facility and create monetary returns as time goes on with the hopes of increased use of the facility occurs to return their investment of the project.

It would be assumed that the completion of this project would in fact increase the occupancy and activity of the area, stimulating the area which would justify this project. It could be noted that with the benefit of using the existing facility for the design, it would be far more beneficial compared to its current use.

With environmental impacts being an issue to keep track of within this project, unnecessary demolition of existing materials will be taking priority in the design process to minimize environmental consequences. This strategy would in turn justify the continuation of this project as it will take effort to minimize unnecessary design decisions.

From a social context, the current area that this site takes place lacks a significant amount of pedestrian activity, with the exception of yearly events of the Fargo Brewing Factory across the street to the West during Summer months. A current adaptive reuse development of a restaurant is taking place directly North of this selected site, so it would be assumed that this project would supplement the direct area within its proximity to increase pedestrian activity and stimulate the neighborhood. Many activities that take place around the Fargo-Moorhead area involve communal aspects, in which people join together to appreciate one-another and the activities for which they are taking place in. The development of this mixed-use entertainment development that this project plans to be would supplement this narrative of the area.

I believe this project to be extremely imperative as it is a continuously relevant issue within the architecture career field. Buildings just don’t disappear once they succeed operation so proper technique and design-solutions must be taken to efficiently use of remove or revitalize these existing structures for continual use.

HISTORICAL, SOCIAL AND CULTURAL CONTEXT FOR THE THESIS .

HISTORICAL CONTEXT

As previously mentioned, there are existing buildings located all over that sit dormant, often waiting for a new project to need its location, only to demolish it for the land it sits on. It is a typical and unfortunate practice that new constuction buildings these days are designed and built to only maintain a mediocre lifespan, only to hopefully fufill the intended use it was designed for.

With the growing practice of adaptive reuse projects, the implementation of this strategy in this selected site will help in providing an economic spark of the area, as well as gravitate more pedestrian activtiy to it as well.

The use of adaptive reuse strategies for this site will allow for the historic value of this building to be maintained and preserved, as well as providing the chance for the Fargo ND area to experience this value themselves.

Figure 32 | *Historical Context*, Image credited to [Cass County Highway Department]

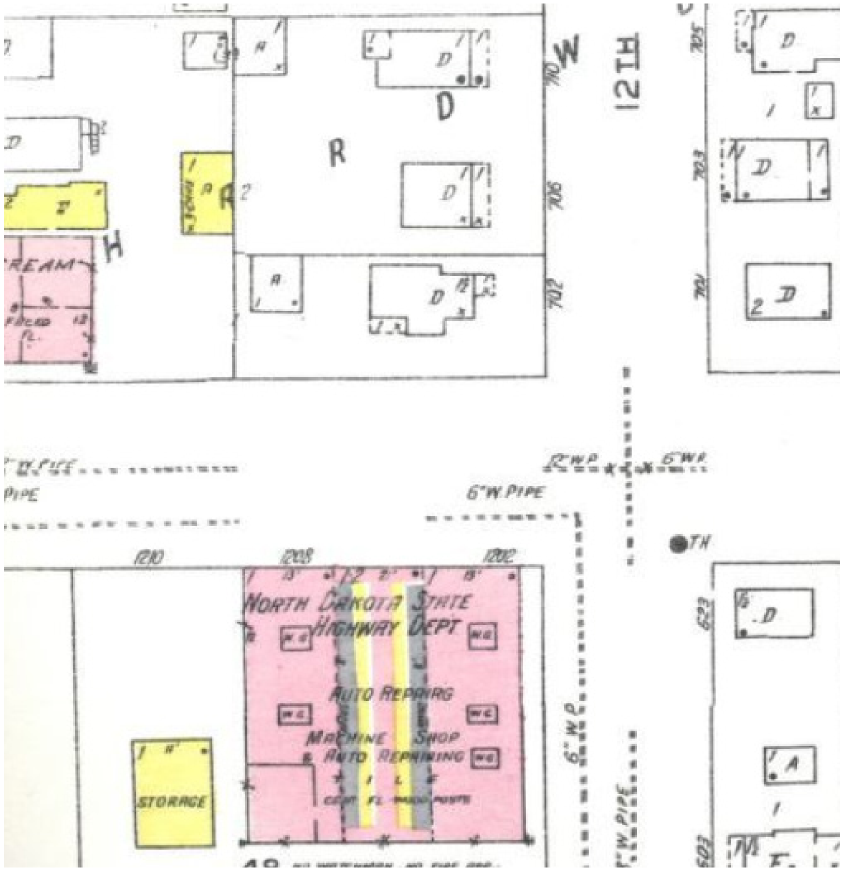


Figure 33 | *Historical Context*, Image credited to [Cass County Highway Department]

HISTORICAL CONTEXT CONTINUED

The site for this project is located in Fargo, North Dakota, at 1202 7th Avenue North. The first signs of constuction for this project site was the first building in the northeast corner of the site, being built in 1918.

From what could be found, the initial use of this first constructed building was to function as a machine shop and auto repair for the North Dakota State Highway Department. Eventually, the Fargo Park District took ownership of the property used the existing space for their general shop. After the Fargo Park District moved their shop to a new location, this existing property is primarily used for general storage purposes.

In the year 2016, this property was proposed to be changed from a General Commercial zoning to a Downtown Mixed-Use zoning ordinace. This zoning change allows for no maximum building coverage allowed, and allows for a more diverse array of building usage.

HISTORICAL CONTEXT CONTINUED

Directly south of this project site is a railroad running directly through Downtown Fargo, which sites to the east of this site.

Right after the St. Paul, Minneapolis & Manitoba railroad of James J. Hill was renamed, the railroad south of this site took its name on September 18, 1889 as the Great Northern Railway (Great Northern Railway Depot. (n.d.)).

The building pictured to the right, the Great Northern Depot, was built in 1906 at 425 Broadway and designed in the Richardson Romanesque style by architect Samuel Bartlett of St. Paul. Bartlett was a friend of James J. Hill, the founder of the Great Northern Railroad. The Great Northern Depot pictured, is located to the East of the projected site and is on the National Register of Historical Places (Great Northern Railway Depot. (n.d.)).

Figure 34 | *Great Northern Railway Depot*, Image credited to [NDSU Archives]

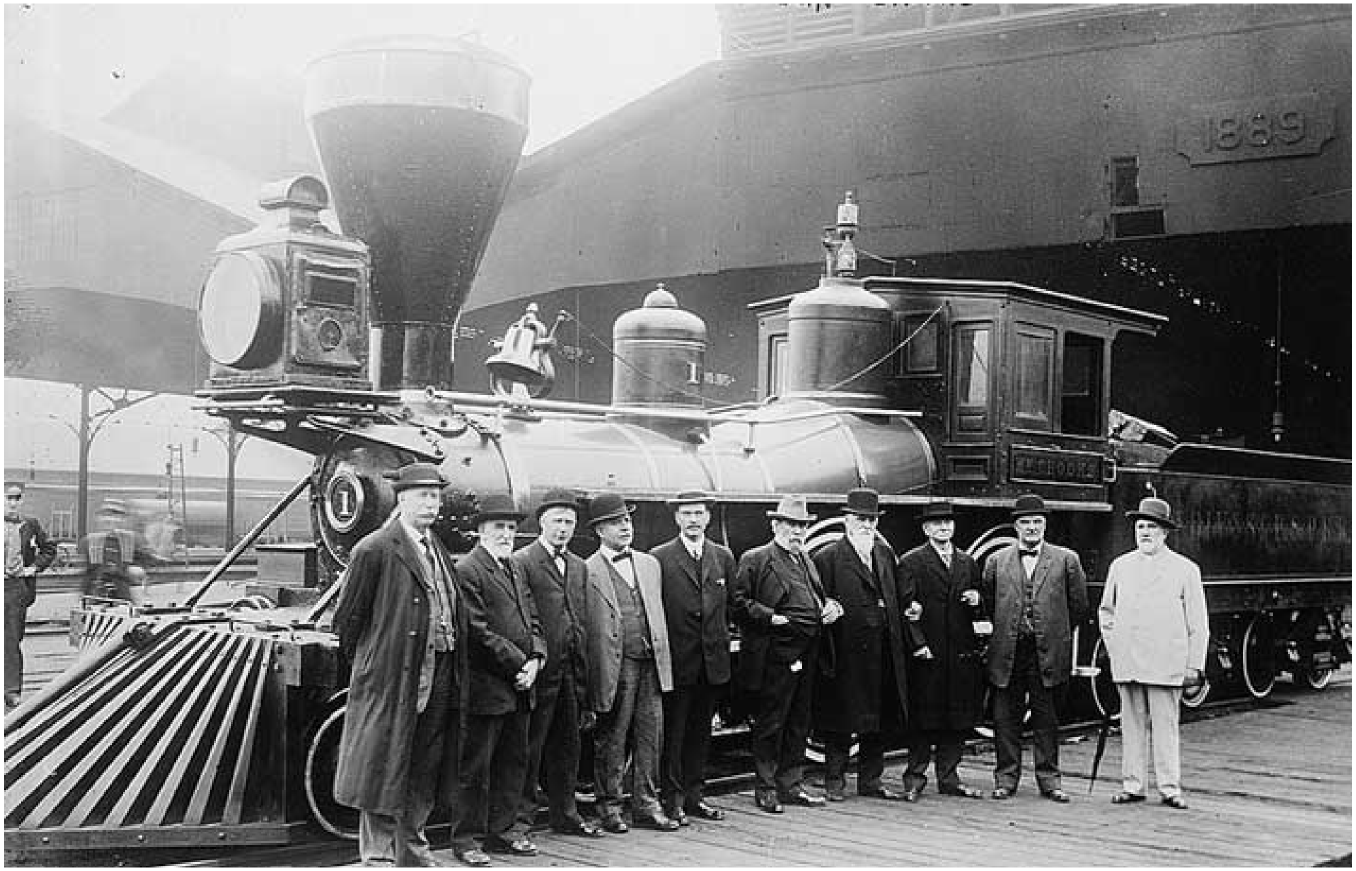


Figure 35 | *Great Northern Railroad*, Image credited to [History Central]

HISTORICAL, SOCIAL AND CULTURAL CONTEXT
THE THESIS .

SOCIAL CONTEXT

This design thesis relates to other adaptive reuse projects from the fact that it currently sits as an opportunity of its full potential as a building. It is commonly seen in adaptive reuse projects, that old buildings sit dormant, or at any case be used as a storage facility, lacking any maintenance to keep the building at a functional level. These spaces often need significant stimulation to create desireable architectural spaces that can perform to the standards of modern new building construction.

The social context of this project type, however, if becoming more and more desireable in society's eyes as time progresses. These often abandoned buildings provide an economic opportunity for buyer's, which allows them to transform these buildings into higher standard, business allocated spaces that provide a significant income to the buyer. It also is often seen desireable to produce these adaptive reuse projects, as the types of unique spaces that can be created with the historic nature of the existing buildings provide more social stimulation in the area, as these types of spaces are currently commonplace for this type of project typology.

Figure 36 | *Social Context*, Image credited to [JWest Productions]

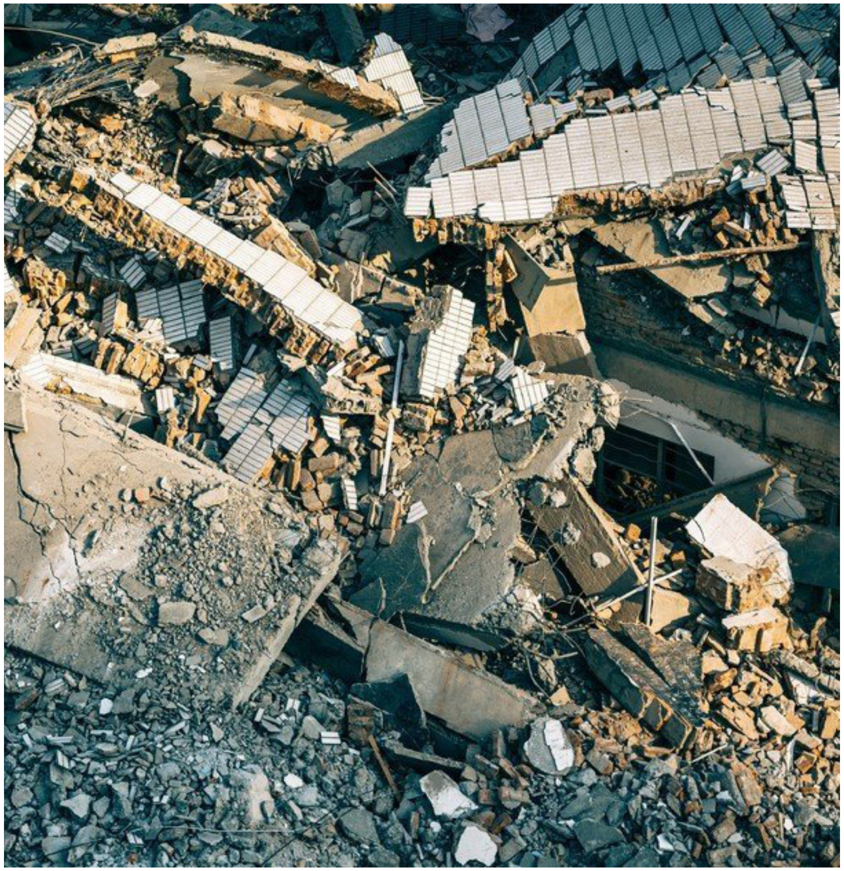


Figure 37 | *Cultural Context*, Image credited to [Nicolina Shormis]

CULTURAL CONTEXT

From a cultural standpoint, the environment is at the forefront on society's concern, as it is always looking for new ways to create a more sustainable functional world. Adaptive reuse projects can play a significant role in the process of reducing the very high natural resource usage, reducing the amount of emissions into the atmoshpere, and limiting material embodied energy waste.

To maintain a environmentally friendly design, unecessary demolition of the existing buildings are to be avoided, and any amount of material removed will be prioritized to be reintroduced into the design in order to avoid any wasted embodied energy of the present materials.

The goal of this project, is to align with the growing context of dependable and longer lifespan buildings. Currently, projects are too likely to be built with shorter lifespans only to fufill one or two functions in its lifetime. This project aims to shift that context towards a more sustainable framework of buildings within the built environment.

Figure 38 | *Site Aerial View*, Image credited to [Google Earth]

SITE ANALYSIS .
1202 7TH AVENUE NORTH | FARGO, NORTH DAKOTA

Often overlooked by the public passing by, the property of 1202 7th Avenue North in Fargo ND sits as a glorified storage facility, lacking its possible potential from its size, location, and percieved historical value.

This area that this site is located is struggling in terms of pedestrian activity, just located outside the Downtown Fargo area, where this activity is always in excess. This selected site is seemingly hidden from the daily individual as no one has a reason to search for it. With its historical persona, and location to other opportunal areas for pedestrian activity nearby, this dormant facility has the potential to spark a new life into the area as well as its inhabitants.

Through site analysis of this site, information will be gathered to aid in searching for the best way create this mixed-use enterainment facility as discussed earlier.

Figure 39 | *Site Analysis* [Proposed Site Extents & Built Features]

SITE EXTENTS .

Located at 1202 7th Avenue North, Fargo North Dakota, the extent of this site provides a large opportunity for an adaptive reuse design of the existing buildings as well as extensive site development, with an approximate size of 93,208 square feet (2.14 acres) at the disposal of this design solution. The site sprawls across this area over streets, with only part of this area actually dedicated to existing features. A large portion of the site to the East is not used, only serving a spot to stockpile materials and trailers if used at all. The site has many trees scattered around it, most of them in good condition. The existing brick building provides a historical prescense with its eroded mateeraiasl as well as the vine-like plant climbing the walls of the North and East faces of the building.

BUILT FEATURES .

The three built features noted on the context map to the left are currently used as storage and not operated as the Fargo Parks District maintenance shop as they were previously. The first building in the NE corner of the clustered building area was previously used as a maintenance shop and is split into three “bays” running North-to-South separated by large overhead doors. The remaining two buildings are warehouses used to store various equipment and materials that do not stay at the owners current maintenance shop.

Figure 40 | *Site Analysis* [Circulation]

TOPOGRAPHIC EXTENTS .

This site sees very little change in elevation thoughout its legal boundaries, with exception to the far western side, which has the start of a relatively steep gradation towards the pedestrian walkway of the underpass. The second area of grade change to note would be the railroad outside the boundary of the site, which is raised on a slight mound running the length of the railway, sloping towards the site, leaving a slight change in elevation of the Southern edge of the entire site, but still remains relatively flat once it reaches the site property boundary.

SOIL .

The area of Fargo, ND contains a aquerts, clayey soil type that is primarily found in areas such as Texas, lower Mississippi River Valley, and the valley of the Red River of the North. This soil type is typically occupied with rangeland, cropland, or forest. Drainage of this soiltype is troublesome from the low nature of saturated hydraulic conductivity. With the relatively flat elevation change of this site, precautions for drainage will need to be considered.

With this design solution being an adaptive reuse project, there will be no addition that will exceed the height / bearing capacity that the soil of the site won't be able to handle which it hasn't already. With this in mind, the soil condition of this site won't be an issue in the design however it will be considered throughout the design process.

Natural Resources Conservation Service. (n.d.). Retrieved November 25, 2020, from https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/maps/?cid=nrcs142p2_053612

CIRCULATION .

With the site located at a relatively populated street corner, there is a steady flow of traffic through an entire day. On the Western boundary of the site, University Dr, a heavily trafficked one-way street runs South under an underpass directly by the site. The Northern boundary of the site is relative to 7th Avenue, another relatively busy street. The remaining streets throughout the site are frontage road-like streets which provide a means of access to single family homes nearby the site. Directly South to the site is a railroad system that runs through Downtown Fargo, directly East of this site, which will provide a significant noise and visual issue for this design thesis solution.

Pedestrian circulation of this site is currently limited, with only a few sidewalk locations around the area, which currently serve in accessing bus stops, the nearby grocery store, and brewery pub across the street to the West. This site has a great opportunity to tie in the pedestrian circulation of the surrounding area to the site itself, its just that currently the interior of the site boundaries lack pedestrian circulation, as this site feels secluded and hidden from the public. The building across the street directly North of this site is another adaptive reuse project, being a restaurant, so it could be said that the addition of this design solution would help supplement in increasing pedestrian traffic of this area with these two sites in such proximity to one another.

Figure 41 | *Site Analysis* [Site Reconnaissance Viewpoints Map]

DISTRESS .

With this design solution being an adaptive reuse project, the main area of distress would be the existing buildings themselves. These buildings area currently only used as a place for storage of excess equipment, vehicles, materials, etc. This use for the building is mainly because the previous functions of this building were moved to a new facility so these structures arent used to their full capability. Window openings are boared with plywood sheathing, the exterior and interior spaces are not upkept and any utilities with the exception of electricity within the structures are not functional. The driveway within the center courtyard area is cracked and starting to show wear, which could be said with the remainder of the legal extents of the site's condition.

SITE RECONNAISSANCE VIEWPOINTS .

With the extensive existing built features of this site, photographic reconnaissance of the entire interior of the facility's spaces as well as the entire property were documented for future reference, as well as to document the extent of the distress of the property. These images are documented in the following pages, with nodes of the views of the areas to be referenced the the context map shown on the previous page.

Figure 42 | *Site Analysis* [Existing Building 1]

Figure 43 | *Site Analysis* [Existing Building 1]

Figure 44 | *Site Analysis* [Existing Building 1]

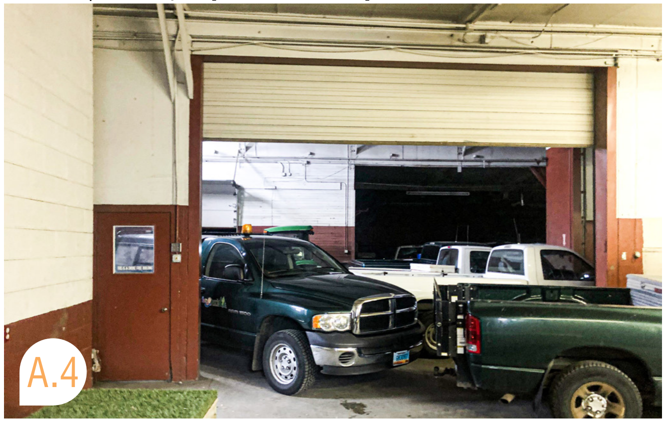


Figure 45 | *Site Analysis* [Existing Building 1]

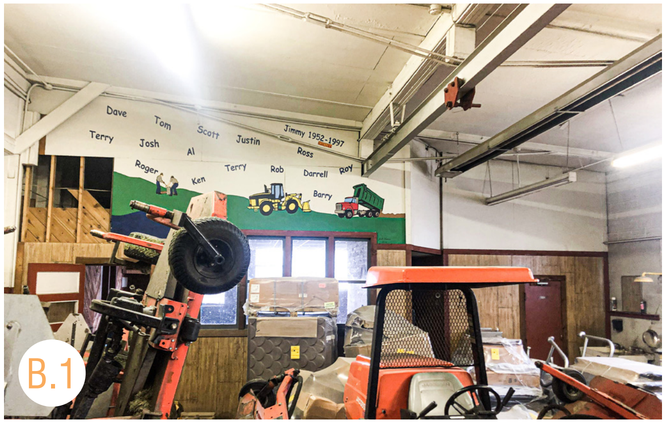


Figure 46 | *Site Analysis* [Existing Building 1]

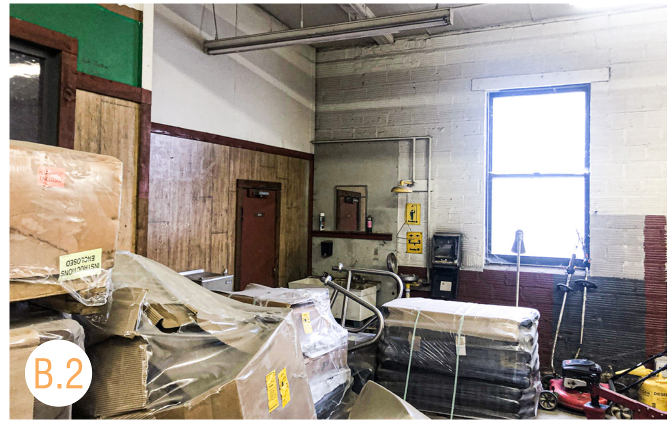


Figure 47 | *Site Analysis* [Existing Building 1]

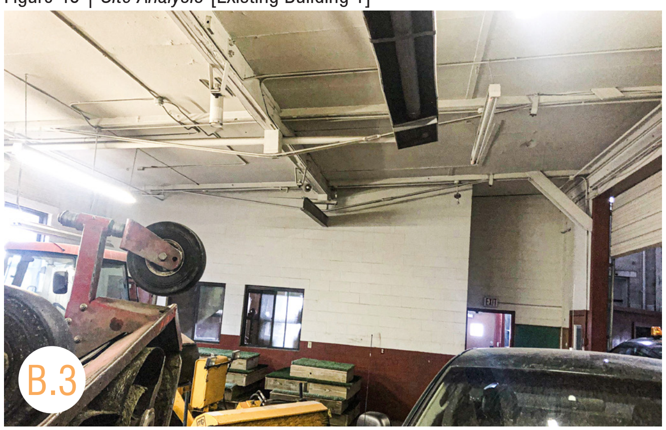


Figure 48 | *Site Analysis* [Existing Building 1]

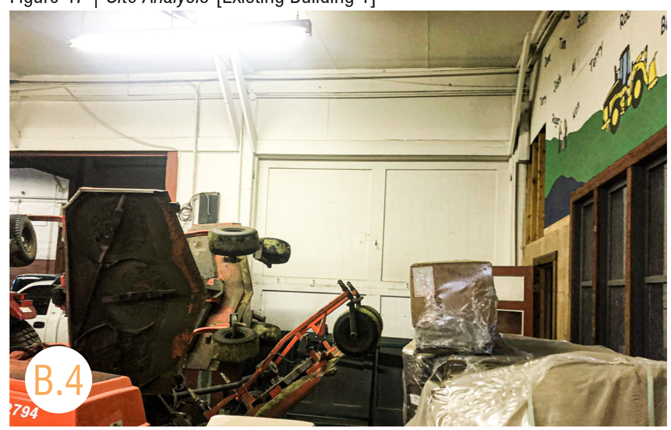


Figure 49 | *Site Analysis* [Existing Building 1]

Figure 50 | *Site Analysis* [Existing Building 1]

Figure 51 | *Site Analysis* [Existing Building 1]

Figure 52 | *Site Analysis* [Existing Building 1]

Figure 53 | *Site Analysis* [Existing Building 1]

Figure 54 | *Site Analysis* [Existing Building 1]

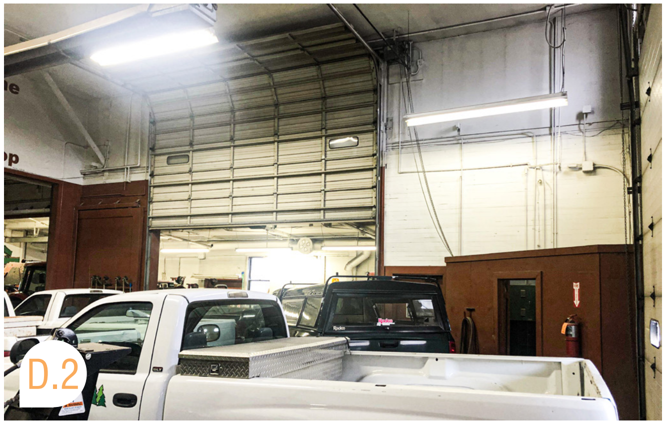


Figure 55 | *Site Analysis* [Existing Building 1]

Figure 56 | *Site Analysis* [Existing Building 1]

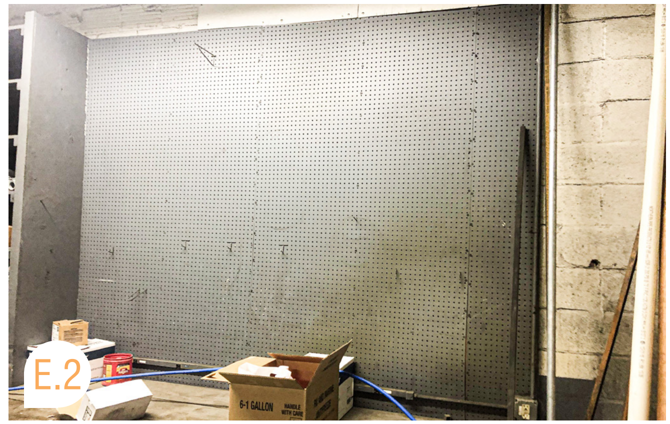


Figure 57 | *Site Analysis* [Existing Building 1]

Figure 58 | *Site Analysis* [Existing Building 1]

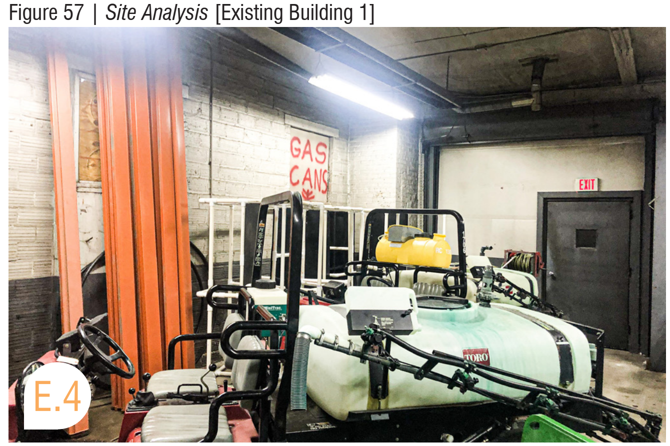


Figure 59 | *Site Analysis* [Existing Building 1]

Figure 60 | *Site Analysis* [Existing Building 1]

Figure 61 | *Site Analysis* [Existing Building 1]

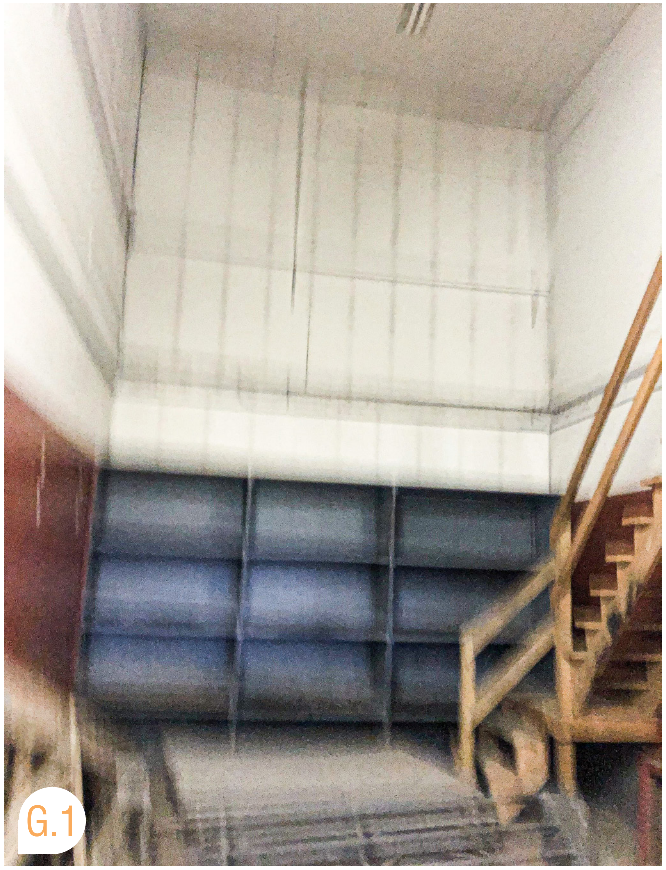


Figure 62 | *Site Analysis* [Existing Building 1]

Figure 63 | *Site Analysis* [Existing Building 1]

Figure 64 | *Site Analysis* [Existing Building 1]

Figure 65 | *Site Analysis* [Existing Building 1]

Figure 66 | *Site Analysis* [Existing Building 1]

Figure 67 | *Site Analysis* [Existing Building 1]

Figure 68 | *Site Analysis* [Existing Building 2]

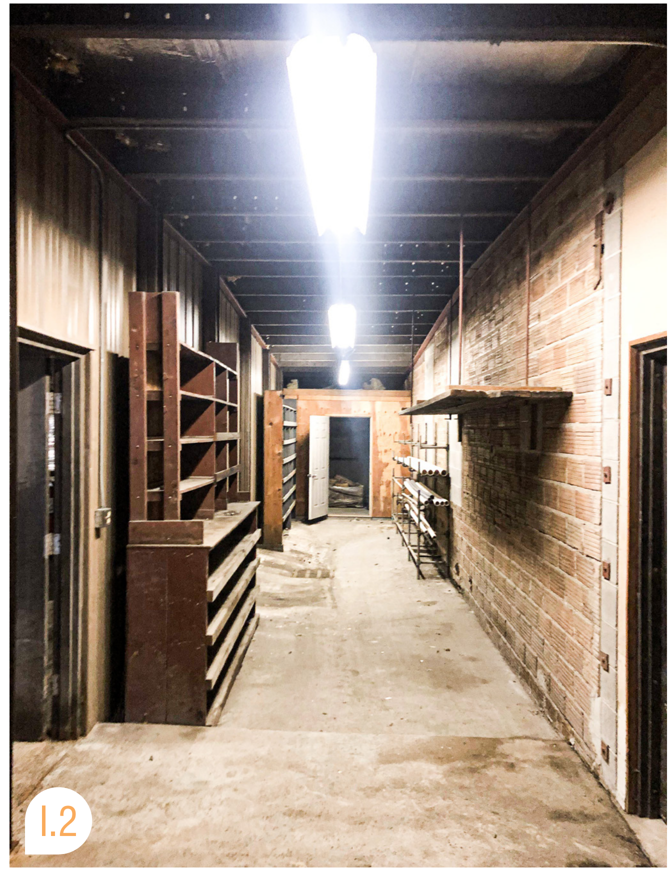


Figure 69 | *Site Analysis* [Existing Building 2]

Figure 70 | *Site Analysis* [Existing Building 2]

Figure 71 | *Site Analysis* [Existing Building 2]

Figure 72 | *Site Analysis* [Existing Building 2]

Figure 73 | *Site Analysis* [Existing Building 2]

Figure 74 | *Site Analysis* [Existing Building 2]

Figure 75 | *Site Analysis* [Existing Building 2]

Figure 76 | *Site Analysis* [Existing Building 2]

Figure 77 | *Site Analysis* [Existing Building 2]

Figure 78 | *Site Analysis* [Existing Building 2]

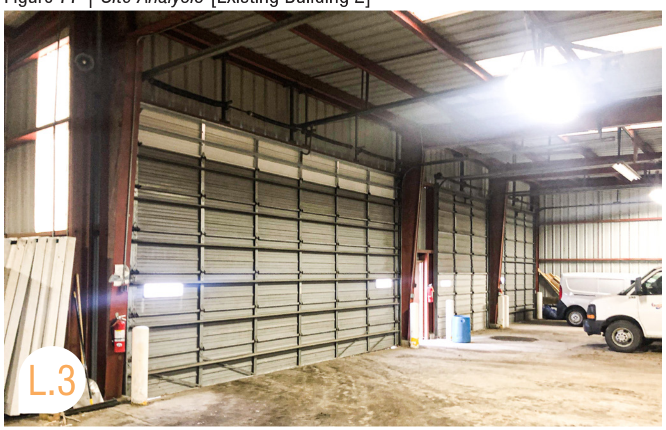


Figure 79 | *Site Analysis* [Existing Building 2]

Figure 80 | *Site Analysis* [Existing Building 2]

Figure 81 | *Site Analysis* [Existing Building 2]

Figure 82 | *Site Analysis* [Existing Building 2]

Figure 83 | *Site Analysis* [Existing Building 3]

Figure 84 | *Site Analysis* [Existing Building 3]

Figure 85 | *Site Analysis* [Existing Building 3]

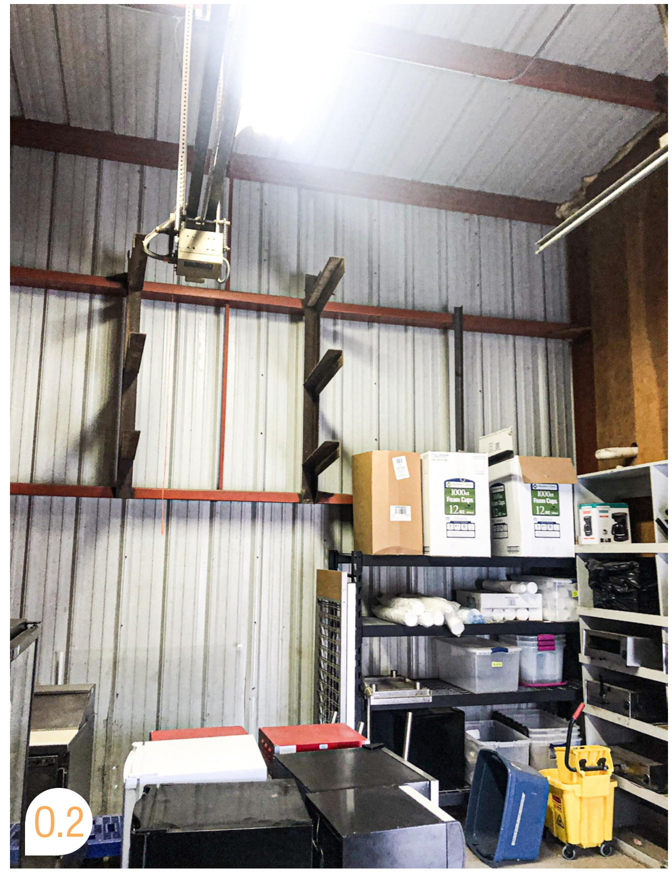


Figure 86 | *Site Analysis* [Existing Building 3]

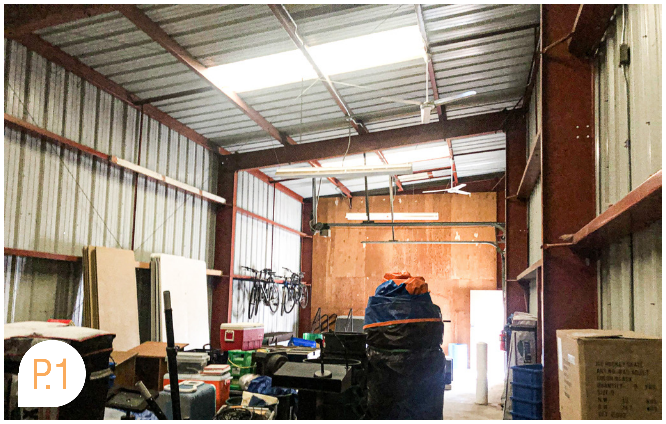


Figure 87 | *Site Analysis* [Existing Building 3]

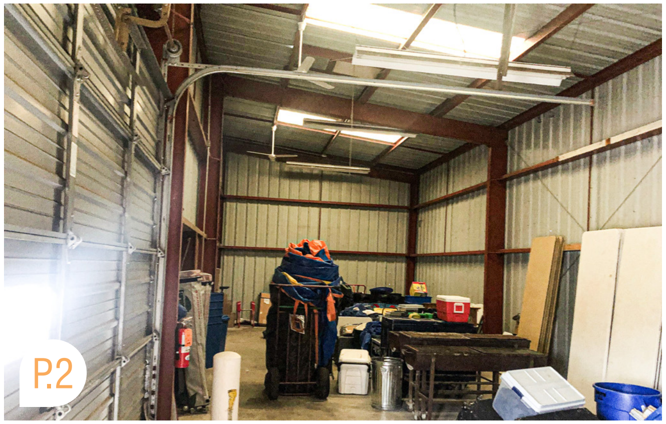


Figure 88 | *Site Analysis* [Existing Building 3]

Figure 89 | *Site Analysis* [Project Site]

Figure 90 | *Site Analysis* [Project Site]

Figure 91 | *Site Analysis* [Project Site]

Figure 92 | *Site Analysis* [Project Site]

Figure 93 | *Site Analysis* [Project Site]

Figure 94 | *Site Analysis* [Project Site]

Figure 95 | *Site Analysis* [Project Site]

Figure 96 | *Site Analysis* [Project Site]

Figure 97 | *Site Analysis* [Project Site]

Figure 98 | *Site Analysis* [Project Site]

Figure 99 | *Site Analysis* [Project Site]

Figure 100 | *Site Analysis* [Project Site]

Figure 101 | *Site Analysis* [Project Site]

Figure 102 | *Site Analysis* [Project Site]

Figure 103 | *Site Analysis* [Project Site]

Figure 104 | *Site Analysis* [Project Site]

Figure 105 | *Site Analysis* [Project Site]

Figure 106 | *Site Analysis* [Project Site]

Figure 107 | *Site Analysis* [Project Site]

Figure 108 | *Site Analysis* [Project Site]

Figure 109 | *Site Analysis* [Project Site]

Figure 110 | *Site Analysis* [Project Site]

Figure 111 | *Site Analysis* [Project Site]

Figure 112 | *Site Analysis* [Project Site]

Figure 113 | *Site Analysis* [Project Site]

Figure 114 | *Site Analysis* [Project Site]

Figure 115 | *Site Analysis* [Project Site]

Figure 116 | *Site Analysis* [Project Site]

Figure 117 | *Site Analysis* [Project Site]

Figure 118 | *Site Analysis* [Project Site]

Figure 119 | *Site Analysis* [Project Site]

Figure 120 | *Site Analysis* [Project Site]

Figure 121 | *Site Analysis* [Project Site]

Figure 122 | *Site Analysis* [Project Site]

Figure 123 | *Site Analysis* [Project Site]

Figure 124 | *Site Analysis* [Project Site]

Figure 125 | *Site Analysis* [Project Site]

Figure 126 | *Site Analysis* [Project Site]

Figure 127 | *Site Analysis* [Project Site]

Figure 128 | *Site Analysis* [Project Site]

Figure 129 | *Site Analysis* [Project Site]

Figure 130 | *Site Analysis* [Project Site]

Figure 131 | *Site Analysis* [Project Site]

Figure 132 | *Site Analysis* [Project Site]

Figure 133 | *Site Analysis* [Project Site]

Figure 134 | *Site Analysis* [Project Site]

Figure 135 | *Site Analysis* [Project Site]

Figure 136 | *Site Analysis* [Project Site]

Figure 137 | *Site Analysis* [Project Site]

Figure 138 | *Site Analysis* [Project Site]

Figure 139 | *Site Analysis* [Project Site]

Figure 140 | *Site Analysis* [Project Site]

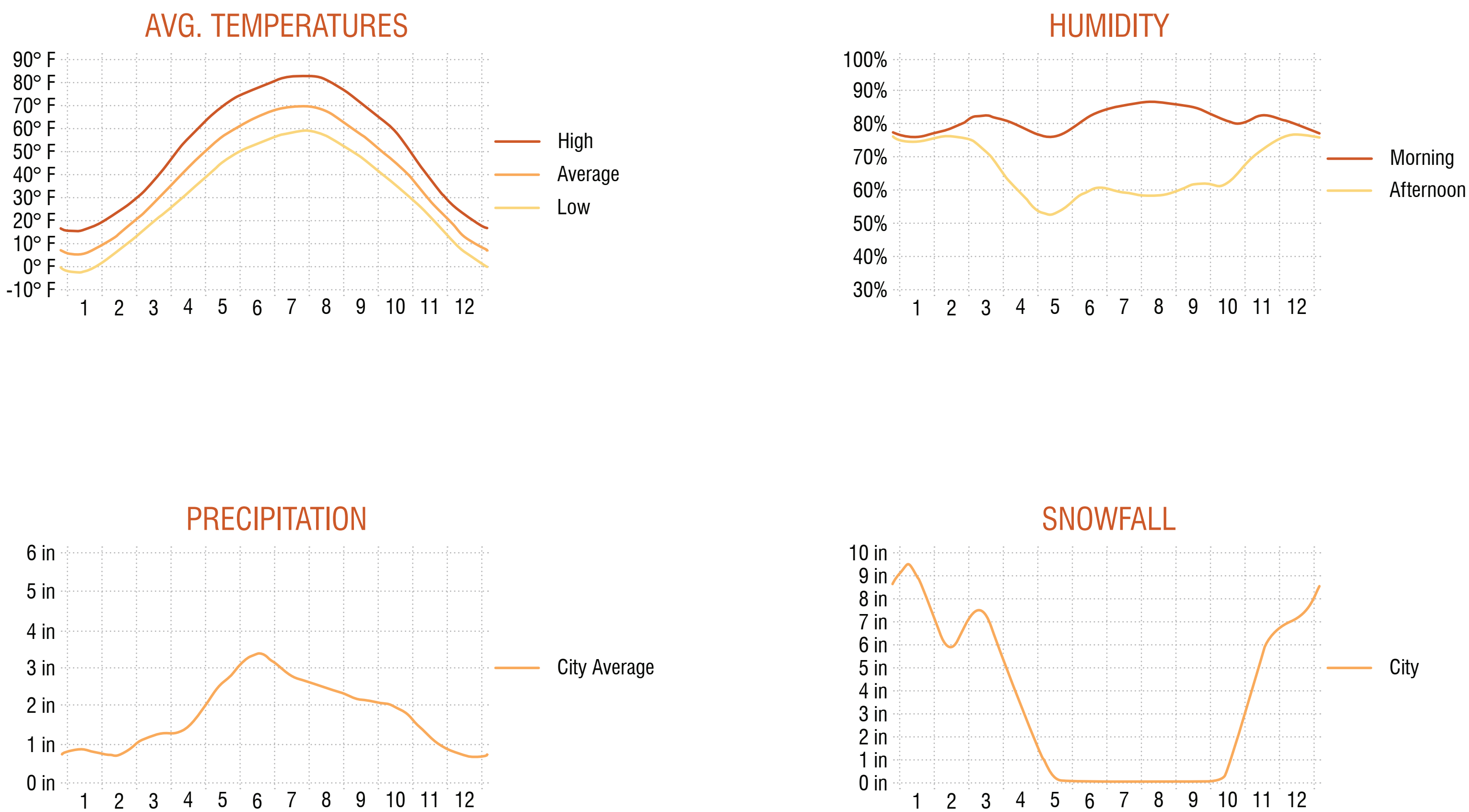
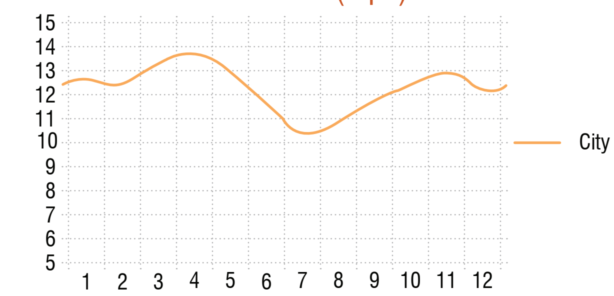


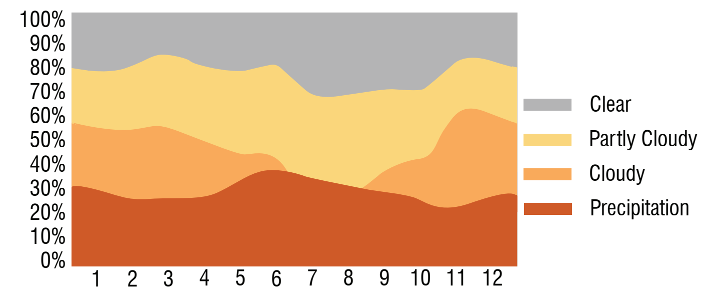
Figure 141 | *Climate Data*

City-Data. (n.d.). Retrieved November 27, 2020, from https://www.city-data.com/city/Fargo-North-Dakota.html

WIND SPEED (mph)



CLOUD COVER



SUN / LIGHT

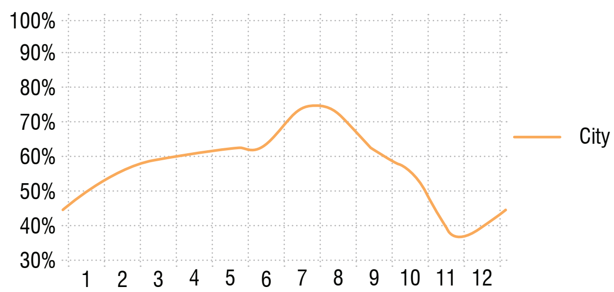


Figure 142 | *Climate Data*

City-Data. (n.d.). Retrieved November 27, 2020, from https://www.city-data.com/city/Fargo-North-Dakota.html

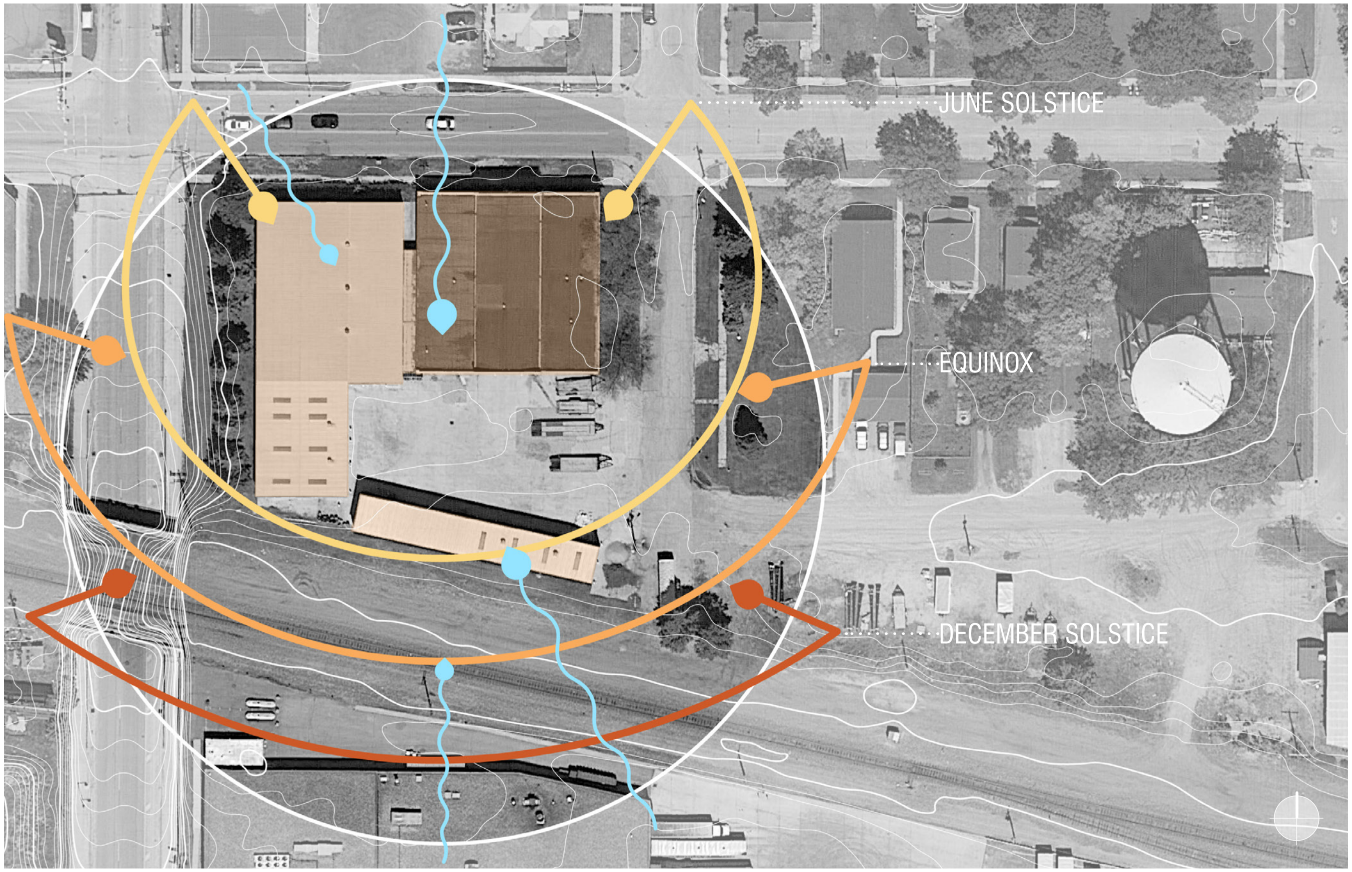


Figure 143 | *Site Analysis* [Sun / Wind]

SUN / LIGHT .

With very little obstruction of the southern boundary of the site, there is a good amount of sunlight penetration into the “courtyard” space of the existing layout of buildings throughout the day, as well a the southern face of the primary existing building one. The western portion of the site is the most obstructed area with the second existing built structure running the depth of the site alongside a row of evergreen trees obstructing the view from the street as well as limiting airflow to the center area, as well as an issue of creating an obstruction of sunlight later into the daylight hours.

PERFORMANCE CRITERIA .

SPACE ALLOCATION

Performance Measure:

With this being an adaptive reuse project, spaces must be organized to fit an existing footprint, compared to designing spaces as desired in a newly constructed building. Measuring the effectiveness of the spaces present in the design, such as space size, proximity to supplementary spaces, light penetration into the space, circulation, etc. may be used to measure this criterion.

Performance Measure Source:

Through the final model in the Revit software, the organization and construction of the model will allow for analysis through software present in this program, using the computer model of the design for its basis in the analysis.

Performance Analysis:

This criterion will be analyzed once the final design has been settled upon. Using software present in programs such as Revit will allow for this data to be measured for analysis compared to similar spaces typical in a newly constructed design, such information may be found through online sources or through mock building forms created for the same site as the project.

Performance Judgement:

It will need to be analyzed with data found through online sources to effectively compare the performance of these values or through the mock building forms as stated earlier, to see if they are within a margin of error, or exceed the performance to justify the space allocation in the adaptive reuse design.

ENVIRONMENTAL IMPACT

Performance Measure:

The necessary demolition, renovation, and additions that will be present in this project should be measured to accurately display the intended nature of this design thesis solution. Measuring units such as embodied energy for materials, labor of the project, emissions for certain construction practices, and the costs of each may be ways to measure the environmental impact of this adaptive reuse project.

Performance Measure Source:

Using information for current and intended materials present in this design will be applied to understand the performance measure for this project. Other supplemental sources such as case studies of similar adaptive reuse projects and information of construction practices and their cost effectiveness as well as specific environmental issues they may have will be applied.

Performance Analysis:

There will be renders, diagrams, and graphical presentations like graphs and tables produced for this project, which will be intended to aid in the understanding of the environmental impact data. Other practices such as comparing the existing structures to the final design to show the changes will be used through renders, supplemental diagrams, etc.

Performance Judgement:

To reach the conclusion for this projects justification in meeting the performance criteria, the comparison of the data found through embodied energy of the construction processes needed to reach the final design, through the renovation, demolition, and additional construction will be analyzed to see if this adaptive reuse process is justified to reach the final design compared to removing the entire existing structures present in the site for a new theoretical mock building to take its place.

COST

Performance Measure:

Being this project takes the form of an adaptive reuse typology, the goal would be to have this design save money throughout the construction process through less costs for demolition of the entire existing building and less costs for new construction materials, as the cost for most of the project is through renovation costs. Material costs would be the main data form used in this criteria measurement.

Performance Measure Source:

Looking into similar project typologies, as well as adaptive reuse projects and figuring out general costs of renovation of certain materials and the labor costs of demolition it could be analyzed how much the renovation of this project may end up costing.

Performance Analysis:

By using software accessible within Revit, the general amount of materials used within the project being newly constructed, and the materials that are being renovated can be assessed to figure out a rough estimate of the cost to complete this project. This amount can be compared to a rough cost required to construct the building of similar size from scratch.

Performance Judgement:

By comparing these cost values between the adaptive reuse project, compared to the theoretical newly constructed building cost values, it will be allowed to make the justification of this project's existence.

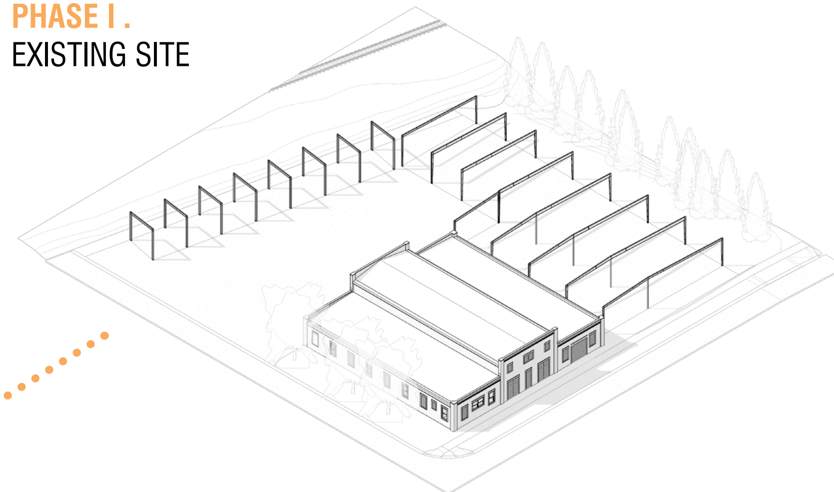
PERFORMANCE CRITERIA SUMMARY .

IN SUMMARY, the main source of information that will be the basis of measurement for this project will be the process of construction through materiality, and the costs and amount of effort needed to erect, renovate, and/or demolish the status of these materials within the project from its current state to the finished design. The main limiting factor of this design solution is the fact that it has to be applied to existing conditions, while this can provide several contributing factors to a successful design, such as unique architectural spaces, this can also limit the amount that can be done through the designer. Issues such as limited space, lack of structural bearing capacity, utility issues, etc. can be troublesome for an adaptive reuse project, however, this can be taken at the forefront of the thought process during the design process to implement strategies that can eliminate these issues. Providing additions to the existing structures may allow for less restrictions on spatial requirements of the program, so it must be necessary that proper caution is taken during the design stages to not over design onto the existing structure to make the efforts of maintaining existing materials is made counterproductive with a surplus of newly added structural elements. This strategy of avoiding unnecessary demolition, or additions to this adaptive reuse design is the underlying narrative to this design solution. It has been stated that the purpose for this adaptive reuse project is to maintain existing structures to avoid the waste of energy put into the existing materials. This is turn will hopefully decrease the cost to finish this project to completion, as the existing framework serves as a “halfway” point for the design, however, creating a functional design that fulfills the criteria developed above is at the hands of the designer, which can either lead down the path of a failed design, or the other being a design that can bring new life to the existing frameworks that are provided.

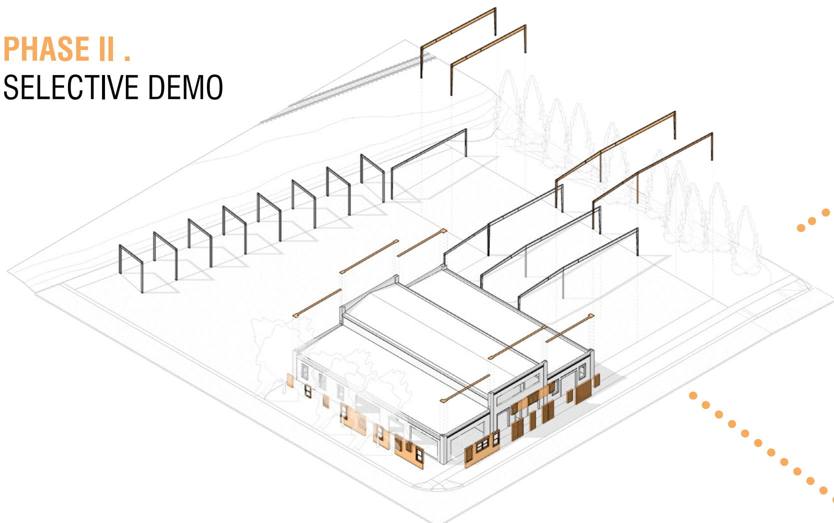
Figure 144 | *Design Solution* [Presentation Render]

DESIGN SOLUTION .

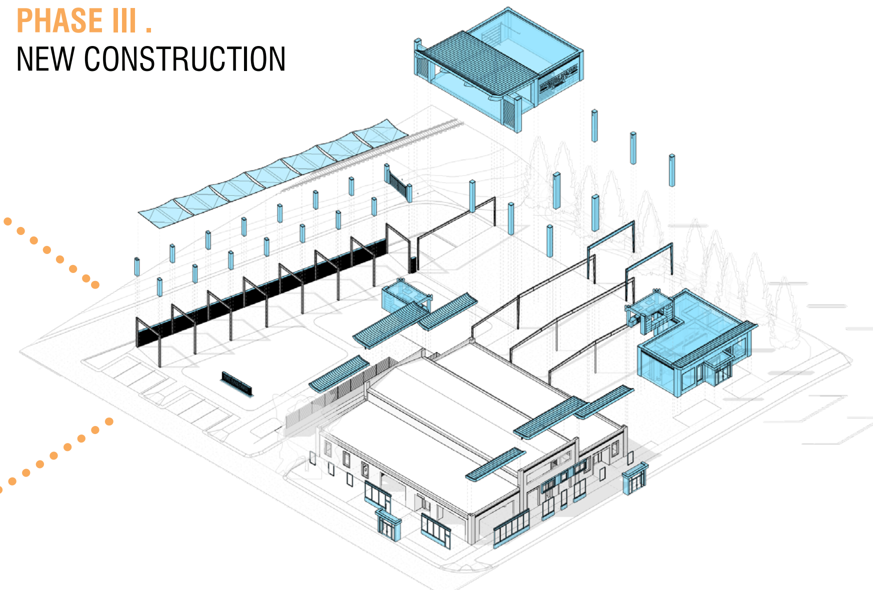
PHASE I .
EXISTING SITE



PHASE II .
SELECTIVE DEMO



PHASE III .
NEW CONSTRUCTION



PHASE IV .
COMPLETE DESIGN

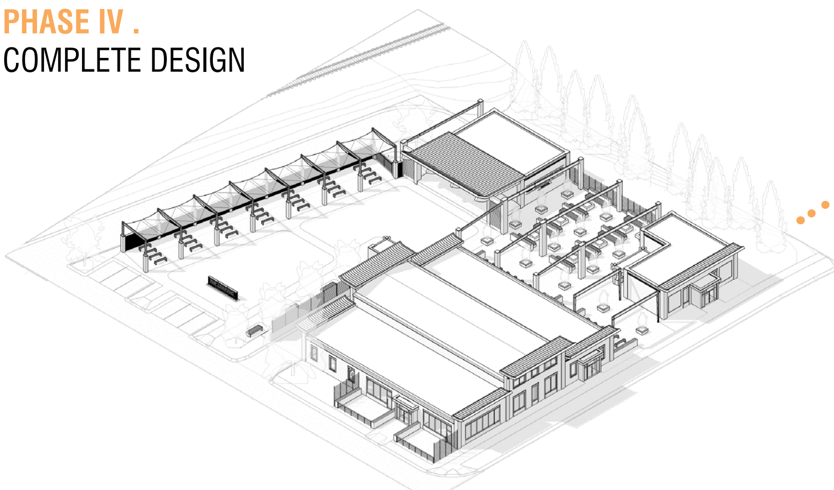
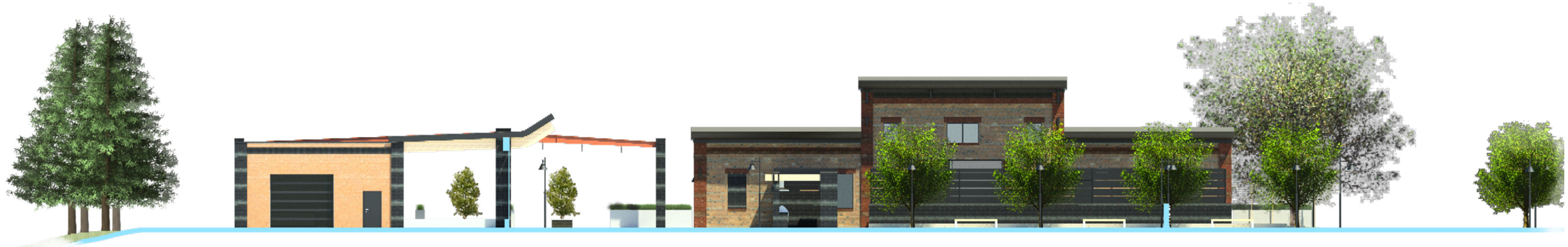
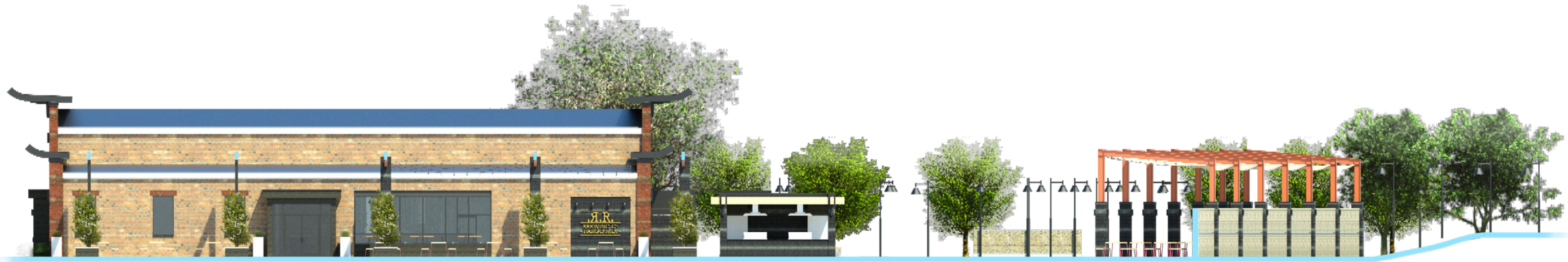


Figure 145 | *Design Solution* [Adaptive Reuse Phases]

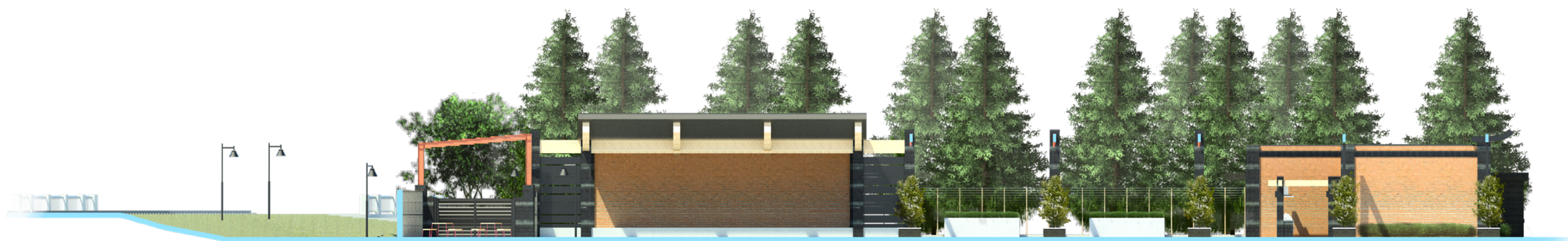
Figure 146 | *Design Solution* [Site Plan]



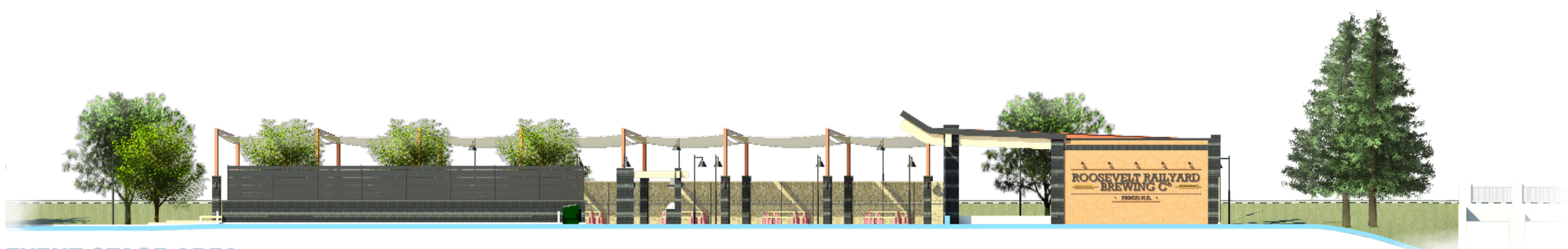
BREWERY LOADING DOCK



BREWPUB SIDE ENTRANCE



BEER GARDEN



EVENT STAGE AREA

Figure 147 | *Design Solution* [Site Sections]

BUILDING I GROUND LEVEL

BUILDING I MEZZANINE LEVEL

Figure 148 | *Design Solution* [Building I Floor Plans]

BUILDING I PROGRAM SPACES .

BREWPUB SPACES

◦ vestibule	74 sq. ft.
◦ leaning bar	224 sq. ft.
◦ tasting area	516 sq. ft.
◦ interior seating	1676 sq. ft.
TOTAL	2,490 sq. ft.

BREWERY SPACES

◦ rest room	40 sq. ft.
◦ pilot brewing system area	52 sq. ft.
◦ office	60 sq. ft.
◦ milling area	70 sq. ft.
◦ keg washing station	256 sq. ft.
◦ grain / malt dry storage	294 sq. ft.
◦ loading area	434 sq. ft.
◦ walk-in cold storage	472 sq. ft.
◦ production brewing area	1,436 sq. ft.
TOTAL	3,114 sq. ft.

RESTAURANT SPACES

◦ hostess table	48 sq. ft.
◦ office	58 sq. ft.
◦ vestibule	74 sq. ft.
◦ walk-in dry storage	74 sq. ft.
◦ walk-in cold storage	80 sq. ft.
◦ leaning bar	280 sq. ft.
◦ waiting area	374 sq. ft.
◦ kitchen	420 sq. ft.
◦ exterior patio seating	714 sq. ft.
◦ interior seating	1,520 sq. ft.
TOTAL	3,642 sq. ft.

MISC. SHARED SPACES

◦ men's rest room	110 sq. ft.
◦ women's rest room	110 sq. ft.
◦ mechanical room	436 sq. ft.
◦ mezzanine seating / observation deck	514 sq. ft.
◦ circulation space	724 sq. ft.
TOTAL	1,894 sq. ft.

BUILDING II GROUND LEVEL

Figure 149 | *Design Solution* [Building II Floor Plan]

BUILDING II + III PROGRAM SPACES .

II . RECEPTION AREA

◦ vestibule	62 sq. ft.
◦ front desk	86 sq. ft.
◦ waiting area	194 sq. ft.
TOTAL	342 sq. ft.

II . WORK AREA

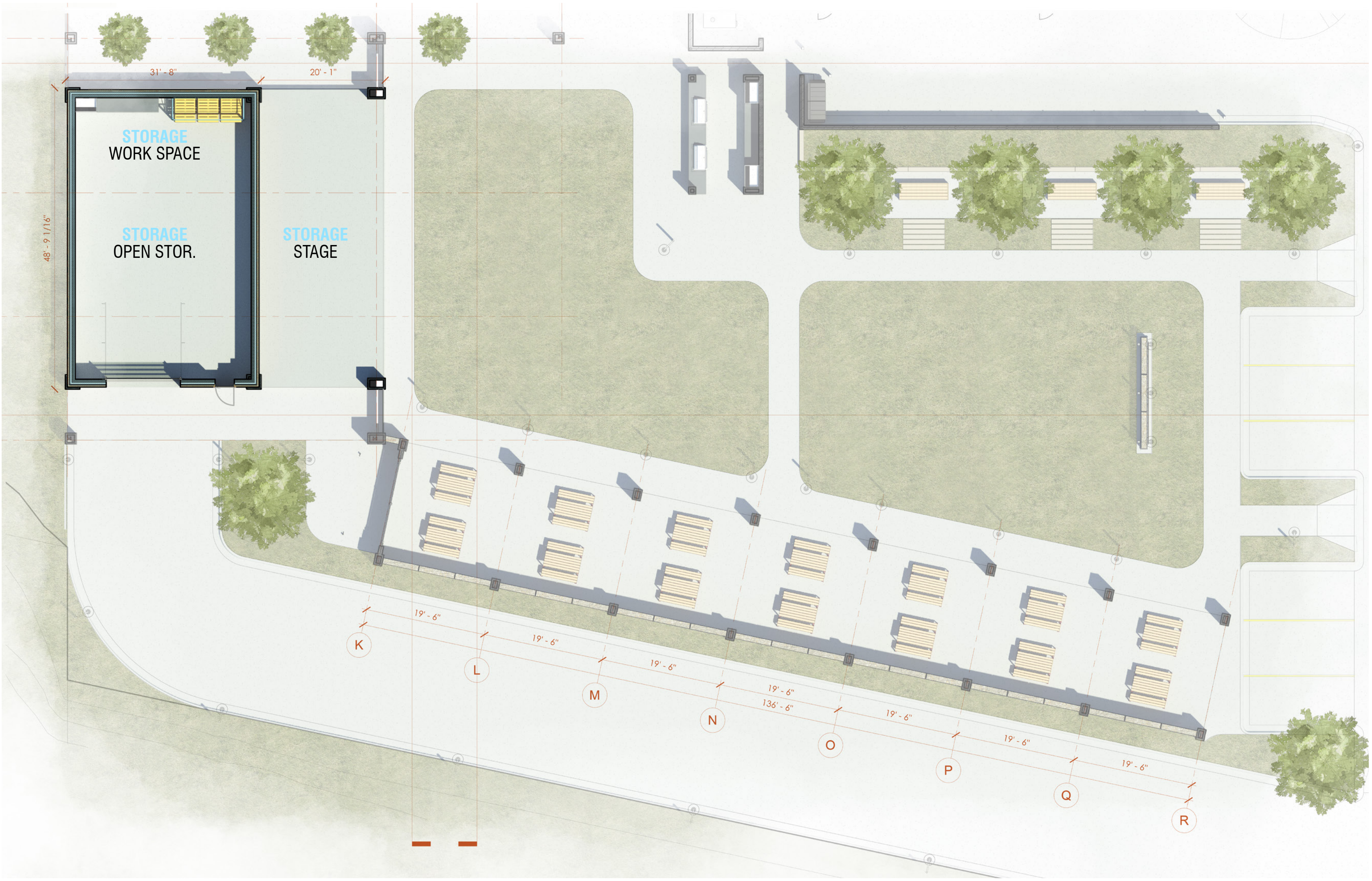
◦ conference / event planning	82 sq. ft.
space	228 sq. ft.
◦ single user offices [3]	
◦ open collaborative work space	292 sq. ft.
TOTAL	602 sq. ft.

II . MISCELLANEOUS SPACES

◦ storage room / mechanical	82 sq. ft.
◦ rest rooms [2]	90 sq. ft.
◦ break room / kitchenette	200 sq. ft.
TOTAL	372 sq. ft.

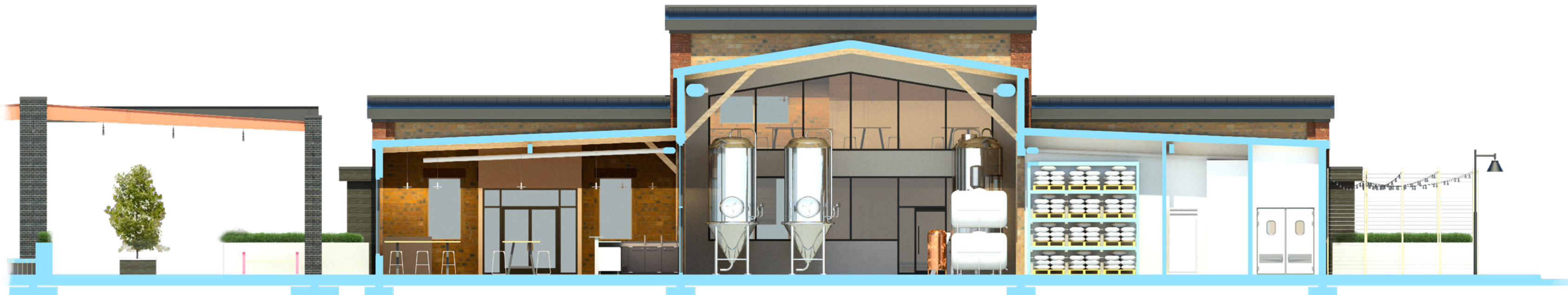
III . STORAGE BUILDING

◦ work space	172 sq. ft.
◦ attached outdoor stage	960 sq. ft.
◦ open storage space	1,126 sq. ft.
TOTAL	2,258 sq. ft.



BUILDING III GROUND LEVEL

Figure 150 | *Design Solution* [Building III Floor Plan]



TRANSVERSE BUILDING SECTION [E / W]

LONGITUDINAL BUILDING SECTION [N / S]

Figure 151 | *Design Solution* [Building Sections]

NORTH ELEVATION

EAST ELEVATION

SOUTH ELEVATION

WEST ELEVATION

Figure 152 | *Design Solution* [Elevations]

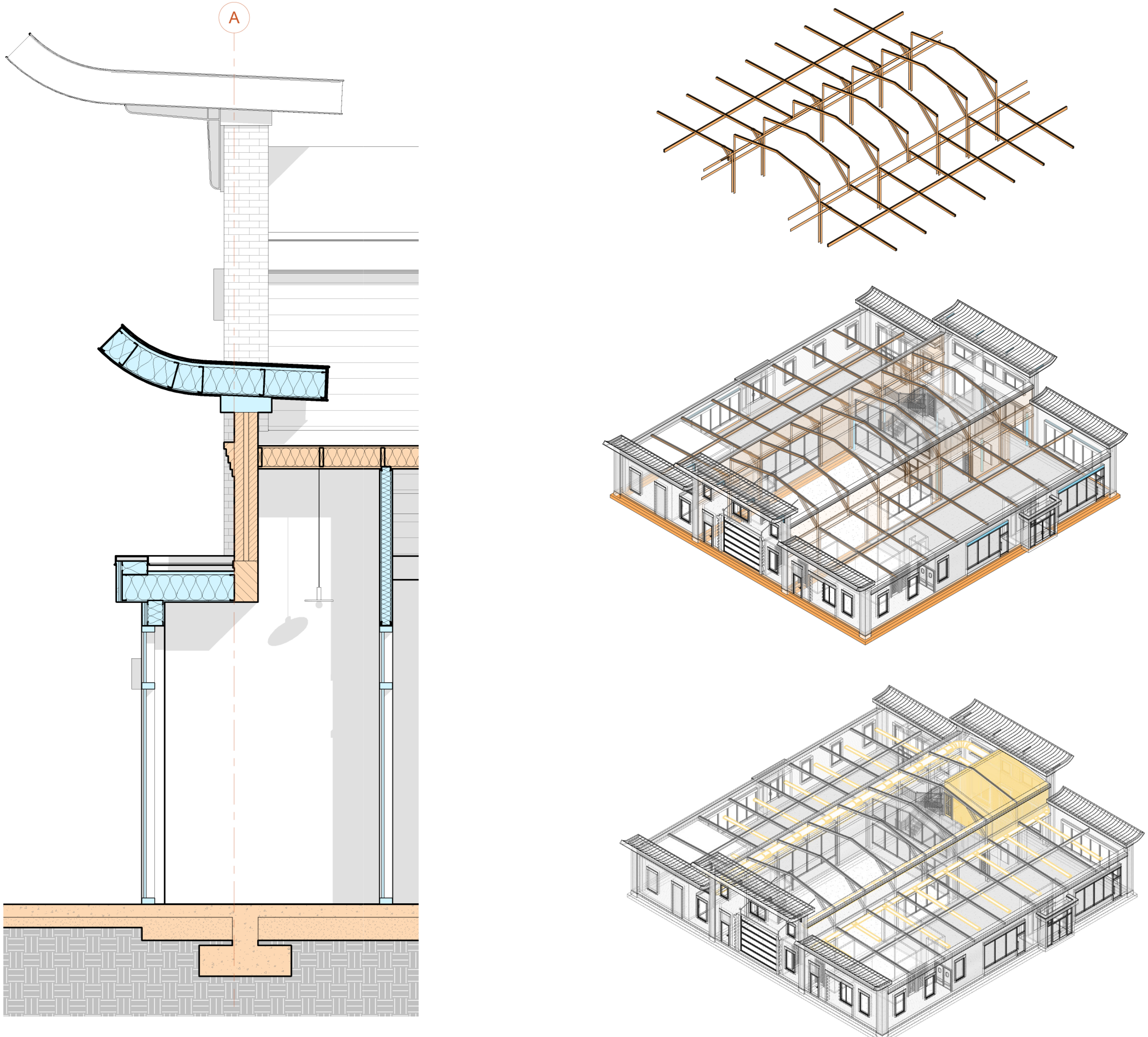


Figure 153 | *Design Solution* [Structure + HVAC]

THEORETICAL PREMISE

This project looks to prove how an existing building can be re-purposed in a way that matches or exceeds the functionality and performance of a newly constructed building at the same geographical location, with the precaution of limiting demolition / construction additions to the existing structure.

COST ANALYSIS

The primary source of analysis to prove this premise is through the cost values that are associated with construction of the built environment in regards to this design.

To illustrate this cost comparison, only the **ADAPTIVE REUSE** BUILDING I of this design was taken into account and compared to a theoretical **NEW CONSTRUCTION** BUILDING I copy of the completed design. This comparison allows for a scenario that proves that the costs of an adaptive reuse design strategy is significantly lower compared the cost required to aquire / demolish the existing building to replace with a new construction building.

Through the adaptive reuse design process, there was minimal demolition needed to the interior of the existing facility, followed with minimal exterior wall demolition to provide openings for new construction storefronts, entrances, and walkways. Costs of maintenance of existing walls and floors were taken into account for the final design, such as cleaning and pointing the existing masonry, as well as repairs necessary to the existing concrete slab as a whole.

PERFORMANCE ANALYSIS .

For the new construction elements added to this design, minimal exterior additions were added to the design, such as vestibule assemblies and roof structures to the Northern and Southern exterior walls. The cost of replacing all window openings were added to the costs of any new construction openings added within the completed design. The final design resulted in a mezzanine observation area, which required the addition of hollow steel tube columns to support the floor structure, which was added to the cost of the complete construction.

The new construction copy used the same calculations for aquiring the existing land and building, as this scenario involves demolishing an existing building to replace it with a new construction design rather than the typology where the project is starting with an open site. When calculating the cost of the new construction replacement, the same area of built assemblies was used, however the building assembly costs were changed to reflect a more modern design approach compared to the existing construction. An example of such changes would be replacing the masonry cavity walls present in the existing building with a steel stud wall and a brick veneer finish for the calculations of the new construction BUILDING I copy,

COST COMPARISON .

I . ADAPTIVE REUSE		COST
EXISTING LAND AQUISITION		$ 333,220 . 00
◦ total property area	[83,305 sq. ft.]	
◦ property value	[$4.00 per sq. ft.]	
◦		
EXISTING BUILDING AQUISITION		$ 275,000 . 00
◦ existing building area	[10,000 sq. ft.]	
◦ building value	[$27.50 per sq. ft.]	
◦		
EXISTING WALL DEMOLITION		$ 1,053 . 00
◦ quantity demolished	[100 cu. yd.]	
◦		
EXISTING CONDITIONS MAINTENANCE		$ 85,106 . 65
DEMOLISHED WALL OPENINGS		$ 4,065 . 48
NEW CONSTRUCTION WALLS		$ 68,684 . 00
◦ quantity added	[3,682 sq. ft.]	
◦		
NEW CONSTRUCTION ROOFS		$ 18,879 . 82
◦ quantity added	[1,789 sq. ft.]	
◦		
NEW CONSTRUCTION OPENINGS		$ 48,467 . 16
NEW CONSTRUCTION STRUCTURAL FRAMING		$ 4,027 . 71
TOTAL COST		$ 838,503 . 82

II . NEW CONSTRUCTION

	COST
EXISTING LAND AQUISITION	$ 333,220 . 00
◦ total property area [83,305 sq. ft.]	
◦ property value [$4.00 per sq. ft.]	
EXISTING BUILDING AQUISITION	$ 275,000 . 00
◦ existing building area [10,000 sq. ft.]	
◦ building value [$27.50 per sq. ft.]	
EXISTING BUILDING DEMOLITION + REMOVAL	$ 80,449 . 45
NEW CONSTRUCTION BUILDING REPLACEMENT	$ 1,279,212 . 95
TOTAL COST	$ 1,967,882 . 40

III . COST COMPARISON

	COST
ADAPTIVE REUSE FINAL COST	$ 838,503 . 82
NEW CONSTRUCTION FINAL COST	$ 1,967,882 . 40
AMOUNT SAVED	$ 1,129.378 . 58

ANALYSIS CONCLUSION

When looking at the final comparison of cost values, it is proved that the adaptive reuse design strategy left a much cheaper alternative to demolishing and replacing the existing building with an identical copy using costs of new construction built assemblies. This conclusion of cost analysis can give enough leverage in favor to adaptive reuse projects, as cost is one of the primary determing factors of any given design project.


Figure 154 | *Design Solution* [Beer Garden]

Figure 155 | *Design Solution* [Event Area]

Figure 156 | *Design Solution* [Beer Garden]

Figure 157 | *Design Solution* [Beer Garden]

Figure 158 | *Design Solution* [Brewpub]

Figure 159 | *Design Solution* [Brewery]

Figure 160 | *Design Solution* [Mezzanine]

Figure 161 | *Design Solution* [Restaurant]

THESIS APPENDIX .

REFERENCE LIST

Amponsah, N.Y., Lacarrière, B., Jamali-Zghal, N., Le Corre, O. (2012). Impact of building material recycle or reuse on selected emergy ratios. Resources, Conservation and Recycling, 67, 9-17. https://doi.org/10.1016/j.resconrec.2012.07.001

City-Data. (n.d.). Retrieved November 27, 2020. https://www.city-data.com/city/Fargo-North-Dakota.html

DJEBBOUR, I., & BIARA, R. W. (2020). The Challenge of Adaptive Reuse Towards the Sustainability of Heritage Buildings. International Journal of Conservation Science, 11(2), 519–520.

Great Northern Railway Depot. (n.d.). Retrieved December 14, 2020. https://library.ndsu.edu/fargo-history/?q=content/great-northern-railway-depot

“Kolstrand Building / Graham Baba Architects” 11 Dec 2010. ArchDaily. Accessed 5 Oct 2020. archdaily.com/94592/kolstrand-building-graham-baba-architects

“Nanchawan·Shiwu Tribe Homestay / The Design Institute of Landscape and Architecture China Academy of Art” 24 Sep 2020. ArchDaily. Accessed 5 Oct 2020. archdaily.com/948098/nanchawan-star-shiwu-tribe-homestay-the-design-institute-of-landscape-and-archi tecture-china-academy-of-art

Natural Resources Conservation Service. (n.d.). Retrieved November 25, 2020. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/maps/?cid=nrcs142p2_053612

Ordoñez Duran, J.F., Chimenos, J.M., Segarra, M., Antonio Boada, P.A., Espindola Ferreira, J.C. (2020). Analysis of embodied energy and product lifespan: the potential embodied power sustainability indicator. Clean Technologies and Environmental Policy, 22, 1055-1068. doi: https://doi.org/10.1007/s10098-020-01848-5

Sanchez, B., Esnaashary Esfahani, M., & Haas, C. (2019). A methodology to analyze the net environmental impacts and building's cost performance of an adaptive reuse project: A case study of the Waterloo County Courthouse renovations. Environment Systems and Decisions, 39, 419-438.
doi: https://doi.org/10.1007/s10669-019-09734-2

"Studio 1334 / debartolo architects" 18 Sep 2020. ArchDaily. Accessed 4 Oct 2020.
archdaily.com/947602/studio-1334-debartolo-architects

REFERENCE LIST, PHOTOS

[Giving Demolished Building Materials a New Life Through Recycling] Accessed 13 Oct 2020.
www.archdaily.com/943293/giving-demolished-building-materials-a-new-life-through-recycling

[Great Northern Railway Depot] Accessed 14 Dec 2020.
https://library.ndsu.edu/fargo-history/?q=content/great-northern-railway-depot

[Kolstrand Building] Accessed 5 Oct 2020.
archdaily.com/94592/kolstrand-building-graham-baba-architects

[Nanchawan·Shiwu Tribe Homestay] Accessed 5 Oct 2020.
archdaily.com/948098/nanchawan-star-shiwu-tribe-homestay-the-design-institute-of-landscape-and-architecture-china-academy-of-art

[Park Shops Adaptive Reuse] Accessed 13 Dec 2020.
https://www.clarknexsen.com/project/park-shops-adaptive-reuse/

[Studio 1334] Accessed 4 Oct 2020.
archdaily.com/947602/studio-1334-debartolo-architects

[The Great Northern Railroad] Accessed 14 Dec 2020.
https://www.historycentral.com/railroad/Greatnorthern.html