THE DAMAGES OF DEMOLITION

Deciding the Future of our Built Environment

by Amy McDonald

The Damages of Demolition

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

By

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THESIS ABSTRACT

THE GOAL OF THIS THESIS IS TO COMPARE THE EFFECTS OF RESTORING A HISTORIC BUILDING VERSUS THE PROCESS OF DEMOLITION AND NEW CONSTRUCTION FOR THE SAME TYPOLOGY. BY QUANTIFYING THE EMBODIED ENERGY PUT INTO THE HISTORIC MATERIALS AND ENERGY LOST THROUGH THE DEMOLITION PROCESS IT WILL CREATE A BENCHMARK TO COMPARE THE ENERGY USED IN NEW CONSTRUCTION. DUE TO THE IMMENSELY BROAD NATURE OF BUILDING DESIGN,THE HARRIS MACHINERY BUILDING IN MINNEAPOLIS WILL BE USED AS THE BUILDING OF CHOICE TO ANALYZE FOR DATA. IT WILL ALSO BE USED IN THE HYPOTHETICAL RESTORATION OR AS THE NEW CONSTRUCTION SITE, BASED ON THE RESULTS OF THE RESEARCH.

EXPLANATION: CONNECTING THE DOTS

This thesis is a multi-phase project that incorporates the knowledge gained through research about the benefits and costs of building restoration. There has been a large amount of time dedicated to the preservation of old buildings and places, but little written guidance on how to best determine when a building should be invested in as a restoration project, or demolished and used as a site for new construction. The hope of this research is create a design methodology to help guide designers through this process by using quantifiable facts and other means of best practice when it comes to analyzing old buildings.

The importance of this topic, I believe, will only continue to grow in the years to come. Preservation has been taught as an important aspect in saving our history, but it may also serve a bigger purpose. As landfills begin to overflow and resources grow scarce, we need to find ways to utilize the built structures around us. Preservation could be one of our best tools in sustainable design.

The research done to support the design method created for this project will all culminate in a final design. A case study building in Minneapolis was chosen to test the design method on and will serve as the basis for the end product: either a restoration or new construction design using the site. It was important to me to use a building that currently exists in order to create the most realistic and usable information possible. All of the products created in this thesis will hopefully be available to aid future designers in their preservation projects, or when faced by the client's question, "what should we do with this old building?"

THESIS NARRATIVE

TYPOLOGY AND PRECEDENTS

Controlling as many variables as possible is important in creating useful information for other design cases. In this project, the building typology for both restored and new construction studies will be mixed-use. The building being studied as the restoration example is a vacant warehouse located in southeast Minneapolis. The conversion of such type of building to mixed-use is very common in this particular neighborhood, making it a realistic candidate for gathering data. The new construction numbers will be gathered from a hypothetical building of identical square footage to the warehouse. A comparable, modern counterpart to the building methods and materials will be used to gather energy data.

precedents

More specific examples of precedent studies will be reviewed later in this text, but in general it was important that the building typology was relative to a broad range of existing buildings in the studied area. The re-purposing of historic buildings into new, useful typologies is common practice all across the world. One of the most common new typologies is mixed-use, which it being taught as one of the most effective ways of improving density and promoting walkable neighborhoods.

Another common link to countless number of case study projects is the popularity of rehabilitation projects in metropolitan areas. Old buildings are being transformed into industrial lofts, offices and retail spaces with loads of character. Clients are paying above and beyond what they would to rent new construction spaces, just for the added ambiance that historic buildings bring. It only makes sense that there should be some type of methodology to selecting which buildings make the cut for restoration and which should simply be demolished, which is where this thesis will be taking us in the case of the Harris Machinery Building.

[PROJECT EMPHASIS

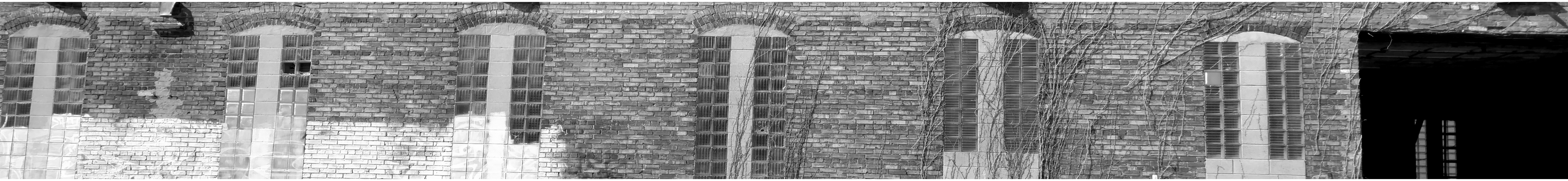
analyzing process

The main goal is to create the start of an analysis process for deciding when a building has reached its full useful life. Realizing that there is no way to create an all-inclusive list of things that make a building a restoration candidate or not, the focus instead is going to be put on defining more broad principles. This will be done by looking at the Harris Machinery Building as a case study, and doing an analysis of its financial, historical, and sustainable viability as a restoration project.

The hope is to end with a clear, and educated decision about the future of the building. This is most important to me because currently not enough attention is given to the initial decision making process in restoration projects. Guidelines for designers would help aide those who find themselves working on restoration projects to make more professional judgments. This in turn could save millions of pounds of waste from entering the landfills, or millions of dollars from the client being spent on a poor restoration candidate.

embodied energy

Within the analysis process, one of the largest areas of focus is going to be gathering the information to calculate the embodied energy of both a historic and new construction building. It is rare in a design field to have quantifiable attributes to compare when looking at options, but embodied energy has become such an important idea that it needs to get talked about a lot more in professional practice. This application of comparing embodied energies is a good way to compare solid facts about the restoration and new construction processes. This is important to me because I believe that a lot of error occurs when the architect begins to simply follow the client's or their own assumptions



about the building without fully understanding what the effects of restoring or tearing it down will be. Looking at the projects from the start with unbiased eyes, along with having quantifiable data, will help to ensure that the best decision possible is being made in temrs of when a building has reached its full useful life.

PROJECT GOALS

1. Bring clarity to the facts about restoration.

The number one goal of this project is to create a reliable resource about the real facts of restoration. It is easy enough for people to label restoration as a good thing, or make generalizations about preserving things from our past. This thesis looks to go beyond these statements and clearly deliver facts about the embodied energy that is in a historic building, the wastes created in the demolition process, and the energy it takes to replace a similar building with a new construction design.

By clearly stating this information, it will help to eliminate the personal preferences or projects done for the wrong reasons. It is our responsibility as designers to be able to make the best decision possible for the client, building and environment. This will not be possible without having all of the facts straight.

2. Examine a real-life case study using this method.

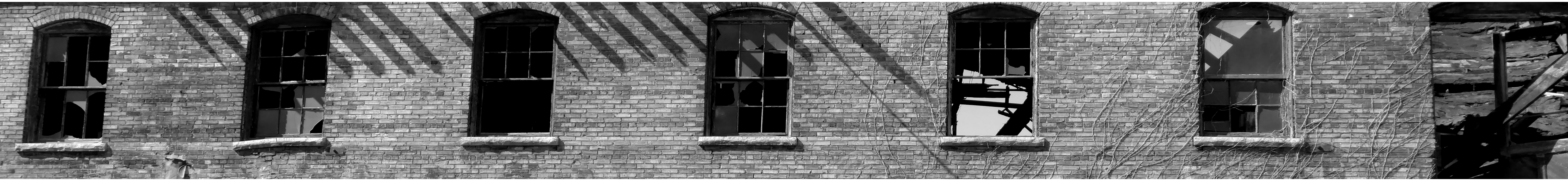
The second step and goal of this project will be to analyze the Harris Machinery Building using the facts gathered in the research portion of this thesis. There is little expectation that the design method created will work perfectly or be all-inclusive, but by using it to analyze an actual building it will help to reveal its shortcomings and test effectiveness.

A unique attribute about the Harris Machinery project is that it has already undergone the analyzing process in the professional realm by both architecture and engineering firms. The results of their studies done for the client to determine the viability of the project will not be used to create pre-biased opinions about whether the building should be saved or not, but rather to compare the issues they felt were most important when analyzing the building. This only adds to the relevance of the research being done, and I believe will shed light on the importance of analyzing the right aspects of a restoration project.

3. Design a viable proposal for the site.

Much of the legwork for this thesis is being done before the design process even begins, but the final step will be to create the best possible design for the site. As mentioned earlier, the design project will either be to rehabilitate the Harris Machinery Building or create a similar sized new building on the same site. The decision for which project will be done is going to be made after the existing building has been analyzing using the design method created earlier.

The typology for either design will be mixed-use, and the considerations taken into account for the real life building will also be applied to this design. The close proximity to the U of M campus was the original owners main focus for the practicality of the building, and will also be taken into account for this project. Other client information from the current Harris Machinery Building owner will be used in the design process to create the most realistic project possible.



CLIENT DESCRIPTION

The client for this project is clearly established since it has been taken on by an actual firm and the owner has been met in previous work experiences. Permission was granted by both owner and firms to use the existing material for academic reasons in this thesis project. For the sake of privacy, the names of the owner and firms involved in the project will not be used at any point. Rather, the owner will be referenced as “AB Developers” and the firm will be given the name “CD Architects”.

The current owner of the building, AB Developers, bought the Harris building after a fire that occurred last January. The original owner’s intent was for the building to become a small brewery that would be within walking distance of the U of M campus.

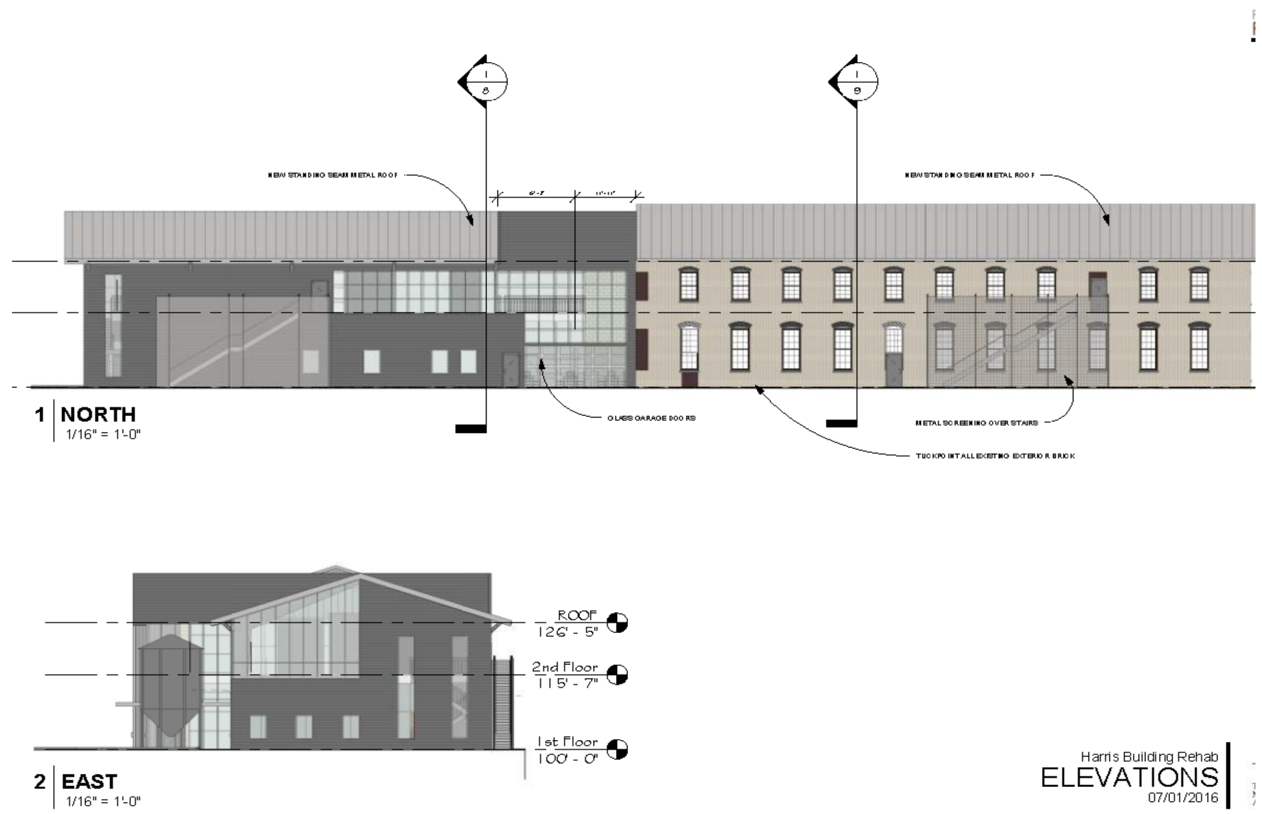
The popularity of micro-breweries within the Minneapolis area made it a viable project, and efforts had already been made to begin stabilizing the structure. CD Architects had been hired to draw plans for a full restoration. Posts were installed on the first floor to help stabilize damage that had occurred after years of vacancy.

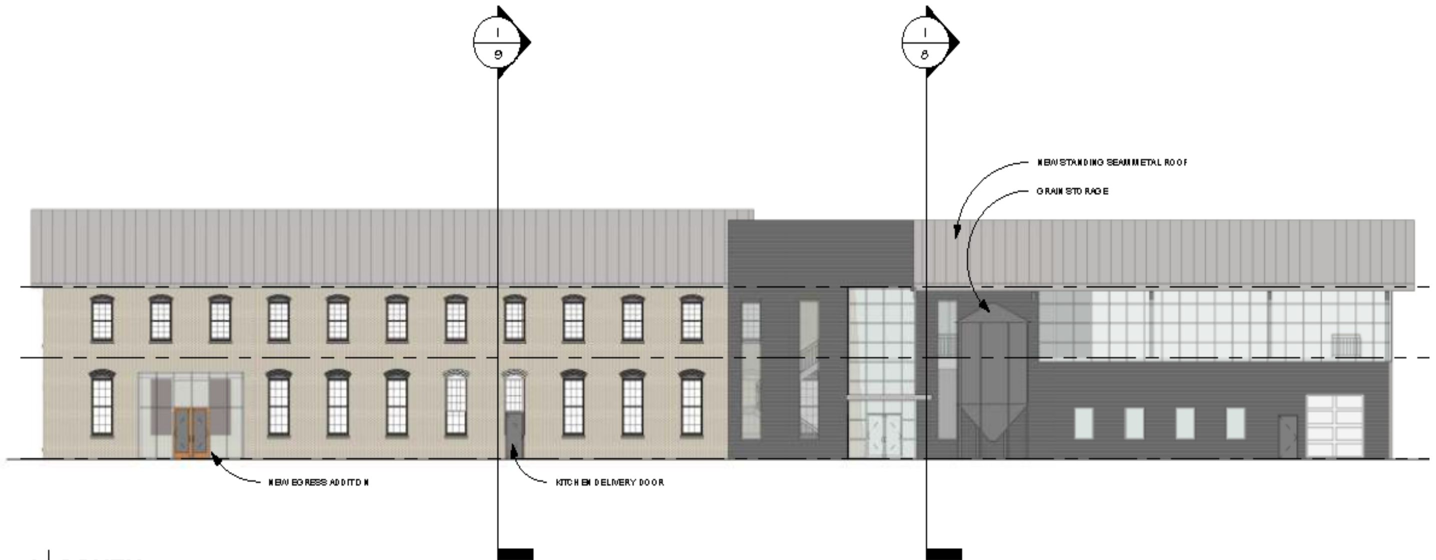
After the fire, the project was discontinued and the Harris Machinery Building was put up for sale. Several months later it was purchase by AB Developers, who once again sought out CD Architects for professional advice on what should be done with the property. The developer’s hope was that it could be restored as a mixed-use building with both retail and apartment space for the nearby college. The client was also open to new construction options on the site if restoration was no longer a viable option. A full analysis was done by CD Architects and a local engineering firm to determine the structural status of the fire damaged building. It was determined at this time that new construction would be the most cost effective option for AB Developers and the idea of restoration was taken out of the design plans.

This is the point in which additional opinions were sought, and this thesis comes into play. A full assessment of the Harris Machinery Building is going to be done for AB Developers with a designed produced based on the information gathered.

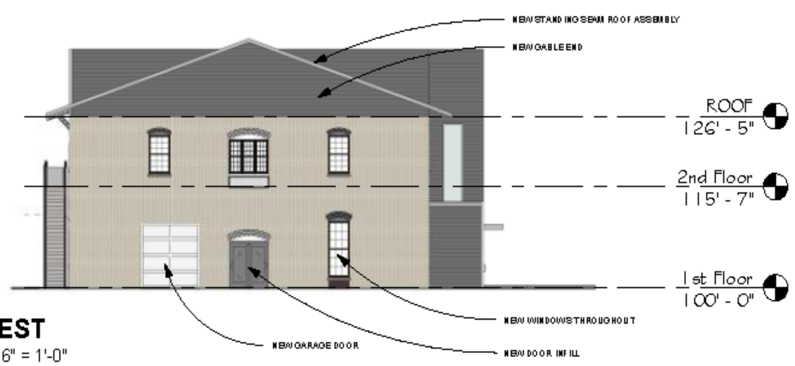
AB Developers is a local business that has done many restoration projects in southeast Minneapolis. They take special interest in mid-sized projects and typically design mixed use buildings to be rented.

Below are the proposed elevations developed by CD Architects for AB Developers. They show the original plans for restoration of the Harris Machinery Building.



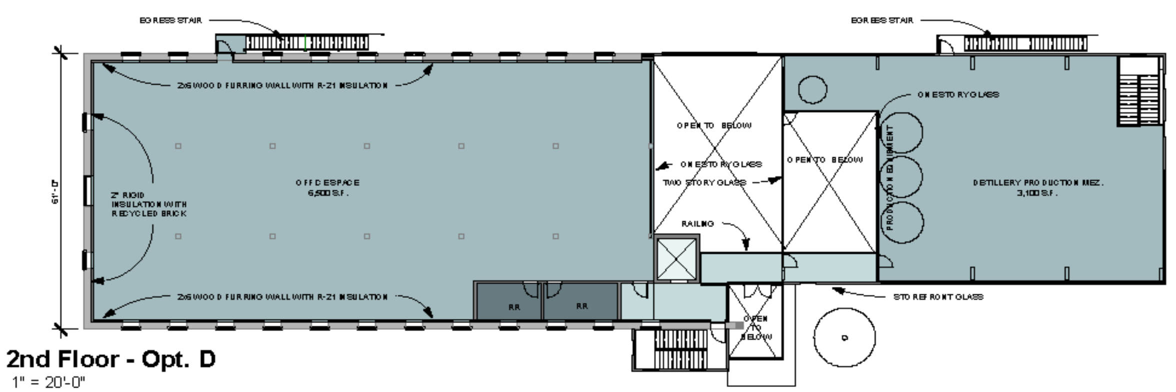


1 | **SOUTH**
1/16" = 1'-0"

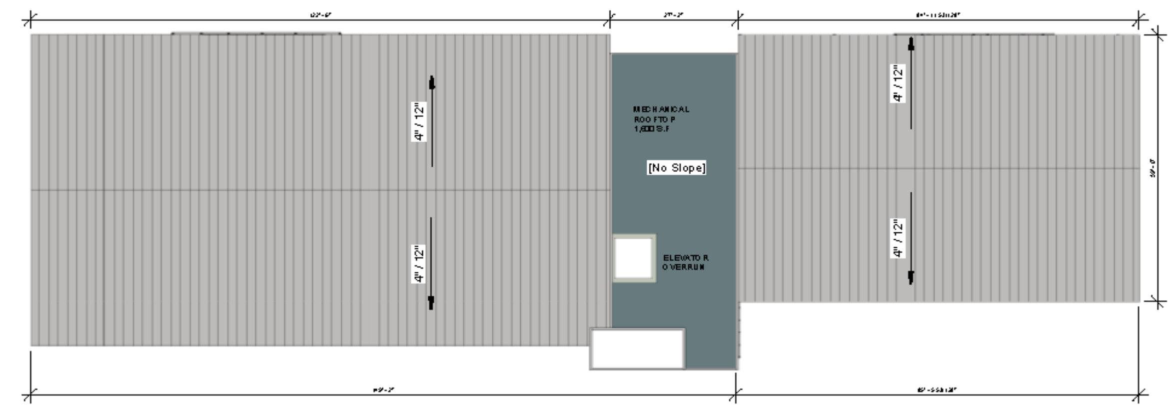


2 | **WEST**
1/16" = 1'-0"

Harris Building Rehab
ELEVATIONS
07/01/2016



1 | **2nd Floor - Opt. D**
1" = 20'-0"



2 | **Roof**
1" = 20'-0"

Harris Building Rehab
FLOOR PLANS - OPT. D
07/01/2016

PROJECT JUSTIFICATION

Historic preservation has been a special topic for me since before my start in the NDSU Architecture program. The old buildings of Sedalia, Missouri were my first interest in the preservation process and eventually what led me to pursue architecture.

Since my time at NDSU, I have taken multiple historic preservation courses, along with practicing preservation in the field at different internships. The Harris Machinery Building was a project at the last firm I interned with and seemed like a perfect fit for the preservation topic I wanted to pursue. There was little question that a restoration was the right typology for my thesis, and the study of the design methodology behind these types of projects came as a thought after taking several graduate courses on preservation.

It became apparent to me during my short time working in the field that there was a gap in the way we handle preservation projects. No matter how good the intentions were of the designers, little guidance is available for people performing an assessment similar to CD Architects. I think that it is important to develop a method for gathering relevant information about historic properties and assessing the facts about each specific project.

With all of the studies done on embodied energy, this seems like the clearly missing piece of the puzzle. Historic preservation has reached a point where it is no longer about only saving historically significant buildings. We are at a crossroads where buildings need to be reused to avoid creating excess waste and putting additional resources into creating a building that may not even be of as high of quality as the building it is replacing. Preservation is no longer just an option, it is a need. The relevance of this topic will only continue to gain ground in the coming years as more emphasis is put on the importance of sustainable design practices. This is why I feel the need for a higher standard of design methodology is needed for all restoration projects.

RESEARCH DESIGN PLAN

This thesis is going to be carried out in three phases: research, analysis and design. Each phase will produce one piece of the final thesis package, with the end product being a final book, boards and presentation.

1. research

Part one has been started already with the initial research paper included in this book. The rest of this phase should be concluded within the first two weeks of the spring semester. This aim of the research is to collect all of information necessary to properly analyze the Harris Machinery Building. This includes facts about embodied energy, demolition waste and other variables effecting the restoration and new construction processes.

2. analysis

The second part is the analysis process. This should take 3 weeks to complete and will include thoroughly analyzing the Harris Machinery Building as well as a hypothetical new building of the same size and typology. The analysis process will be very in depth and the most critical piece of the thesis. The design method will be created from the research done during the first week, and the next two weeks will be used to apply this to the case study building and test its viability. All of this will be recorded and included in a later section of the thesis book. The results of the analysis will determine the path of the third step of the thesis.

3. design

The last piece is the design, which will take the next 6-8 weeks. Based on the results from the analysis, either a restoration or new construction project will be designed for the southeast Minneapolis site.

A typical design project will take place, including an in depth building design and site proposal. The amount of time needed for each design phase will vary based on the project path determined by the analysis. The final product will be the remainder of the thesis book, along with project boards and a presentation that will be completed in the remaining weeks of the spring semester.

RESEARCH PAPER

INTRODUCTION

A desire to preserve the past from the effects of time is an instinctive human quality. Building preservation has been valued globally since the earliest construction projects. Protection has been given to certain places of cultural and architectural significance, but few guidelines have been laid out for the treatment of non-registered historic buildings. Further more, there have been no research supported guidelines put in place to direct a designer when asked by the client "Is this building worth saving?" If architects are to continue making decisions on what the full useful life of a building is, it is necessary to have an evaluation process based on proven statistics.

A structured guideline for the initial decision making process would fill a current gap in our system for preserving historic buildings. All buildings reach a point in their lives where the decision must be made to either continue maintenance or demolish and begin the new construction cycle again. The process behind these kinds of decisions is often overlooked or incomplete in the case of many old buildings. All built things have a useful lifespan, whether that is 5 or 500 years. It is the job of the designer to make educated, ethical and professional decisions when it comes to the future of aged structures.

THESIS PART I ABSTRACT

Part one of my exploration is to develop an evidence-based framework that includes useful information for designers who are working with non-registered, historic buildings. Four simple questions will be further developed with supporting data, these include: 1. Where did the building come from? 2. What has the building been through? 3. How does the building currently exist? and 4. What does the remaining useful life of the building hold? Although broad, the questions

will be explored while looking at a specific design case study, the Harris Machinery building in Minneapolis, MN. The use of this building is strictly to focus the realm of research being done. It can not be emphasized enough that there is no number of case studies that could possibly be used to create an all-encompassing method for examining old buildings. Every design is purely unique in itself, making a general guideline the only possible way to help designers who are working with historic structures.

EXISTING GUIDELINES

The hope of this thesis work is to compliment the existing guidelines that have been put in place by various entities throughout the last century. Many of these are well known and widely used resources that help to educate and guide the public as they seek to preserve both registered and non-registered buildings. A main focus for many of these is the cultural and architectural significance captured by historic buildings, which is undoubtedly an invaluable trait. However, a gap I seem to notice is research based data on the benefits and downfalls of preserving old buildings. It is my hope that the use of both these resources will create a more efficient and educated approach to deciding the future of existing buildings.

One of the most recognized resources for preservationists is The Secretary of Interior's Standards for the Treatment of Historic Properties. The original purpose of this document was to assist grant-aided projects through the National Historic Preservation Fund, although it has grown into a general guideline for homeowners and professionals alike (Tepper, 2015). It outlines four different treatment types for historic structures that have been widely taught as the main preservation categories: preservation, rehabilitation, restoration and reconstruction. The criteria for selecting the most appropriate treatment is also broken into user-friendly terms. Things to be considered include the building's historical important, the integrity of its existing condition, desired future use and local code requirements (Weeks, 1995). This guide has proven highly effective in educating the public about historical buildings, but does not provide alternatives out of the preservation realm. Thus, little about the decision making process that occurs before deciding to invest resources into an existing building is revealed.

A second organization that has provided abundant information and programs to protect nationally recognized historic places is the National Trust for Historic Preservation. The need for a national identity to help empower local and state level projects was made evident to President Truman in the mid 1900's. This was the beginning of the National Trust, which has since brought light to the importance of preserving our nation's history through many different programs. Some of these include the National Treasures List, Most Endangered Historic Places List, Preservation Leadership Forum and Historic Hotels of America (America's Eroding Edges, 2016). Recognition is indeed a great step in protecting historic properties and inspiring individuals to take on preservation projects of their own, but once again it is lacking in statistical support for those working with the less recognized buildings that make up our cities.

Last, and perhaps the most useful for this study, is the Whole Building Design Guide (WBDG) provided by the National Institute of Building Sciences. The process laid out by the WBDG is meant to work in conjunction with the National Register of Historic Places. This is the most applicable process to my research because it is one of the only that mentions alternatives for a building if it isn't feasible to preserve it. According to Tepper (2015), steps in approaching a preservation project should include initial planning, design development, construction, occupancy/operation and divestiture.

The most interesting of these it the last step, in which Tepper states "Any discussion concerning life-cycle costing is not complete unless the end of an asset's useful life is planned" (p.2). The most preferable option is disposal, in which the property changes hands to new ownership where it can be repurposed and used again. This includes sales, exchanges and transfers of property. The second option is referred to as mothballing, where the building is properly prepared and protected to be left vacant for a period of time. Lastly is demolition, which is brought up as an actual reality for the first time in the last three preservation processes.

Although the WBDG claims that the demolition process is highly regulated and all buildings are thoroughly document before demolition, I would call the claim controversial. Too many times buildings are torn down for new construction and little protest is brought about whether or not they could have been saved. Even nationally registered buildings can be demolished by their owners if they are not in a historic district. Statements such as these are concerning, dismissing an important part of a building's life-cycle that is starting to lead to major environmental concerns.

THE IMPACT OF DEMOLITION

The United States has buried itself in a culture of material waste. In just one year, we dispose and replace nearly 1 billion square feet of buildings. It is predicted by the Brookings Institute that between the years 2005 and 2030 we will have demolished and reconstructed one-quarter of today's existing structures (Frey, Dunn & Cochran, 2011). This means that we are loading up landfills at an unjustifiable rate, and the claims of material recycling aren't cutting it. In a study done by SNES consultants, it was found that construction and demolition wastes account for nearly 41% of our urban trash, with only 42% of that being recycled or reused (Proctor, 1991).

How did we get to this point? Industrialization was the start, with new and highly specialized construction materials being made for different building types it took a cyclical process and made it a linear one (Gordon, 1997). From a production and maintenance side, this means higher embodied energies going into more complex materials. From a demolition standpoint, it means assembled building materials are much more complicated to take apart and recycle.

In a study carried out by Athena Institute this last step of the life cycle was analyzed further based on different structural systems. Wood, steel and concrete were all used to calculate the actual amount of energy put into the deconstruction of such structures. The results shed light onto the issue of specialized materials and the difficulties of recycling them. By far the most easily reused materials were the more simple and modest ones often found in historic buildings. Yet still the embodied energy of the demolition process seems a heavy toll on our already damaged environment. Results from the Athena study are given below:

1. Wood- The recycling process of wood is highly limited by the materials cleanliness and purity. Large dimensional lumber was the optimal candidate for recycling, while reclaimed wood came in second with the new trend in rustic barn wood design. Table A1 shows the energy calculations for wood demolition provided by the Athena research group

2. Steel- When present in large quantities, steel can be a great candidate for recycling or reuse. This decision typically depends on the current market value of steel, since the disassemble process is very laborious and expensive. In most instances steel cannot be reused in structural applications due to the minimum load and stress standards that must be met. Table A2 shows the energy calculations for steel demolition provided by the Athena research group

3. Concrete- The most commonly recycled material of the three, approximately 73% of concrete construction debris is diverted from landfills (Gordon, 1997). This is due to the fact that concrete can be easily reduced in size and transported to other locations, where it is crushed and used in other applications. Gordon noted the downside of this process was the large amounts of energy consumed in the transport of process of such a substan tial material. Table A3 shows the energy calculations for concrete demolition provided by the Athena research group.

The data collected through the Athena research group's study provided some interesting numbers regarding the demolition process. As seen in graphs 7.1 and 7.1a, the embodied energy used in the demolition process depends on the material type as well as the contractor's decision to reuse or recycle it. Although still substantially lower than the energy needed to harvest and create new materials, it should be noted that certain options stand superior to others in terms of embodied energy. For example, it would be much wiser to recycle steel debris based on this data than to attempt to reuse it, which requires significantly more energy.

THE IMPACT OF MAINTENANCE

All of our currently existing buildings require a certain amount of energy to continue operating and providing basic needs for inhabitants. These operational energy needs vary by building use, location and technology. It would be easy to assume that with the advance in sustainable technologies, all new construction would be far superior in maintenance costs to their older counterparts. However a study conducted by Frey, Dunn and Cochran that was sponsored by the National Trust for Historic Preservation has proven otherwise.

Data collected through the study of a large variety of building types, both new and "vintage" in construction, showed that we are in many cases still playing catch-up to the building performance of past times. In particular, buildings from the early 1900's consume far less energy than their more modern counterparts, as seen in figure 3 below (Frey, Dunn and Cochran, 2011). This may be in part because they were designed for a time where electricity was not as cheap and readily available as it is today. Building concepts of this time could not ignore the value of natural light, heating and ventilation because it was all that many buildings could afford to have.

In addition to this the study also found that choosing an appropriate building program when retrofitting old buildings makes a large impact on the potential maintenance energy use. The most efficient was the urban village mixed use building type, while the least efficient was the warehouse-to-residential conversion which yielded almost no advantage over new construction (Frey, Dunn and Cochran, 2011).

MATERIAL LIFE

It has been concluded in the last two sections that both demolition and preservation require a certain amount of energy and will impact the environment in different ways. So what should the deciding factor be between these two options for a building? I believe that the link lies in material life.

Before any assessments are made in regards to material life, it is important to understand exactly what the building is composed of. This is no easy task when you are working with structures that have been around longer than yourself and may have faced multiple renovations during that time. In an article done for the National Park Service, Travis McDonald listed some key questions that should be answered about a buildings materiality.

1. Wood- Is the structure log, timber or balloon framed? Was the lumber ax, adze, pit saw, mill saw or band sawed? Are joints formed using notching, mortise/tenon, pegs or nailing? Are nails hand wrought, machine cut with wrought heads or entirely machine cut?

2. Masonry- Are bricks hand or machine molded? Is the mortar's primary component lime or cement? How was wood trim attached to the masonry?

3. Roof- Are several generations in place, and if so are the layers identifiable? Can the original roof pitch be distinguished? What is the materiality of the roof covering?

4. Floor- Are there tack hole patterns that can be used to distinguish the original floor covering?

All of these questions can help designers to better understand the authenticity of the building's materials and make better decisions when it comes to either preserving or demolishing the structure (McDonald, 1994).

Once specific materials have been dated and defined, a broader look at their properties is the next step in the research process. A commonly accepted assessment of material life is the Life Cycle Assessment, sometimes also referred to as a life cost analysis. As described in an overview of the process done for the GSA, the goal of the Life Cycle Assessment is to quantify the inputs and outputs of a material to best understand how it affects the environment (Noblis, 2016). Figures 4 and 5 below from Building and Environment (2011) by Qingyan Chen give an overview of the embodied energy and CO2 emissions created just from the early parts of a material's life cycle. Information such as this is invaluable when it comes to educating designers about the materials we are putting in and taking out of buildings. This also provides a sound basis for material choice and in our case the larger decision of when a building has provided its full useful life.

Another widely used term coined by William McDonough is "cradle-to-cradle". This describes the life of a material from the point it is extracted from earth to its return to a manufacturable resource (Jansweg, 2014). The less extensive version of this idea is cradle-to-grave, which includes everything up until a materials disposal. Both are important concepts to keep in mind when looking at a materials life and considering all the impacts they have during their full life cycle.

CONCLUSION

In conclusion, there are many aspects of a building's life and every one is completely unique in itself. There is data available that should be used by designers to educate themselves on the impact our currently building and demolition processes have on the environment. Our current efforts are not enough, additional guidelines need to be set in order to ensure that we are making the best possible decisions about the futures of historic properties.

			Recycle Case			*Reuse Case*		
Location	**Climate Point**	**[Productivity]** $^{-1}$	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**
Vancouver	Baseline	1	546895	0.419	118.37	423698	0.324	91.71
Vancouver	August	1.14	623460	0.47	134.95	483016	0.37	104.55
Vancouver	July (2.5%)	1.18	645336	0.494	139.68	499964	0.383	108.22
Vancouver	January	1.69	743759	0.569	160.99	626418	0.480	135.59
Vancouver	January (2.5%)	2.38	885933	0.678	191.76	786767	0.602	170.29
Toronto	Baseline	1	546895	0.419	118.37	423698	0.324	91.71
Toronto	July	1.19	650805	0.498	140.87	504291	0.386	109.13
Toronto	July (2.5%)	1.3	710963	0.544	153.89	550807	0.422	119.22
Toronto	January	2.32	873570	0.669	189.08	772824	0.592	167.28
Toronto	January (2.5%)	4.17	1254762	0.961	271.59	1202747	0.921	260.33

Table A1: Summary of Demolition Energy Calculations - Wood Assembly

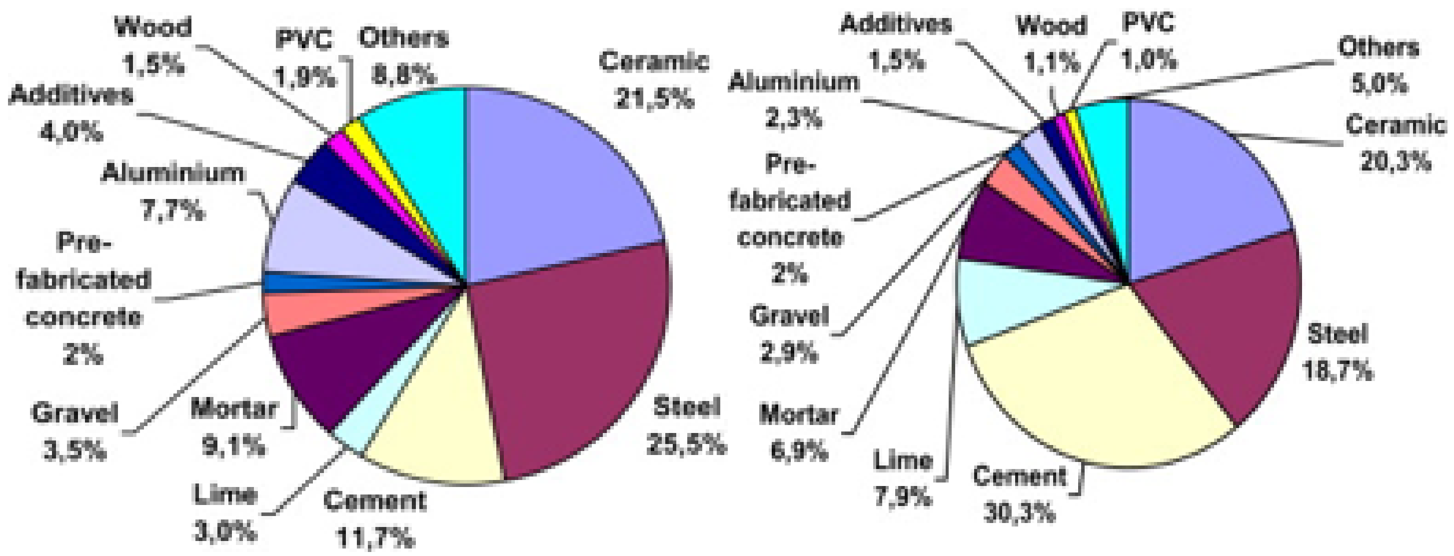
			Recycle Case			*Reuse Case*		
Location	**Climate Point**	**[Productivity]** $^{-1}$	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**
Vancouver	Baseline	1	509605	0.301	110.3	1029811	0.608	222.9
Vancouver	August	1.14	580950	0.343	125.75	1173984	0.693	254.11
Vancouver	July (2.5%)	1.18	601334	0.355	130.16	1215177	0.717	263.02
Vancouver	January	1.69	792844	0.468	171.61	1781895	1.052	385.69
Vancouver	January (2.5%)	2.38	1025124	0.605	221.89	2430999	1.435	520.35
Toronto	Baseline	1	509605	0.301	110.3	1029811	0.608	222.9
Toronto	July	1.19	606430	0.358	131.26	1225475	0.723	265.25
Toronto	July (2.5%)	1.3	662486	0.391	143.39	1338754	0.79	289.77
Toronto	January	2.32	1004926	0.593	217.52	2374555	1.402	513.97
Toronto	January (2.5%)	4.17	1627704	0.961	352.32	4114905	2.43	890.67

Table A2: Summary of Demolition Energy Calculations - Structural Steel Assembly

			Recycle Case			*Reuse Case*		
Location	**Climate Point**	**[Productivity]** $^{-1}$	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**	**Total Energy (MJ)**	**Energy Int. (MJ/kg)**	**Energy Int. (MJ/m^2)**
Vancouver	Baseline	1	477886	0.107	103.44	556109	0.124	120.37
Vancouver	August	1.14	544790	0.122	117.92	663964	0.148	143.71
Vancouver	July (2.5%)	1.18	563905	0.126	122.06	656209	0.147	142.04
Vancouver	January	1.69	557386	0.125	120.65	611720	0.137	132.41
Vancouver	January (2.5%)	2.38	589097	0.132	127.51	611720	0.137	132.41
Toronto	Baseline	1	477886	0.107	103.44	556109	0.124	120.37
Toronto	July	1.19	568684	0.127	123.09	661770	0.148	143.24
Toronto	July (2.5%)	1.3	621252	0.139	134.47	722942	0.162	156.48
Toronto	January	2.32	586340	0.131	126.91	611720	0.137	132.41
Toronto	January (2.5%)	4.17	671362	0.15	145.32	611720	0.137	132.41

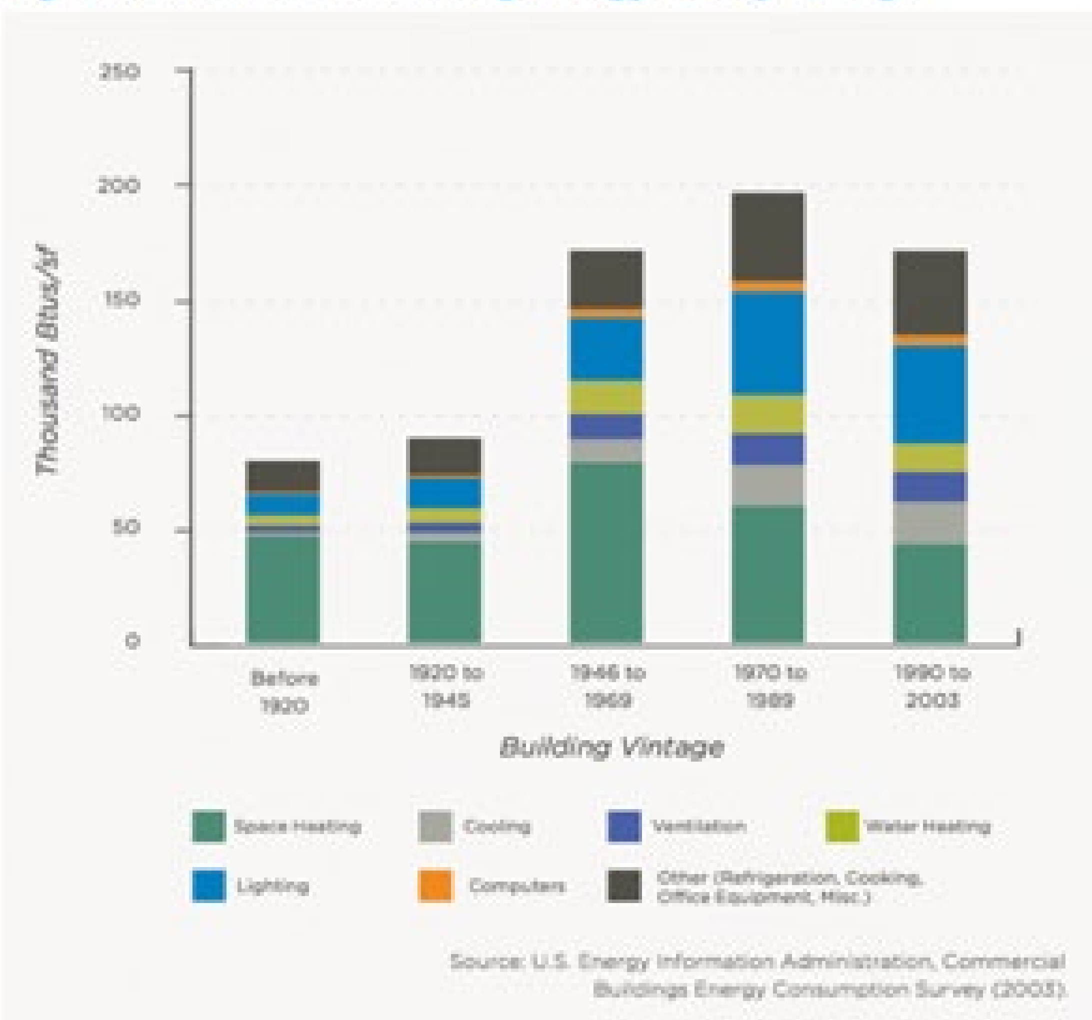
Table A3: Summary of Demolition Energy Calculations - Reinforced Concrete Assembly

The above tables were produced by the Athena Sustainable Materials Institute in their study of embodied energy in demolition processes (Gordon, 1997).



The above graphs were produced by the Athena Sustainable Materials Institute in their study of embodied energy in demolition processes (Gordon, 1997).

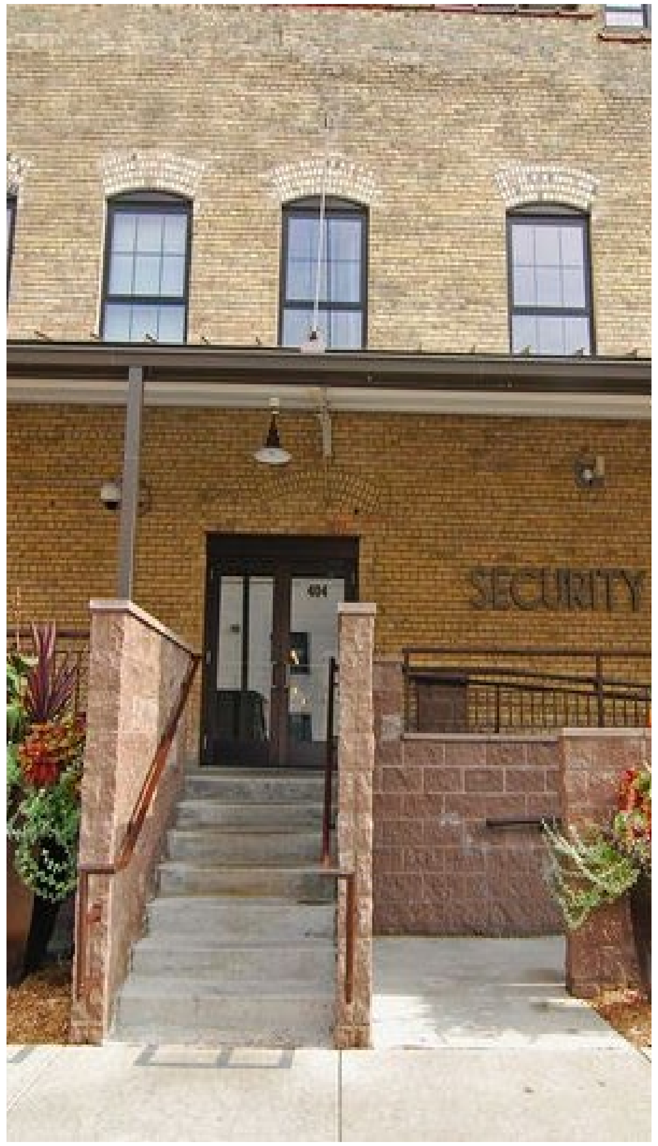
Figure 3: Commercial Building Energy Use by Vintage



The above table was produced by the National Trust for Historic Preservation in their study of maintenance energy costs (Frey, Dunn & Cochran, 2011).

PRECEDENT ANALYSIS

ALL THREE OF THE FOLLOWING CASE STUDIES ARE FOUND IN THE HEART OF MINNEAPOLIS, WHERE THE REHABILITATION OF BUILDINGS AND NEIGHBORHOODS HAS TAKEN OFF AS AN OVERWHELMING TREND IN THE LAST DECADE. WAREHOUSES, MILLS AND MANY OTHER TYPOLOGIES ARE BEING REINVENTED TO SERVE A NEW PURPOSE IN THE QUICKLY EXPANDING CITY. EACH STUDY WAS SELECTED FOR ITS PARTICULAR CONTRIBUTION OF RELEVANT INFORMATION IN REGARDS TO THE HARRIS MACHINERY BUILDING.



SURLEY BREWING, SE MINNEAPOLIS

development

The addition of Surly Brewing Company's latest building in Southeast Minneapolis is part of a larger redevelopment plan for the SEMI district. Currently made up of warehouses (including Harris Machinery), SEMI is hoping to become a more lively link between the Como and Prospect Park neighborhoods. Surly has always been a local hit, and has been pinpointed as the starter of the big micro-brewery trend that has taken off in recent years. The 8.3 acre lot was previously home to a photo processing factory, which had fallen into disrepair. The addition of Surly is a perfect fit for the SEMI district's new plan and will hopefully continue to draw people into the area as the neighborhood continues to be rehabilitated and portioned off for additional new construction.

conclusion

SEMI's new identity should be forged by bringing in popular new amenities for Minneapolis citizens. The Harris Building should take into consideration the modern development ideas being put into place for this district.

program

The Surly Brewery has labeled itself as a "destination brewery" in Minneapolis that consists of a German inspired beer hall, upscale restaurant, event center, brew-house and beer garden out front of the building. The spaces are very open, with the beer hall and brew-house on the first level and restaurant and event center on the second. The layout of the building relates closely to the layout of many warehouse conversions in the area, with large open spaces and exaggerated ceilings. The site itself allowed for plenty of room for the design to flow horizontally and avoid a high rise feel. The designers at HGA took advantage of this and created comfortable spaces that capture the casual spirit of the company.

conclusion

The program of the building at the end of the day needs to translate well with the desired feel. Horizontal spaces, rather than small vertical ones, are more common in this area.

composition

The design proposed to Surly by HGA of Minneapolis is not comparable to anything in the area. It has been described in articles as ominous and "as dark as the names of Surly's brews." This monstrous building certainly takes on a persona of its own, with dark metal sheathing and large horizontal bands of glass. The industrial theme of the neighborhood is kept with the shape and scale of the building.

conclusion

The modern approach to the warehouse taken by HGA may not directly translate into existing buildings in SEMI, but the ingenuity of the design is inspirational different views on a classic typology are important in creating a diversified neighborhood.

TYPOLOGY:
brewery
(new construction)
TOTAL SF:
50,000
BUILT IN:
2013
PROJECT COST:
$30 mil.

JACKSON BUILDING, MINNEAPOLIS

development

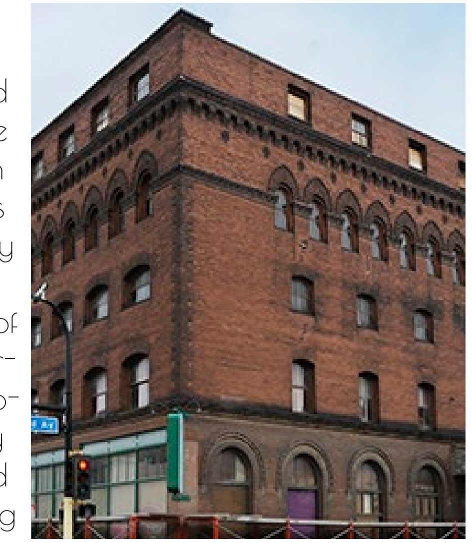
The North Loop neighborhood in Minneapolis was one of the first to take off with restoration and rehabilitation projects. As the area has started to run dry of buildings to be renovated, the Jackson Building was one of the last projects to join the party in 2015. Now the Hewet Hotel, the buildings was formerly a farm warehouse and served as a "fortress" of types standing on the corner of Washington and 3rd Avenue. It stood empty for many years and left people wondering what its future would hold as the buildings around it were bought up and began to fill with small businesses. The design team worked closely with the neighborhood association in North Loop to make sure they approved the plans for development and that it met the overall scheme of the district.

conclusion

The design team's work to include a local group in the planning process is a great example of how to design in an already developing neighborhood. This could apply to the Harris Building's relation to the nearby U of M campus buildings.

program

Hewing Hotel is a luxury feature of North Loop that attracts many traveling business people and those wanting a finer staying experience in Minneapolis. It houses 120



rooms, a rooftop area for those staying at the hotel and a fine dining restaurant. One missing piece that has proved to be a problem is the lack of parking. This is a common issue with many of the sites in this area, where few off-street parking spaces are available. The original Jackson Building was 5 stories above grade for farmhouse equipment and one below grade for storage. To meet circulation needs for the hotel, two elevators were added and floors sectioned off to provide the best room views possible.

conclusion

The transition from warehouse space to hotel seemed to have worked fairly seamlessly. The open floor plan of most warehouses allows for some design creativity and the luxury of creating many unique spaces within the building.

composition

The design was created by ESG and mostly preserves the original exterior state of the Jackson Building. Its heavy masonry presence on the block corner is an important piece of the neighborhood, so it was not greatly altered during the remodeling process. The interior took on a luxurious industrial theme, with plenty of character to be had in all of the spaces. Metal and dark wood finishes add a component of depth that works well with the exterior appearance of the hotel.

conclusion

Preserving the exterior of the building was a key component in maintaining the presence of the structure within the neighborhood. It is a good model for the benefits of saving historic masonry buildings.

SECURITY WAREHOUSE, MINNEAPOLIS

development

Another part of the North Loop development, the Security Warehouse Lofts were one of the first large scale projects in the area. The historic characteristics of the neighborhood were maintained in the exterior of the masonry building. It has added more spacious living options for residents wanting to call North Loop home, during a time when micro-apartments have taken reign over the metropolitan area.

conclusion

The conscious effort made to preserve the historic characteristics of the building's exterior help blend the remodel with the existing neighborhood. This is an important consideration in any historic preservation project.

program

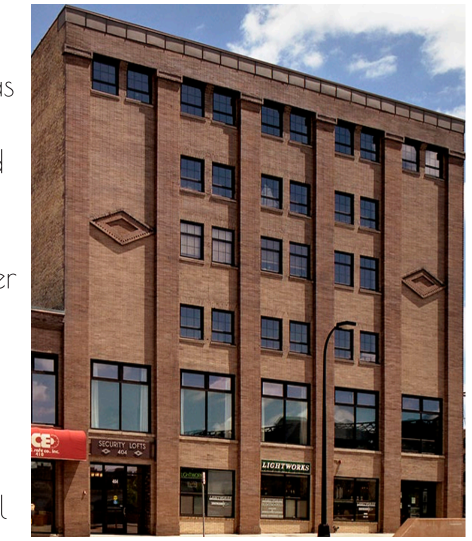
The Security Warehouse building now contains 54 units, workout and community rooms spread out on 6 floors. Most of the units range from 1,200-1,500 sf making them larger than the typical Minneapolis apartment. During the plan drawing process an emphasis was put on working around original architectural elements of the building, with hope of creating a more vintage feel that has been popular with the market in recent years. The heavy timber structure lent itself well to the design, since most of the floors had originally been completely open. This gave designers a blank slate to work with when it came to subdividing the space.

conclusion

This is another great example of the diversity of uses for old warehouse buildings. Although larger in size, the structure is similar to that of the Harris Machinery Building and will also be a great canvas for re-purposing.

composition

The exterior of the building was kept mostly original with new glazing added to the first and second floors where the original windows had fallen into disrepair. The interior timber structure was completely exposed throughout the building. The lofts are generously sized to allow for a more open, airy feel under the large beams. An industrial theme was kept throughout the building with finishes such as metal, concrete and wood used abundantly.



conclusion

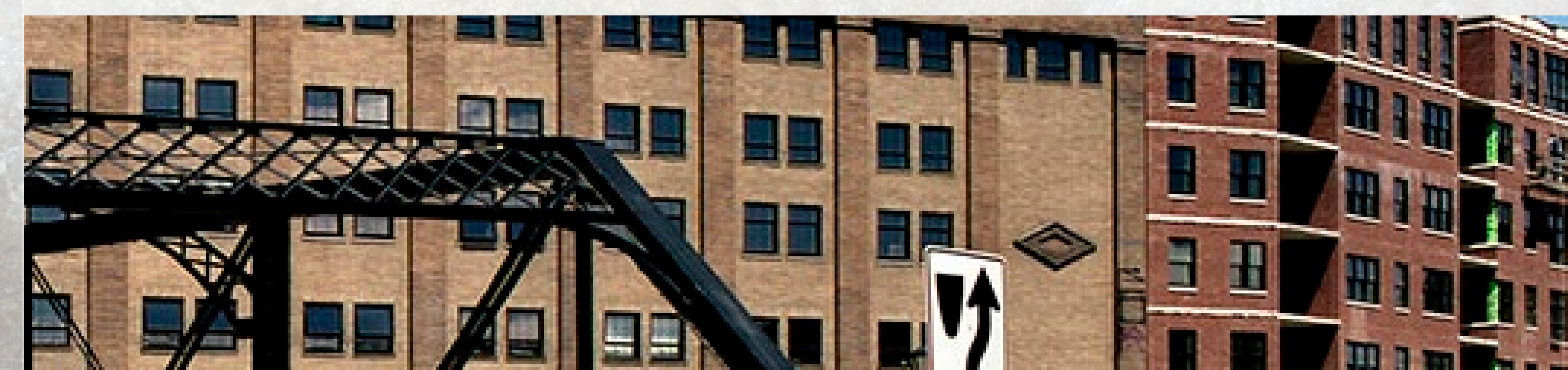
Preserving the exterior of the original building was once again utilized to keep the overall feel of the neighborhood consistent. Replacing elements where necessary was a key factor in the success of the design. This will also need to be implemented in the fire damaged areas of the Harris Machinery Building.

TYPOLOGY:
condo/lofts
(restoration)

TOTAL SF:
88,000

BUILT IN:
2004

PROJECT COST:
not avail.



PROJECT PROGRAM

THE PROGRAM OF A BUILDING IS THE FOUNDATION OF ITS FUNCTIONALITY, EITHER SETTING IT UP TO BE A SUCCESSFUL DESIGN OR FAILURE IN LIVABILITY. THE NATURE OF WAREHOUSES LEND THEM TO BE GREAT CANDIDATES FOR REHABILITATION. FLEXIBILITY IN THE NUMBER, SIZE AND ORGANIZATION OF SPACES GIVES THE DESIGNER COMPLETE CONTROL OVER THE PROGRAMMING OF THE BUILDING. THE HARRIS MACHINERY BUILDING IS THE PERFECT MODEL OF SUCH DESIGN FREEDOM, WITH OPEN SPACES AND LIMITED STRUCTURAL OBSTRUCTIONS.

MASTER PLAN: PROBLEM STATEMENT

function

Steering away from the average rehabilitation process, this project will not have a specific typology. Rather it will be designed to adapt to a wide range of uses, in hopes to elongate the useful lifespan of the building. In order to do this, only fundamental program elements will be included in the original floor plans. These include egress, circulation, restrooms and utilities.

The second part of the project will show possible adaptations of the base floor plan to a variety of uses.

form

The existing site/building should set precedent for the form of the design. Since it is an existing of the developed neighborhood, it should maintain its presence and overall scale. Efforts should be made to preserve any significant historical properties of the site/building during the rehabilitation process.

economy

In consideration of the budget constraints caused by the fire damage to the original structure, the design must be sensitive to the cost of the project. Construction should be executed in such a way that the building is fully stabilized for its new uses, but not so far beyond in embellishments to create a project that is not economically viable for the client.

time

Due to the setbacks already caused in the construction process, a tight time line must be kept during all phases of design and construction. An estimated six week assessment period will take place in order to make the best possible decision as to whether restoration or new construction is the best alternative for the project. After this either a full rehabilitation or new construction will take place, both with varying time lines. The master plan must also take into consideration other projects that may occur in the surrounding SEMI district, causing higher volumes of traffic to the site.

BUILDING SUMMARY

Building Area	Phase 1						
Space Name	**People**	**Capacity**	**Unit**	**Net Area**	**Net:Gross**	**Gross Building Area**	**Qualitative**
Harris Machinery Offices							
Reception	1	3	1	750	0.5	1,500	Formal
Seating	5	5	1	500	0.5	1,000	
Executive Office	2	20	10	6,000	0.4	8,400	Formal
Open Work Area	12	24	2	2,000	0.55	3,100	Collaborative, Inviting
Board Room	15	15	2	1,000	0.4	1,400	
Storage			2	250	0.4	350	
Janitorial			2	200	0.4	280	
Bathroom			2	300	0.5	350	
IT Closet			2	200	0.4	280	
Subtotal	35	67	26			16,660	
Harris Machinery Apartments							
Seating	5	5	1	600	0.5	900	
Renting Office	1	2	2	900	0.4	1,260	
Storage			1	500	0.4	700	
Bathroom			1	100	0.5	150	
Administration	1	1	1	250	0.5	375	
One Bedroom	10	1	10	7,500	0.5	11,250	Urban, Casual
Two Bedroom	10	2	5	5,000	0.5	7,500	Urban, Casual
Effeciency	5	1	5	2,500	0.5	3,750	Urban, Casual
Subtotal	32	13	26			25,885	
Shared Ammenities							
Exercise Room	15	20	1	2,000	0.55	3,100	
Locker Room	8	10	2	400	0.5	600	
Cafeteria	24	25	1	2,000	0.5	3,000	
Subtotal	47	55	4			6,700	

PLEASE NOTE: All space estimations are done for schematic purposes. This project is not specified for one typology, so a "typical" mixed-use program was used to complete this requirement of the thesis.

LAND USE SUMMARY

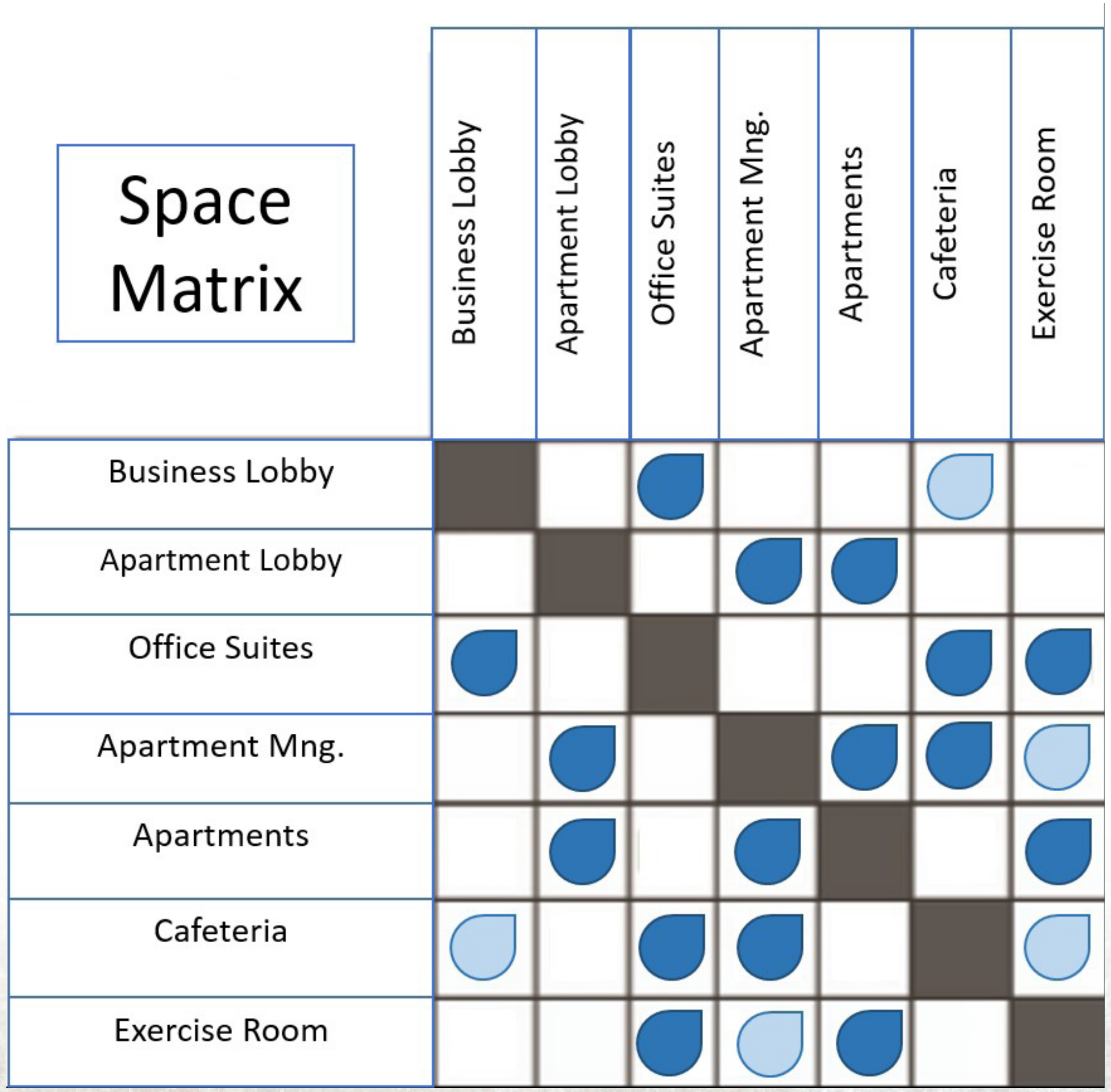
Land Use Area	Phase 1						
	People	**Gross Building Area**	**Floors**	**Building Footprint**	**GAC**	**Land Area**	**Qualitative**
Harris Machinery Building							
Building	114	49,245	2	25,000	50%	50,000	
Public Green Space	50		1		25%	20,000	Urban, Open
Parking:		Parking Count:					
Apartment	85	32,300	1	32,300	70%	46,142	
Business	40	15,200	1	15,200	70%	21,714	
Guest	20	7,600	1	7,600	70%	10,857	
	309	75,284		80,100		148,695	

SPACE LIST

Function	People	Capacity	No. of Units	Area/Unit	Net Area	Net Area Subtotal
Harris Warehouse Apartments						
Business Lobby						
Reception		3	1	750	750	
Seating		5	1	500	500	
Subtotal						1,250
Apartment Lobby						
Seating		5	1	600	600	
Subtotal						600
Rentable Office Suites						
Executive Office	2		10	600	6,000	
Open Work Area	12		2	2,000	4,000	
Board Room		15	2	1,000	2,000	
Storage			2	250	500	
Janitorial			2	100	200	
Bathroom			2	150	300	
IT Closet			2	100	200	
Subtotal						13,200
Apartment Management						
Renting Office	2		2	450	900	
Storage			1	500	500	
Bathroom			1	100	100	
Administration	1		1	250	250	
Subtotal						1,650
Aparments						
One Bedroom			10	750	7,500	
Two Bedroom			5	1,000	5,000	
Effeciency			5	500	2,500	
Subtotal						15,000
Shared Ammenities						
Exercise Room		20	1	2,000	2,000	
Locker Room			2	200	400	
Cafeteria		25	1	2,000	2,000	
Subtotal						4,400

PLEASE NOTE: All space estimations are done for schematic purposes. This project is not specified for one typology, so a "typical" mixed-use program was used to complete this requirement of the thesis.

SPACE MATRIX



SITE ANALYSIS

THE COMPASSION OF A MINNEAPOLIS BUSINESS OWNER LEFT THE HARRIS MACHINERY BUILDING ABLAZE ONE COLD WINTER MORNING LAST JANUARY. THE DEVASTATION LEFT BY THE FIRE NOT ONLY SEVERELY DAMAGED THE BUILDING, BUT GREATLY AFFECTED THE SURROUNDING SITE THAT HAD ONCE BEEN HOME TO ONE OF THE CITY'S BIG NAMES IN MANUFACTURING.

501 30TH AVE SE MINNEAPOLIS

context

The Harris Machinery site sits behind an old dirt road with towering grain elevators creating a backdrop reminiscent of a small Midwestern town. It is hard to believe that just three blocks away sits the infamous Witch's Hat tower and even closer is the University Transit-way. This area has come to be known as the Southeast Minneapolis Industrial area (SEMI). It is a quirky blank spot in the bustling Southeast Minneapolis that has left many scratching their heads on what its future will hold. It has posed itself as a barricade between the Como and Prospect Park neighborhoods, making itself easy enough for a driver to end up lost in an abandoned railway yard or peering through the monstrous 1900's building windows.

conclusion

The unique atmosphere of SEMI should be preserved while also meeting the current needs of Como and Prospect Park residents with any future design efforts.

climate

The Twin Cities' metro experiences extreme changes in temperature, precipitation and humidity throughout the year, making it an incredibly challenging area to design for. Average lows in the winter are near single digits, and highs in the summer can soar over 100 degrees Fahrenheit. Adding to this is the urban heat island effect, in which large areas of concrete or asphalt trap heat and tall building blocking the wind limit cooling. The site is susceptible to the heat island effect due to the large amounts of hardtop ground covering. Precipitation is also a variable in the Minneapolis climate. Rain, sleet and snow occur through-out the year, drenching the landscape. The average annual snowfall is just over 45 inches but has historically reached up to 100 inches per winter.

conclusion

Designing for the seasons will be a large influence on the decisions made for the site. Minimizing the urban heat island effect will be important to ensure a comfortable environment on the site.

topography

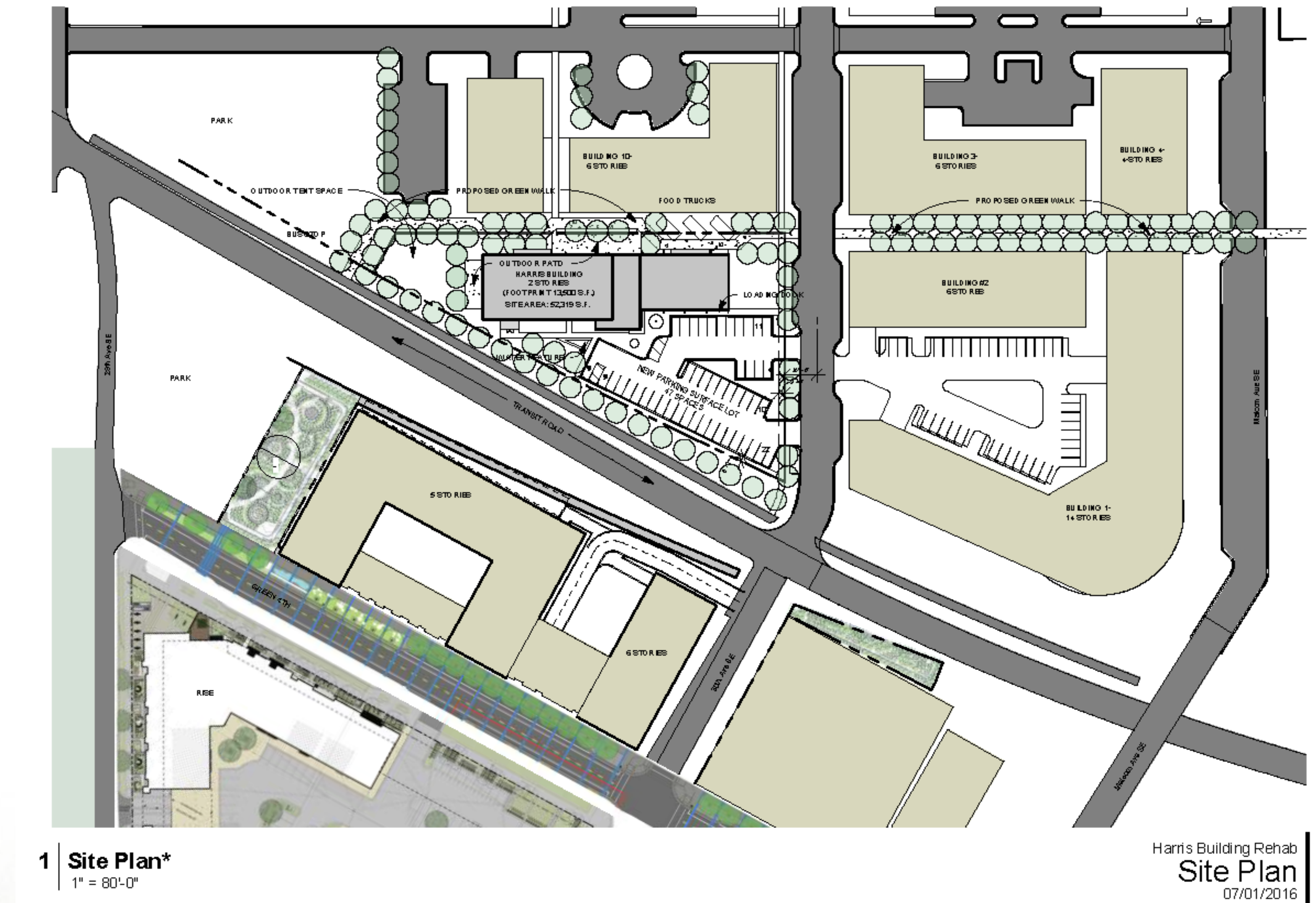
The site is primarily flat, which is very typical of the more highly developed areas in Minneapolis. This can pose drainage issues due to the large amounts of precipitation gathered throughout the year. The current building has sunk some from its original elevation, so any restoration of this would need to be mindful of drainage paths away from the building.

conclusion

The topography should not be for the design of a new building or rehabilitation of the existing building. Care will need to be taken to ensure proper drainage away from the buildings.

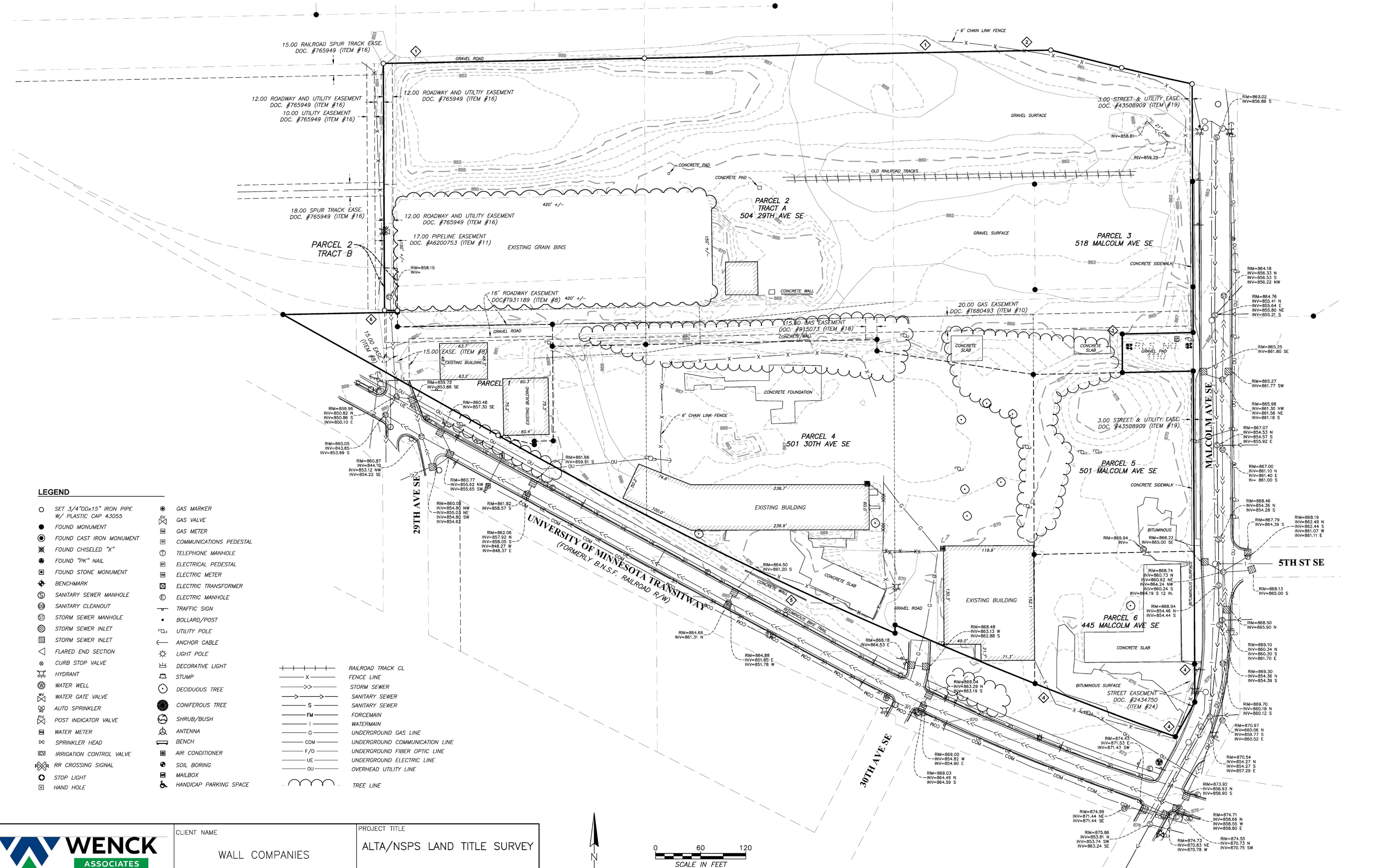
EACH NEW SITUATION REQUIRES A NEW ARCHITECTURE

-Jean Nouvel



Proposed site plan for the original building restoration done by firm AB Architects.

ALTA/NSPS LAND TITLE SURVEY



LEGEND

- SET 3/4"OD×15" IRON PIPE W/ PLASTIC CAP 43055
- FOUND MONUMENT
- FOUND CAST IRON MONUMENT
- FOUND CHISELED "X"
- FOUND "PK" NAIL
- FOUND STONE MONUMENT
- BENCHMARK
- SANITARY SEWER MANHOLE
- SANITARY CLEANOUT
- STORM SEWER MANHOLE
- STORM SEWER INLET
- STORM SEWER INLET
- FLARED END SECTION
- CURB STOP VALVE
- HYDRANT
- WATER WELL
- WATER GATE VALVE
- AUTO SPRINKLER
- POST INDICATOR VALVE
- WATER METER
- SPRINKLER HEAD
- IRRIGATION CONTROL VALVE
- RR CROSSING SIGNAL
- STOP LIGHT
- HAND HOLE
- GAS MARKER
- GAS VALVE
- GAS METER
- COMMUNICATIONS PEDESTAL
- TELEPHONE MANHOLE
- ELECTRICAL PEDESTAL
- ELECTRIC METER
- ELECTRIC TRANSFORMER
- ELECTRIC MANHOLE
- TRAFFIC SIGN
- BOLLARD/POST
- UTILITY POLE
- ANCHOR CABLE
- LIGHT POLE
- DECORATIVE LIGHT
- STUMP
- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB/BUSH
- ANTENNA
- BENCH
- AIR CONDITIONER
- SOIL BORING
- MAILBOX
- HANDICAP PARKING SPACE
- RAILROAD TRACK CL
- X — FENCE LINE
- >> — STORM SEWER
- > — SANITARY SEWER
- S — SANITARY SEWER
- FM — FORCEMAIN
- I — WATERMAIN
- G — UNDERGROUND GAS LINE
- COM — UNDERGROUND COMMUNICATION LINE
- F/O — UNDERGROUND FIBER OPTIC LINE
- UE — UNDERGROUND ELECTRIC LINE
- OU — OVERHEAD UTILITY LINE
- TREE LINE

SCALE IN FEET: 0 60 120

BEARINGS ARE BASED ON THE HENNEPIN COUNTY COORDINATE SYSTEM NAD83(96)

VERTICAL DATUM IS NAVD88

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CLIENT NAME	PROJECT TITLE			
WALL COMPANIES	ALTA/NSPS LAND TITLE SURVEY			
	DWN BY: XXX	CHK'D: XXX	APP'D: XXX	DWG DATE: JUNE 2016; SCALE: 1" = 60'
	PROJECT NO.: 3116-0005		SHEET NO.: 3 OF 3	

CODE ANALYSIS

The proposed site for construction is located at 501 30th Ave. SE, Minneapolis, MN. It has been classified as a zone 12- medium industrial / guided mixed use site. A zoning request will be submitted for the project (as done by the previous project owner) to re-zone for mixed use development. The site's location in the bioscience district qualifies it as a valid candidate for re-zoning surrounding lots are currently classified as light industrial and general commercial zones. For the sake of this document, all classifications and descriptions are in coordination with the International Building Code (ICC) and Minnesota Building Code 2015 (MBC).

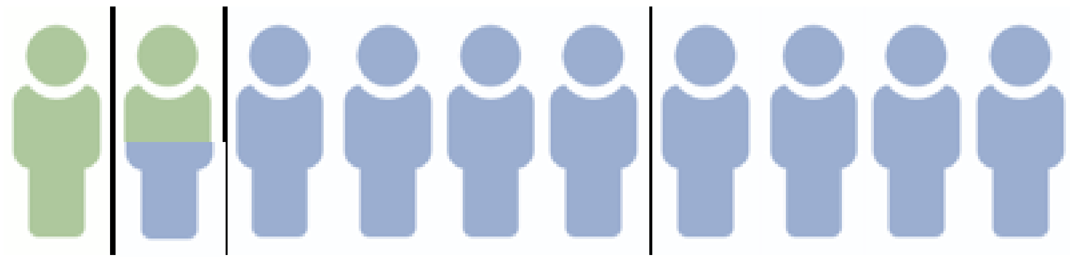
OCCUPANCY TYPE

The existing building is currently classified as an industrial occupancy type. It has historically been utilized for warehouse/manufacturing purposes. The proposed project would re-purpose this building to be used for assembly (restaurant/bar) and residential (apartment) purposes. The following definitions are provided for these classifications:

<u>Assembly Group A-2:</u> Places of assembly intended for the consumption of food/beverage that may include restaurants, cafeterias, dining facilities (with kitchens), taverns and bars. (ICC)

<u>Residential Group R-2:</u> Places including greater than two dwelling units where the occupants are permanent in nature. (ICC)

The residential occupancy type R-2 also requires additional precautions to be taken above and beyond an R-1 classification. The first is that all walls that serve to either A) separate sleeping units or B) separate units from other occupancies must be built as fire partitions meeting a 4-hour rating, as stated in section 708 of the ICC. Second, all type R occupancies must have an automatic sprinkler system, fire alarm system and smoke alarm meeting the standards set in sections 903.2 and 907.2 of the ICC. Both of these codes are in compliance with section 420 of the International Building Code. Lastly, all spaces classified as R-2 are to be separated from type A-2 spaces with a minimum 3-hour partition wall in any sprinkler protected space and a 4-hour partition wall in a non-sprinkler protected space. This is in compliance with section 508.4 of the ICC.



Residential (14%) Assembly (86%)

OCCUPANCY LOAD

The calculated maximum occupancy for type A-2 spaces was based on the assumption that 11 SF must be allowed per individual within the assembly space and approximately 4,000 SF of the building will be dedicated to this occupancy type. Therefore, the maximum occupancy for A-2 spaces is 363 people. The calculated maximum occupancy for type R-2 spaces was based on the assumption that 200 Sf must be allowed per individual within the residential space and approximately 12,400 SF of the building will be dedicated to this occupancy type. Therefore, the maximum occupancy for R-2 spaces is 62 people. This makes the total building occupancy 425 people, with a mix of 14% residential and 86% assembly.

EXIT REQUIREMENTS

Based upon the assumption that the building has a full automatic sprinkler system to comply with type R-2 requirements, the maximum travel distance to an exit access is 100 feet. Due to the mixed use of the building, the maximum require for type A-2 spaces (250 feet) is not acceptable since the most stringent code over rules in this instance. This rule will apply elsewhere within the code requirements when contradicting values occur.

CONSTRUCTION TYPE

The current construction type of the building is most consistent with building type IC as described in section 602.4 of the ICC. This is stated as having exterior walls built of non-combustible material and interior elements of solid wood/timbers. Under normal circumstances, the exterior walls must have a minimum fire rating of 2-hours, structural frame with a fire rating of 1-hour and floor/ceiling/roof with a minimum rating of 1 hour (MBC). Due to the extensive fire damage to the roof and parts of the second floor of the existing building, all replacement structure will be made to accommodate these requirements. All existing undamaged structure will be retrofitted to the best of its ability to adhere to the fire rating requirements for this construction type as well.

MAXIMUM HEIGHT AND ALLOWABLE AREA

Given the building is an existing structure, maximum height and allowable area is considered to be a grandfathered attribute per the Minnesota Building Code for this project. However, the building is still considered to be in compliance with both of the current codes for height and area. This is documented in the table below:

	A-2, full sprinkler	R-2, full sprinkler	Existing
Allowable Area	45,000 SF	10,500 SF	Approx. 12,000 SF
Maximum Height	65 Ft.	85 ft.	27'-6" (@ eave)
Maximum Stories	4	2	2

PLAN FOR PROCEEDING

DEFINITIONS: RESEARCH DIRECTION

The hope of this project is that all research will be useful in the creation of the design method for analyzing historic buildings. One of the major topics of research will be embodied energy, which has already been explored through the research paper. Additional information will be sought after to create a complete summary of the energy involved in the creation, transportation and assembly of materials in existing buildings.

A second part of the research will be to study the demolition process. From the energy used to physically take apart a building, to the amounts of waste created by non-recyclable materials, all aspects will be included in this summary.

The last piece of research will be to create a general outline of the energy used in our current material production and new building assembly process. The building type studied will be comparable to the existing building, but with more modern construction practices. Things such as maintenance will be taken into consideration in both examples.

All of these topics are very broad and encompass many aspects, such as transportation, that will need to be generalized for the sake of time limits. It is understood that there is no way to include all possible scenarios, and each design study should be treated as a special case.

It is important in this thesis to use the most up-to-date figures when discussing numbers such as energy and waste. Much research has been done in the last decade on this topic, so it is reasonable to set that as the usable time frame for information.

DESIGN METHODOLOGY PLAN

evaluative

The majority of the research done for this project is classified as evaluative research. This can be simply defined as questioning already established norms or comparing different standards.

The premise of this thesis is to create a new way for designers to analyze buildings. This is questioning the existing standards due to the lack of information given to most people about the different aspects of preservation and building rehabilitation. It is important to understand the qualities of evaluative research because much can be gained by comparing new methods to old. I also believe that it always important to question past norms set in the profession in hopes of always expanding our body of knowledge and creating new and better practices.

The evaluative approach will be considered the main methodology for this project, and this attitude will also carry over into the second design methodology , which is design research.

design

The final phase of the project will include the design of either a restoration or new construction building on the studied site. Regardless the outcome, design research will be used to create a structure that best fits the physical, cultural, and client needs for the project.

New methods will be explored to maintain the focus on sustainability in the project. Ensuring that all of the effort put into make the most sustainable initial judgments of the building are not lost in the design is just as important as the evaluation process.

PLAN FOR DOCUMENTATION

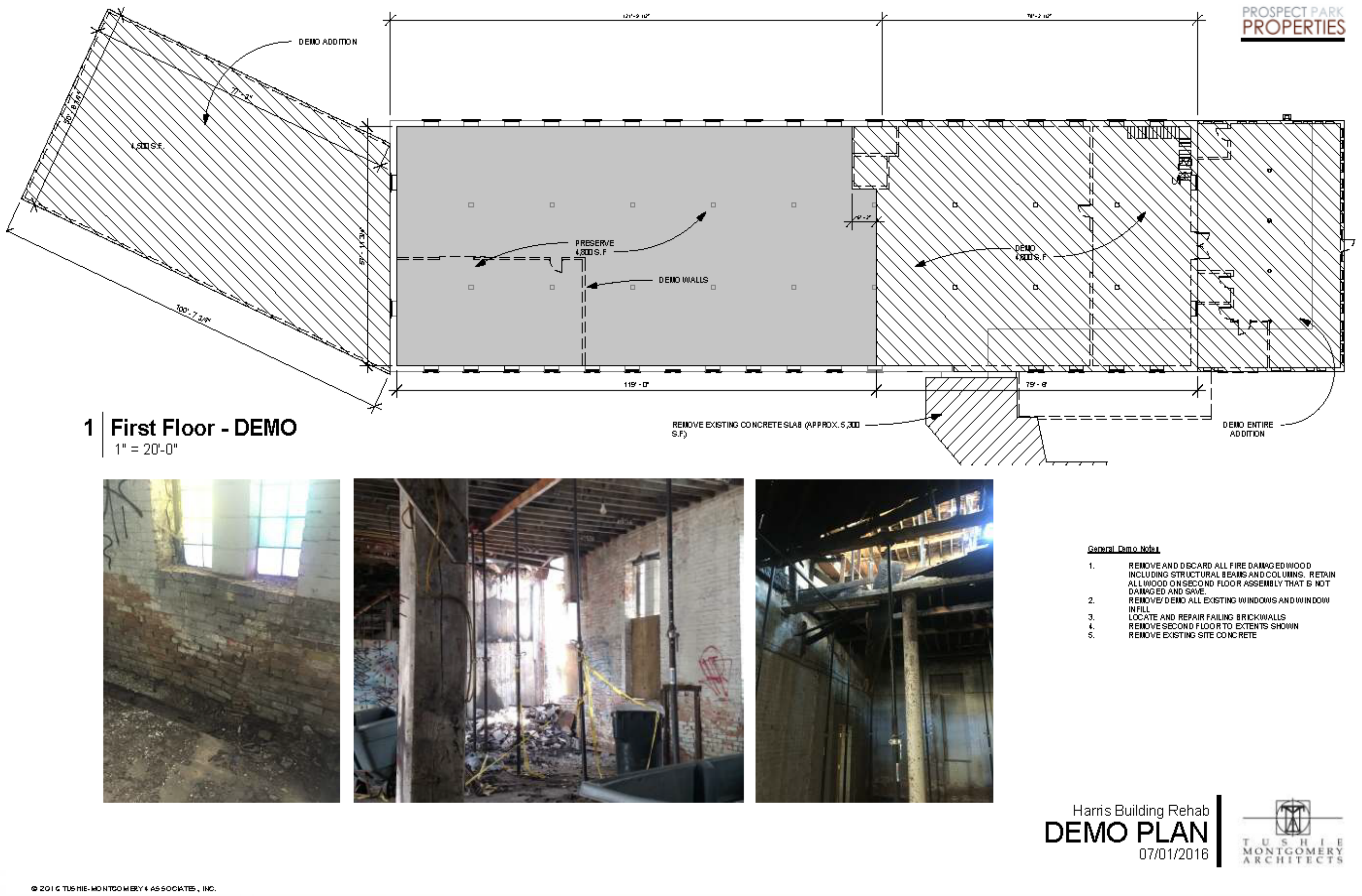
Since this is a real-world project that has already been carried out by a firm, the same quality of documentation will be expected for the final thesis work. Site visits were conducted during the summer of 2016 to document the existing condition of the building and site before any further action was taken on the project. The original design documents were also obtained and cleared for use in this project, creating a great baseline for future materials.

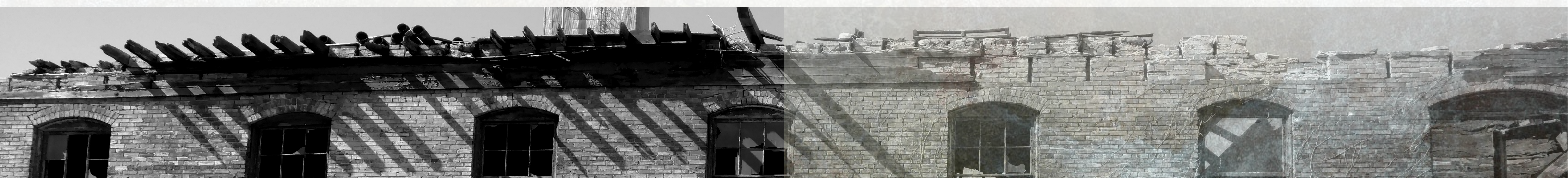
Since this is a research-intensive thesis, the largest final product will be the thesis book. This will include all of the research done in phase one of the project along with any other additional literature describing the process.

All of this information will also be organized into a presentation for the final thesis critique. These graphics will all be based on the facts gathered throughout the research and should clearly identify the conclusions drawn in the process.

The final design phase will be documented graphically and in a like manor to the documents created by CD Architects. They should convey a professional quality and be similar to a full pre-design document set. Since the aim of the project is to be as realistic as possible, this will only further solidify the qualifications of the thesis project.

Shown right is an example of the design documents created by CD Architects. These will be used as a template for all work done in the design phase of the project.



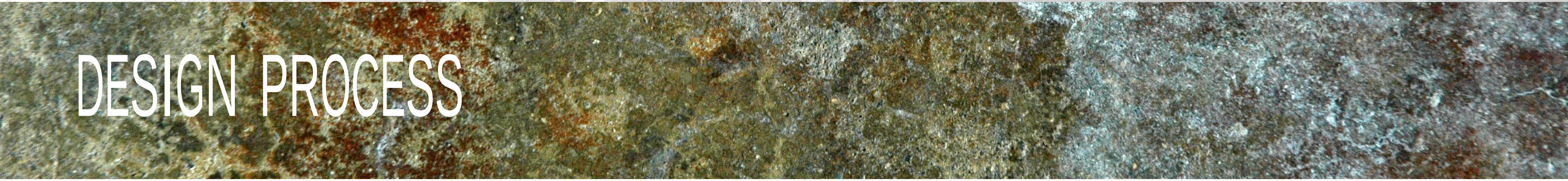


DETAILED PROJECT SCHEDULE

spring 2017

DATE	DAY	DESCRIPTION
Jan 9	Mon	Classes Begin at 4
Jan 12	Weds	Start Research Process
Jan 16	Mon	Research: Embodied Energy
Jan 18	Weds	Research: Demolition Wastes
Jan 23	Mon	Research: New Construction/Maintenance
Jan 25	Weds	Compile Research Documents
Jan 30	Mon	Update Thesis Book Research
Feb 1	Weds	Begin Analysis Process
Feb 6	Mon	Embodied Energy Data Collection
Feb 8	Weds	Embodied Energy Data Collection
Feb 13	Mon	New Construction Analysis
Feb 15	Weds	New Construction Analysis
Feb 20	Mon	Compile Analysis Information
Feb 22	Weds	Update Thesis Book
Feb 27	Mon	Begin Design Phase

DATE	DAY	DESCRIPTION
Mar 1	Weds	Schematic Design
Mar 6	Mon	Schematic Design
Mar 8	Weds	Produce Floorplans
Mar 13	Mon	Elevation/Exterior Design
Mar 15	Weds	Elevation/Exterior Design
Mar 20	Mon	Elevation/Exterior Design
Mar 22	Weds	Begin Producing Design Documents
Mar 27	Mon	Site Design
Mar 29	Weds	Site Design
Apr 3	Mon	Finalized Floorplans/Elevations
Apr 5	Weds	Begin Building Detailing
Apr 10	Mon	Detailing
Apr 12	Weds	Final Design Documents
Apr 17	Mon	Renderings
Apr 19	Weds	Renderings
Apr 24	Mon	Renderings
Apr 26	Weds	Final Board Materials Completed
May 1	Mon	Assemble Presentation
May 3	Weds	Assemble Presentation/Finalize Book
May 8	Mon	Print Thesis Book
May 10	Weds	Display Materials



DESIGN PROCESS

INTRO TO DESIGN THINKING

For our week one intro we were asked to think about a poem that talks about the perfection in the imperfections. I think that any human process is full of imperfections and part of the beauty is taking joy in them.

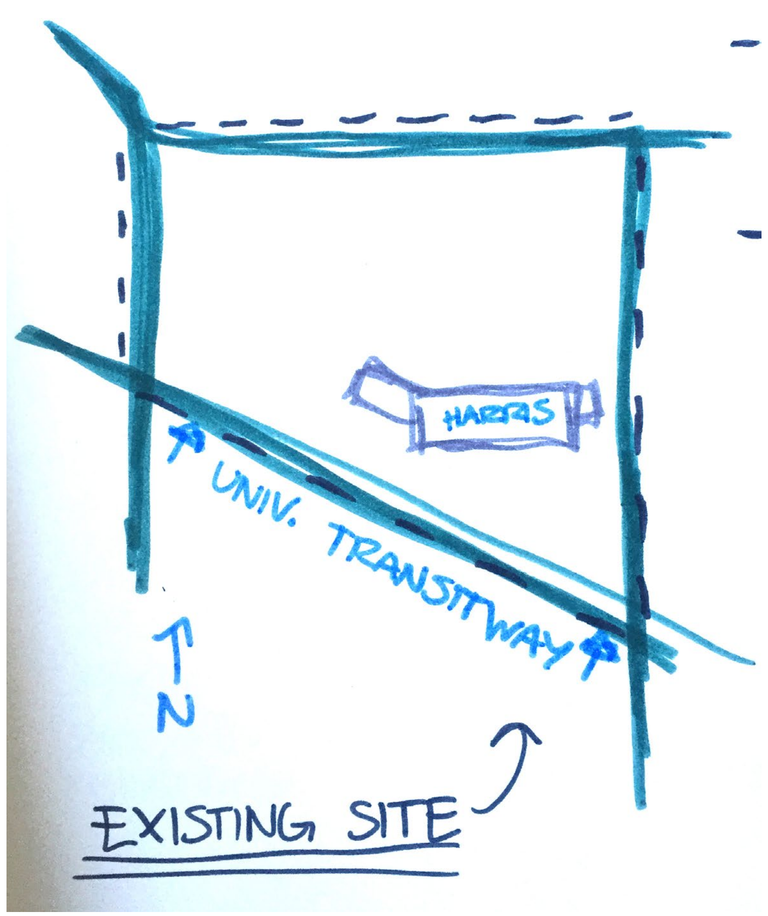
It can be easy to dwell on certain aspects of a design process, but I think it will be important in this thesis to make sure your approach is well-rounded and does not get hung up on a specific detail.

I am coming into this thesis feeling fairly confident in the schedule I have created for myself, and that the design techniques I have learned in the past will help to inform my project as a whole.

Site Mapping: Know your site using thoughts, words, diagrams, photos and other means

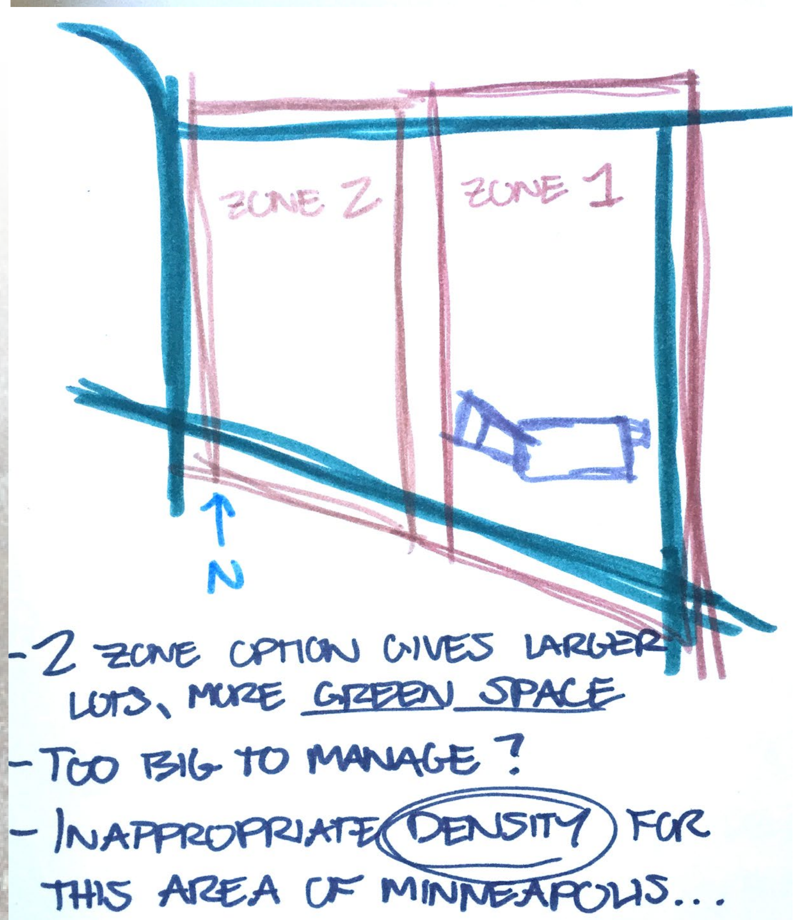
- LARGE AMOUNTS OF SPACE
  - ZONING THE SITE FOR DEVELOPMENT
  - SMALLER, MORE MANAGEABLE NEW CONSTRUCTION
- OTHER NEW CONSTRUCTION PROJECTS GOING ON IN SURROUNDING AREA
  - BUILD RELATIONSHIPS BETWEEN OTHER BUILDINGS COMING IN THE FUTURE

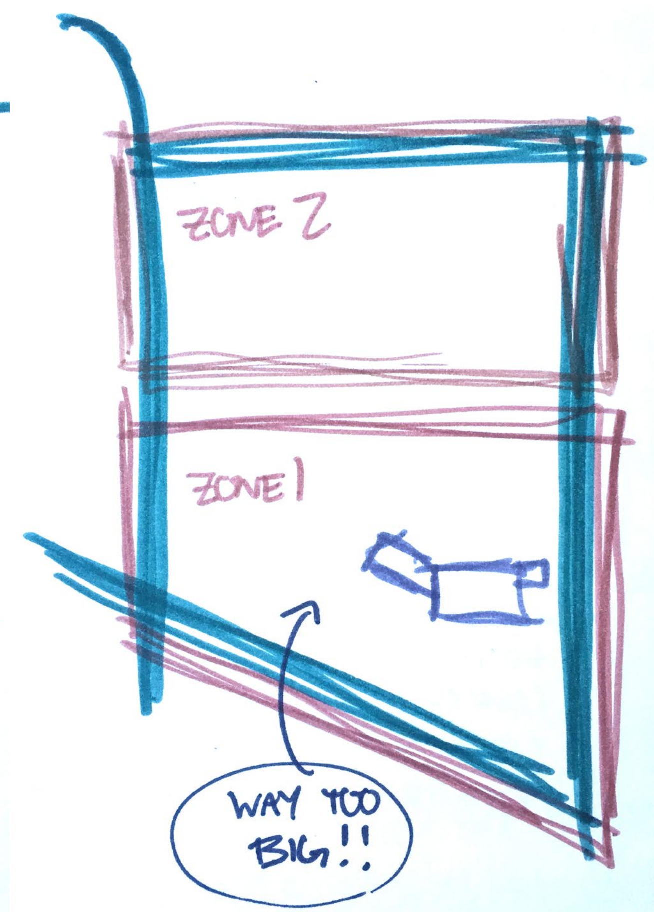
BUILDING DENSITY VS.
GREEN SPACE

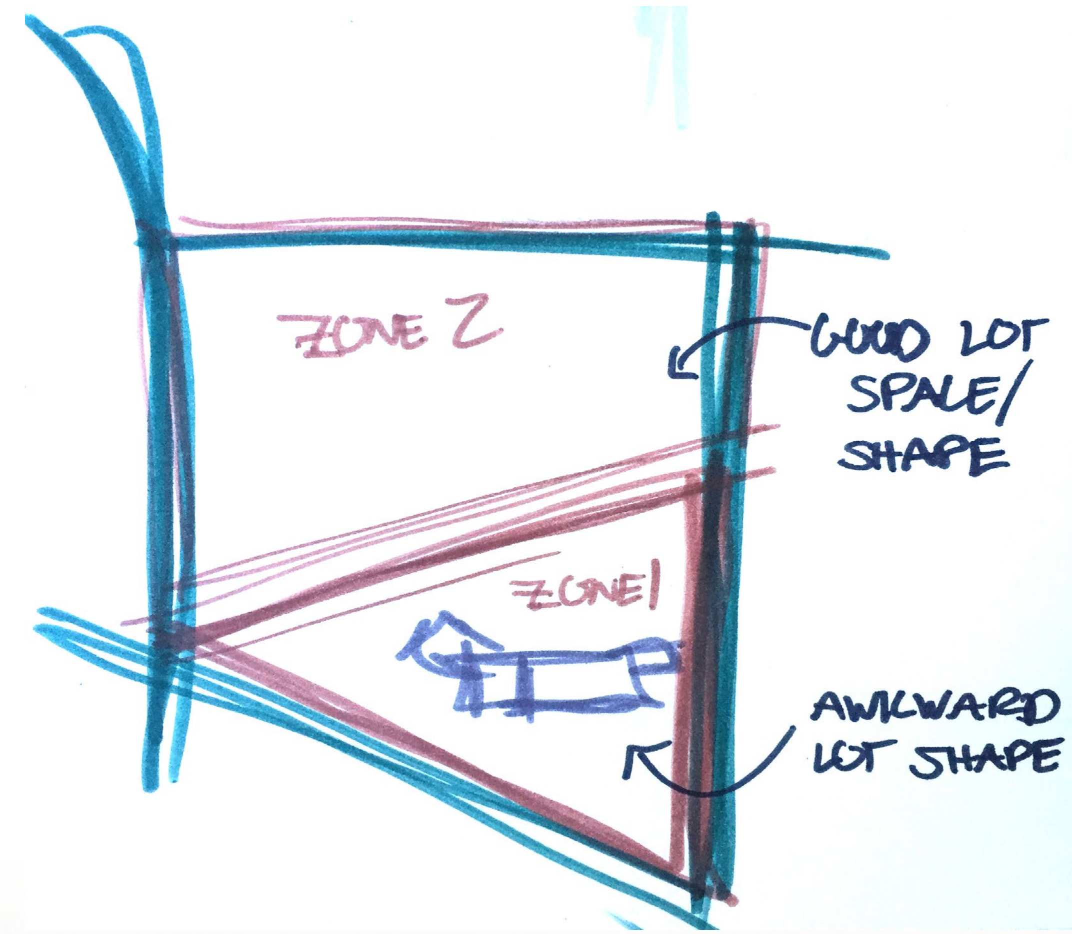


Breaking the site up into three regions makes the project more manageable in scale and would allow for the Harris Machinery complex to expand itself in the future, but also be surrounded by land that is cleared of out-buildings in disrepair.

Phase one of development would include the Harris Machine building. Phase two would develop land to the west into a possible park, which has been suggested by previous developers. Phase three would include further construction to the north of the Harris building, and the possibility to begin of campus of buildings across the entire site.

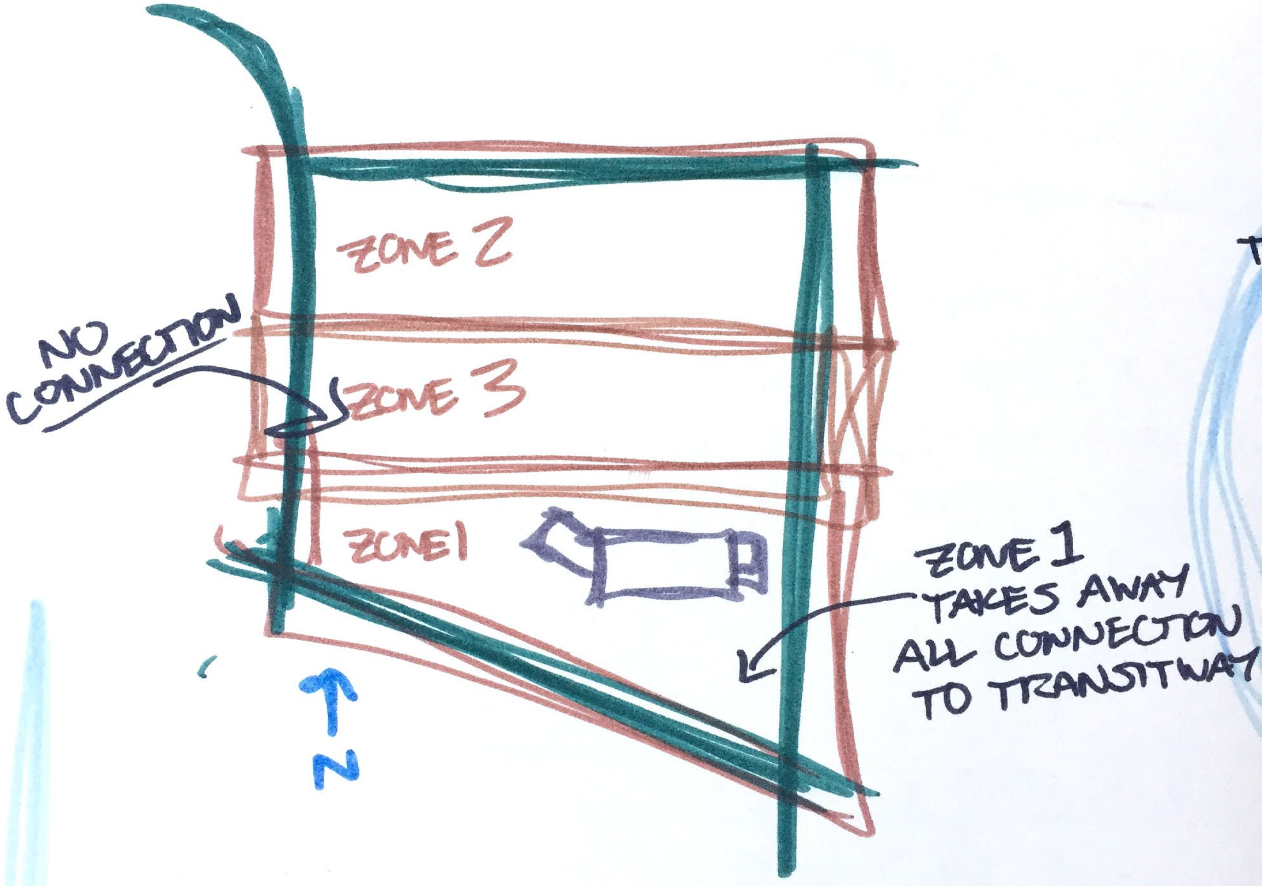


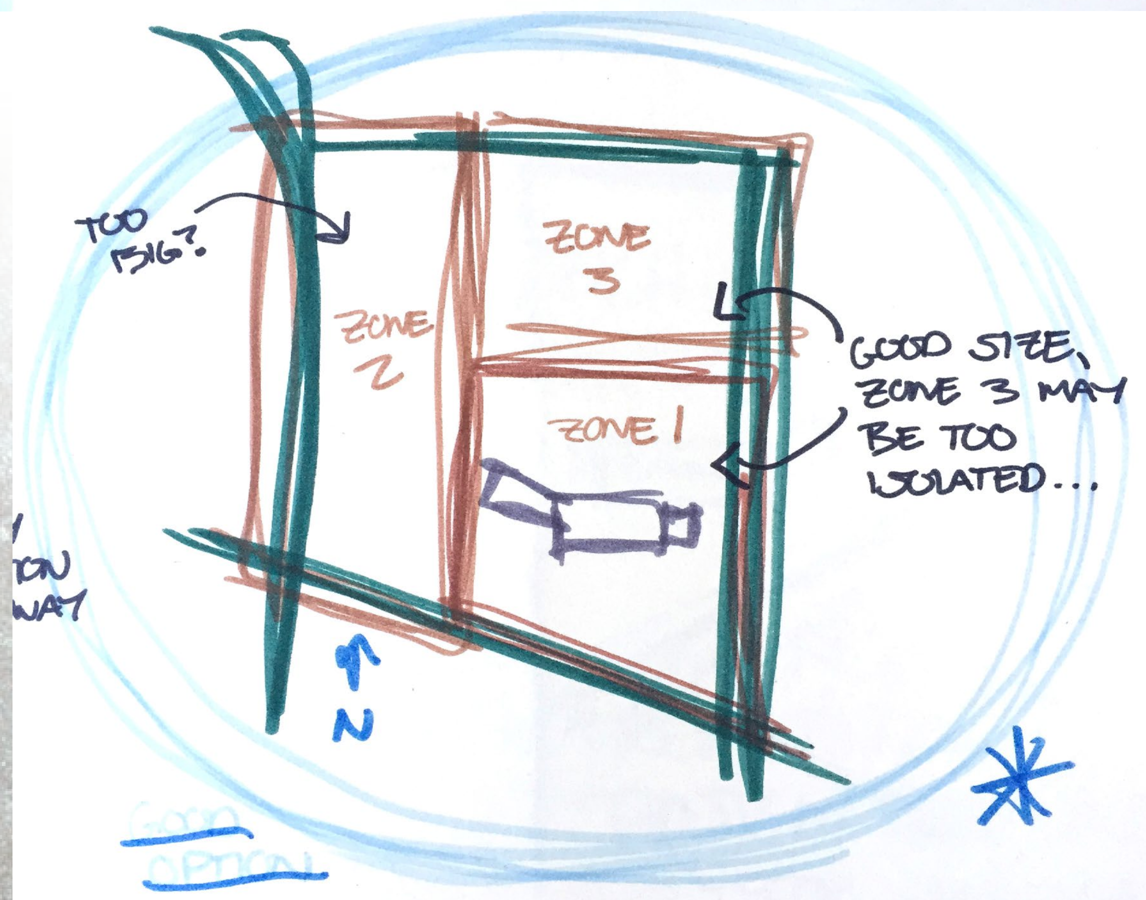


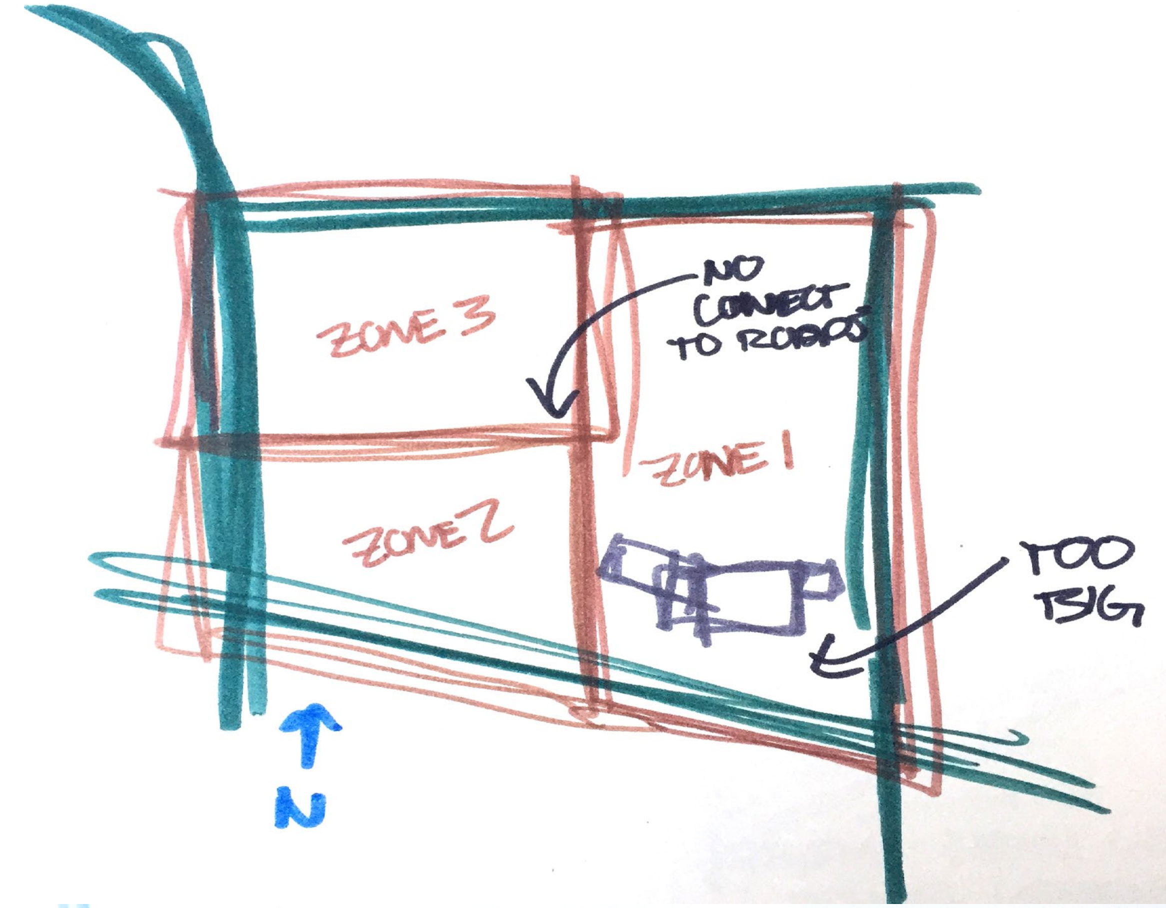


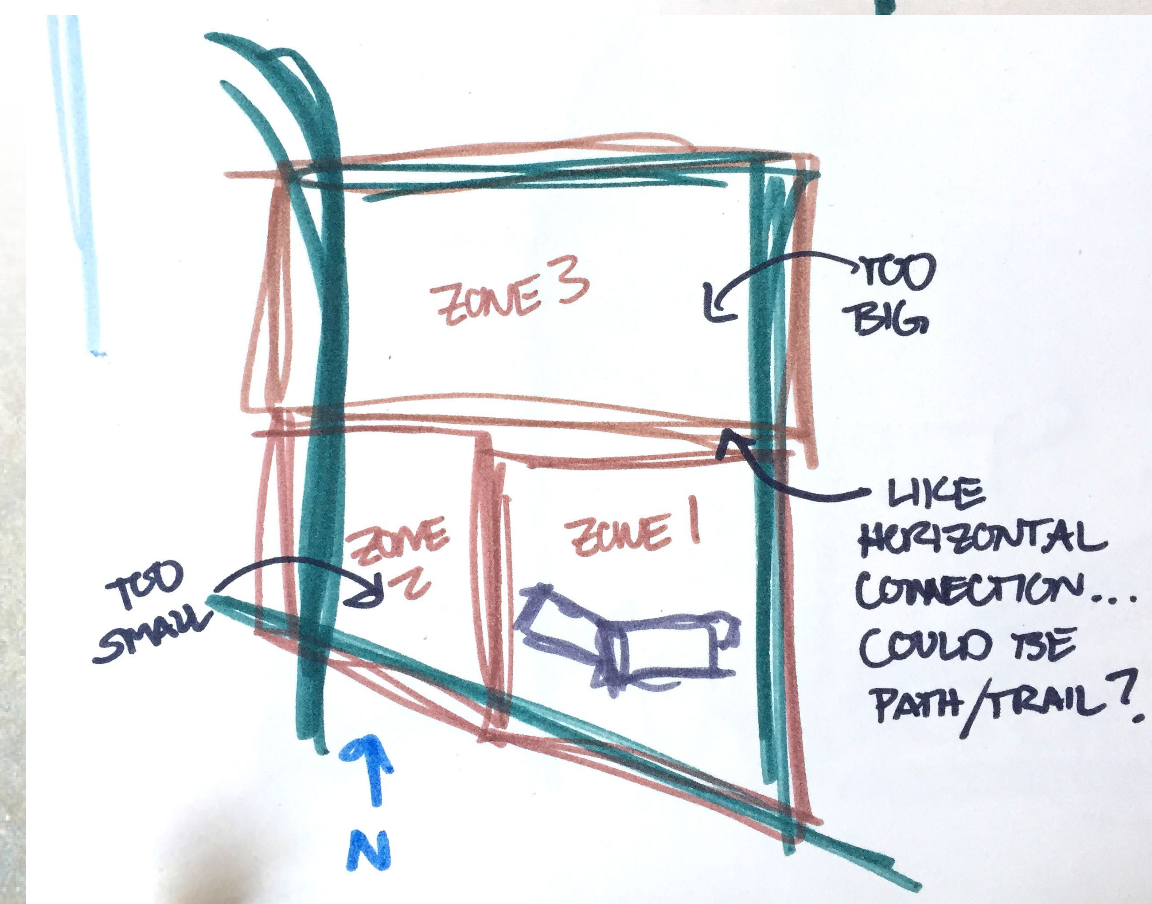
-3 ZONE OPTION FEELS CLOSER IN SCALE TO SURROUNDING SITES

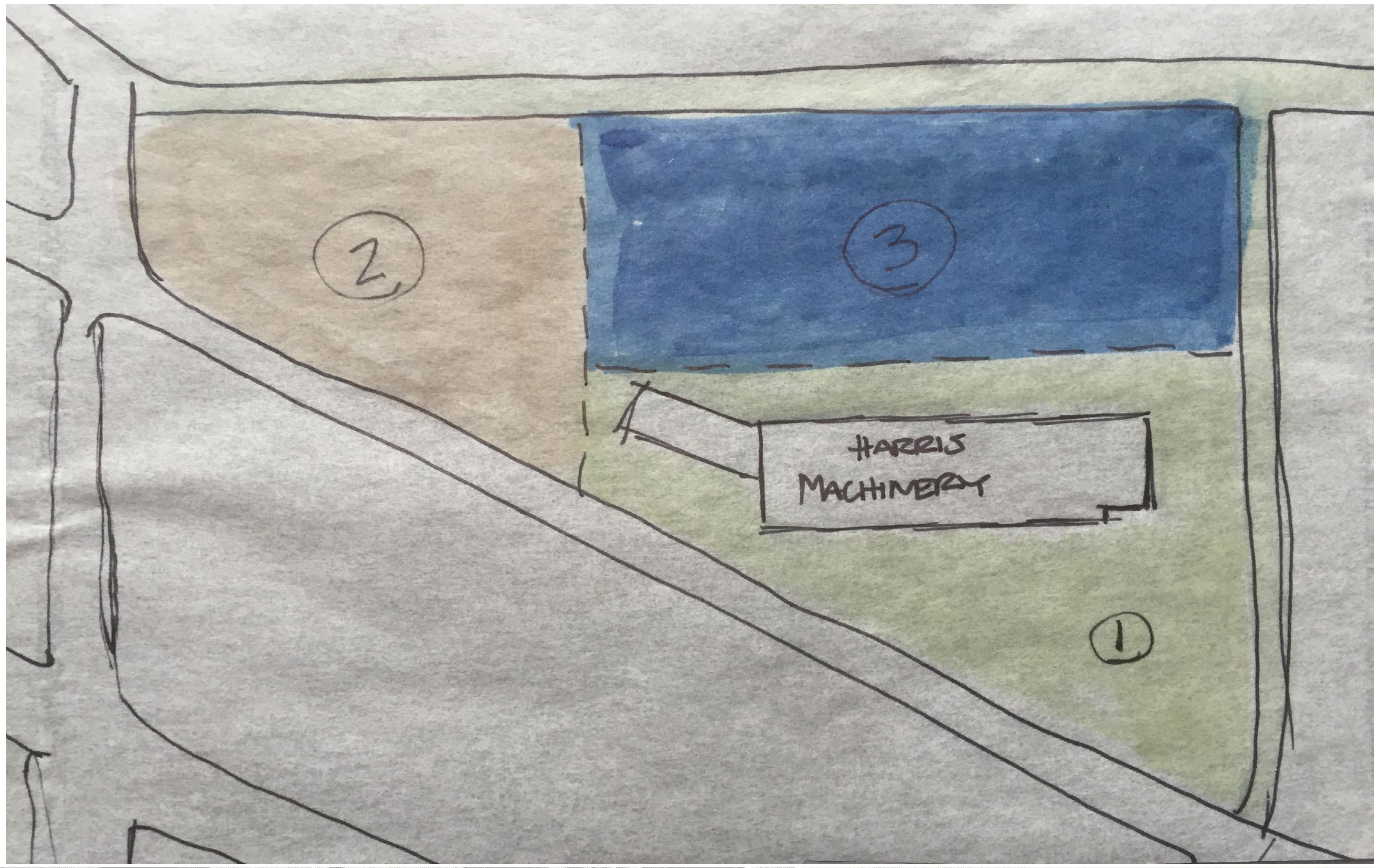
- NEED TO MAKE SURE ALL LOTS ARE ACCESSIBLE
  - ADDING ROADS & PATHS
  - CONNECT TO TRANSITWAY


ZONE 2
NO CONNECTION
ZONE 3
ZONE 1
ZONE 1
TAKES AWAY
ALL CONNECTION
TO TRANSITWAY
N

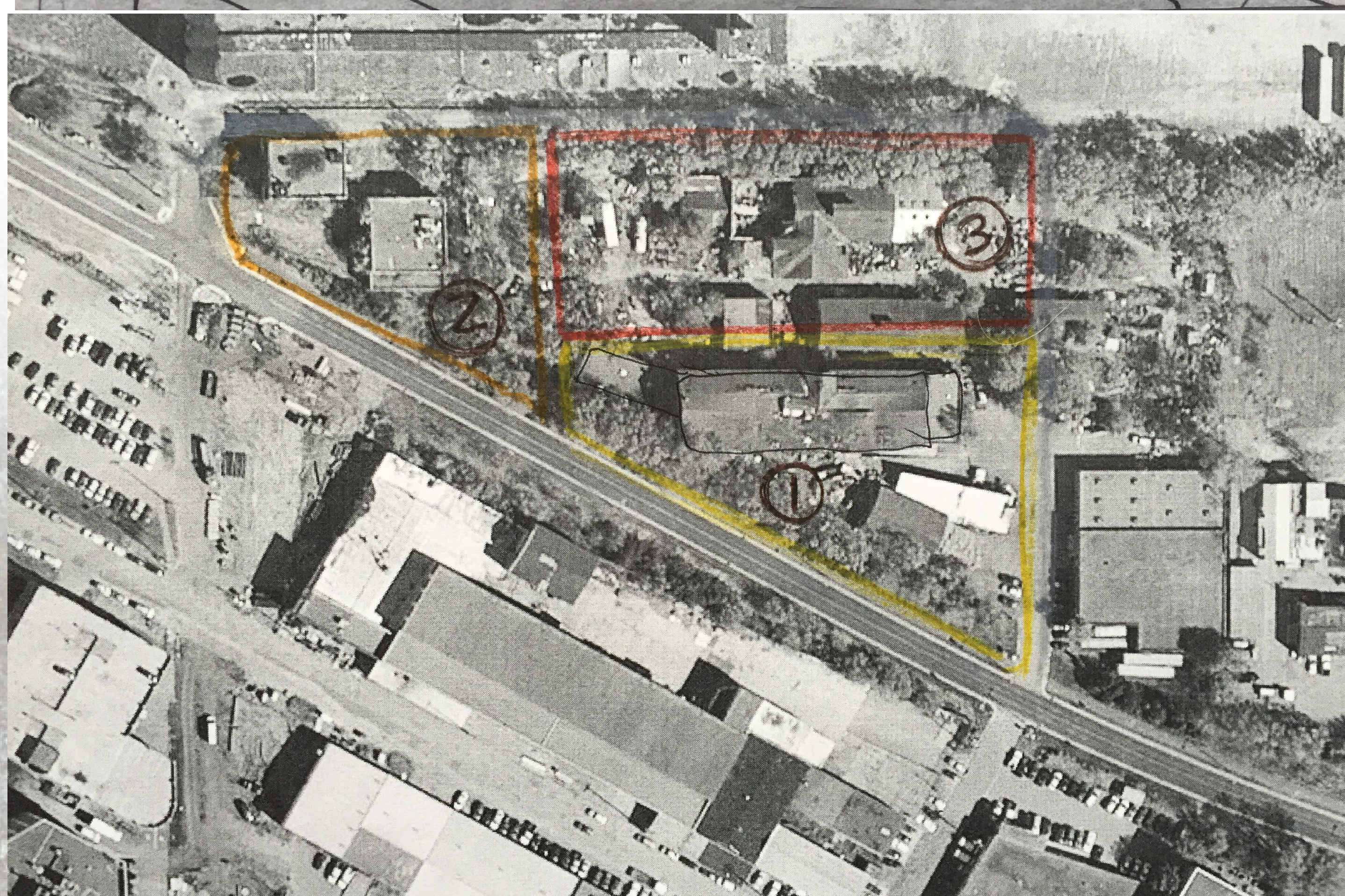

TOO BIG?
ZONE 3
ZONE 2
GOOD SIZE,
ZONE 3 MAY
BE TOO
ISOLATED...
ZONE 1
N
GOOD OPTION


ZONE 3
NO CONNECT TO ROADS
ZONE 1
ZONE 2
TOO BIG
N

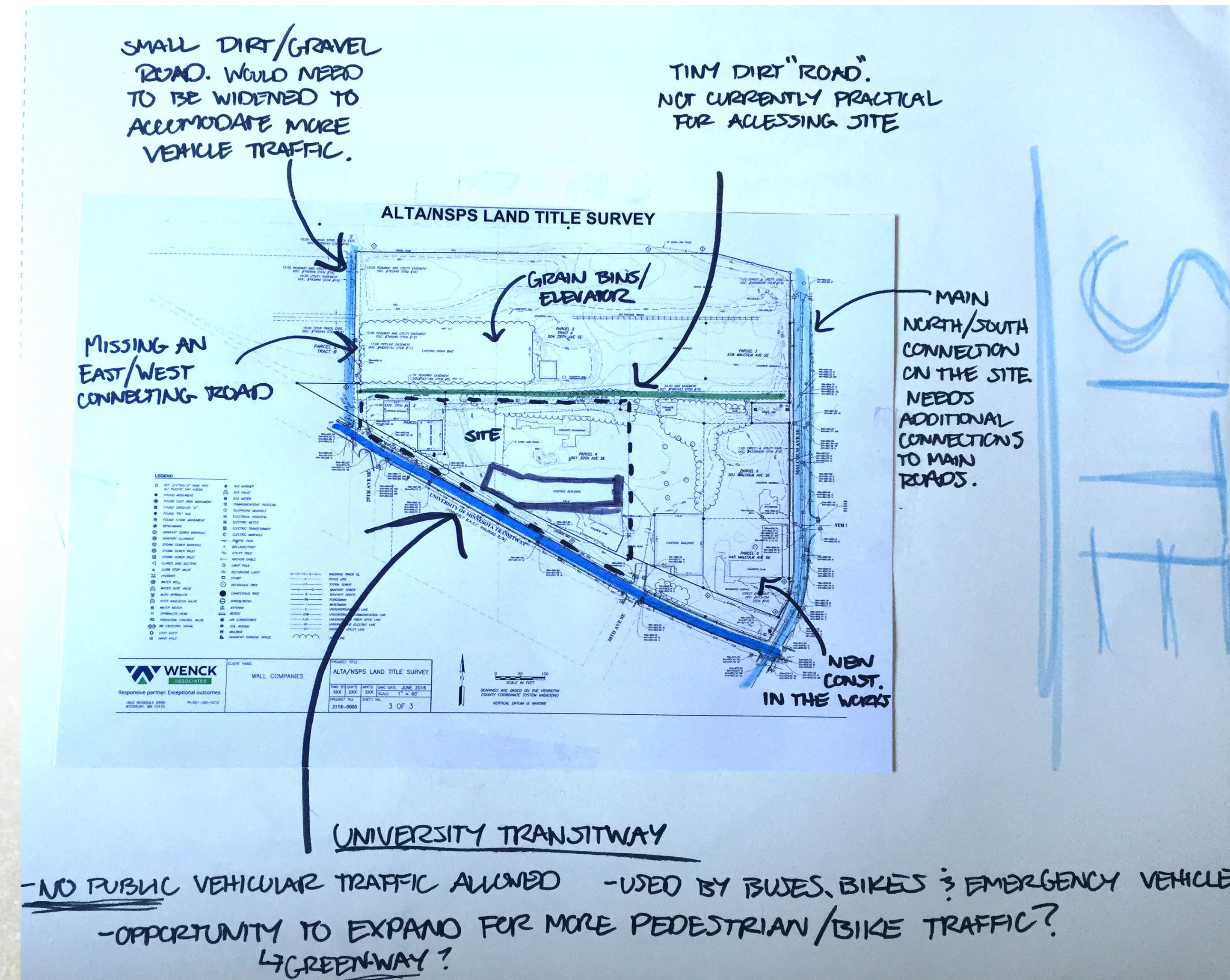

ZONE 3
TOO BIG
LIKE
HORIZONTAL
CONNECTION...
COULD BE
PATH/TRAIL?
ZONE 2
ZONE 1
TOO SMALL
N



2
3
HARRIS MACHINERY
1



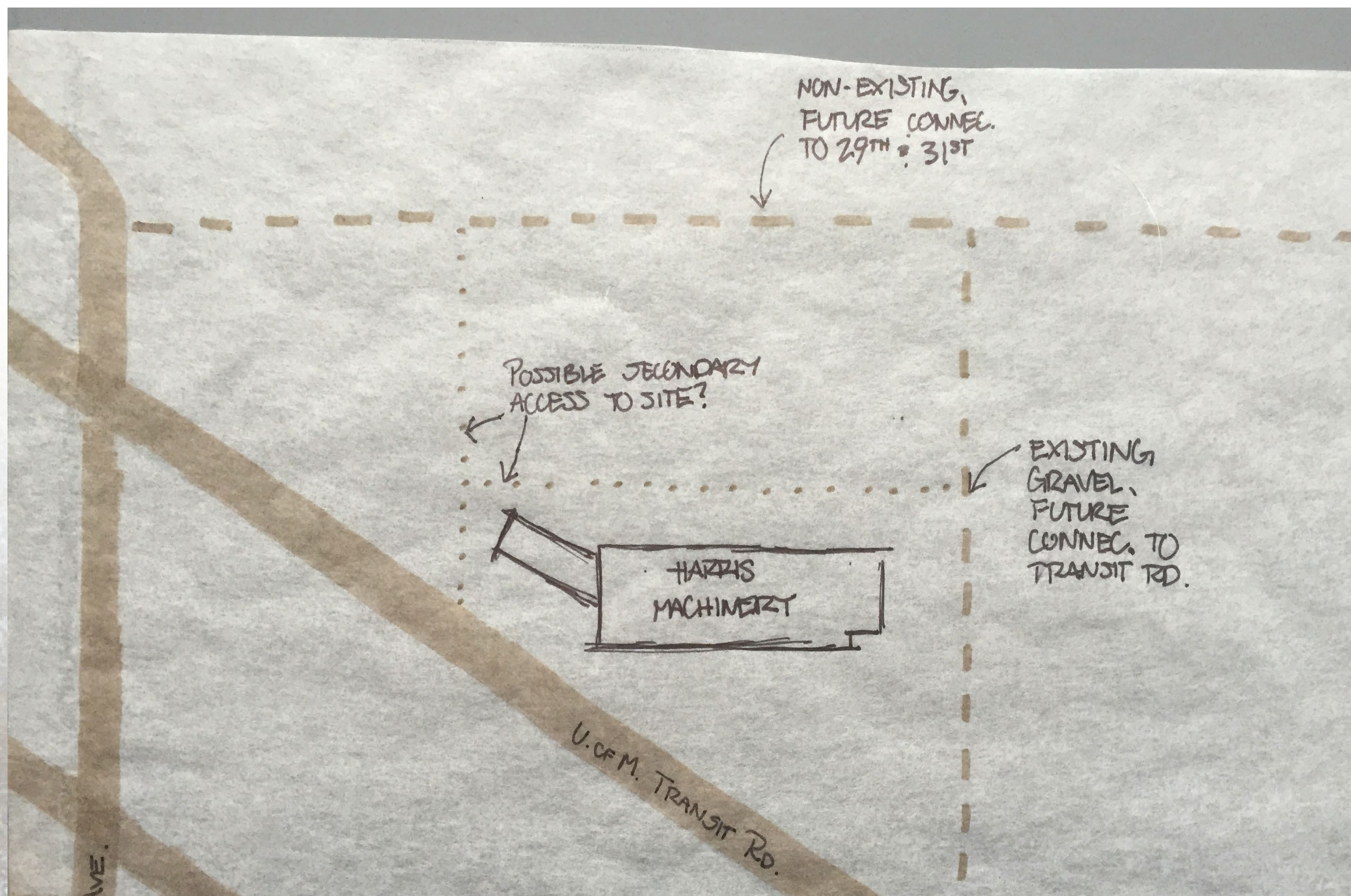
3
2
1

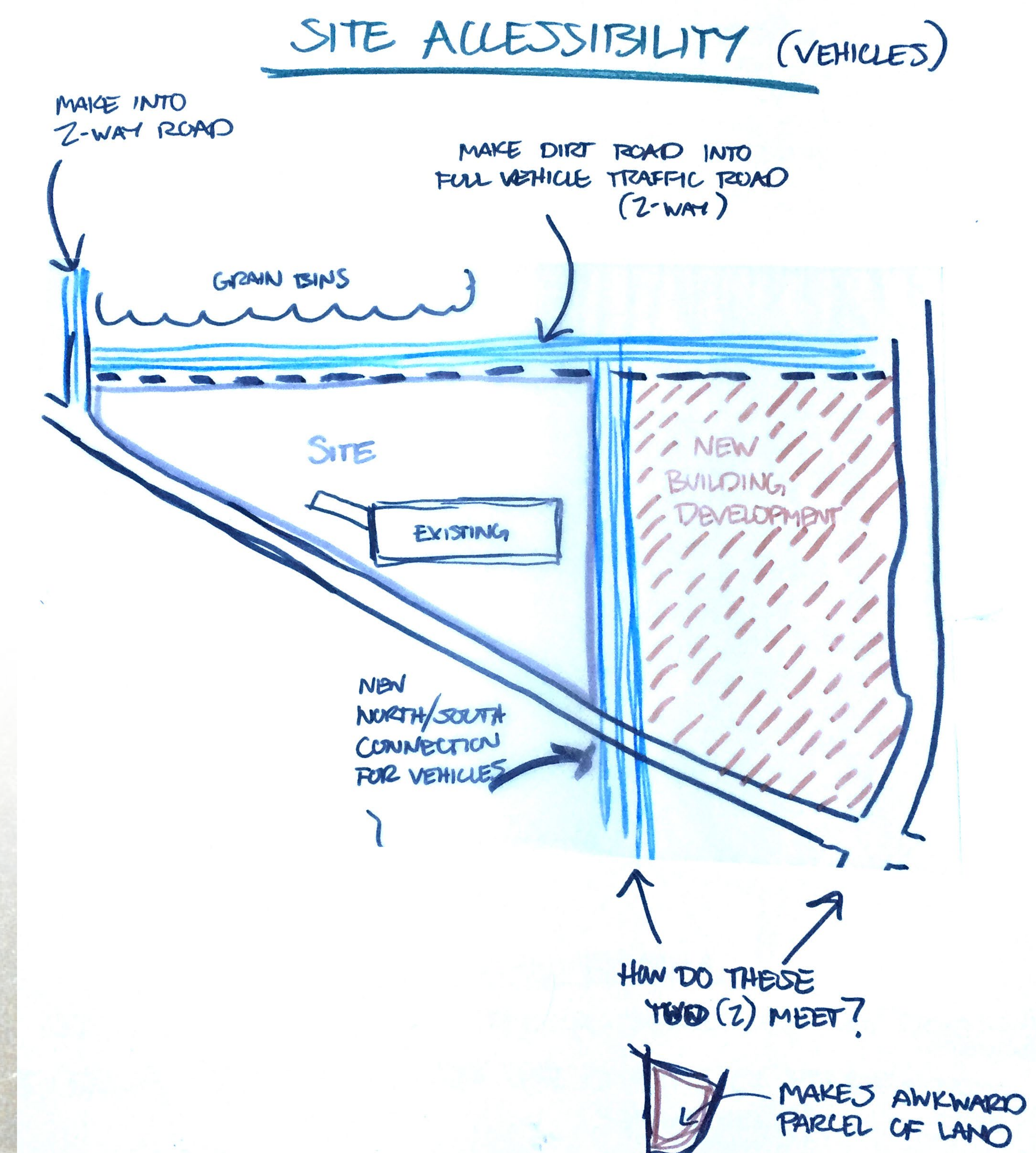


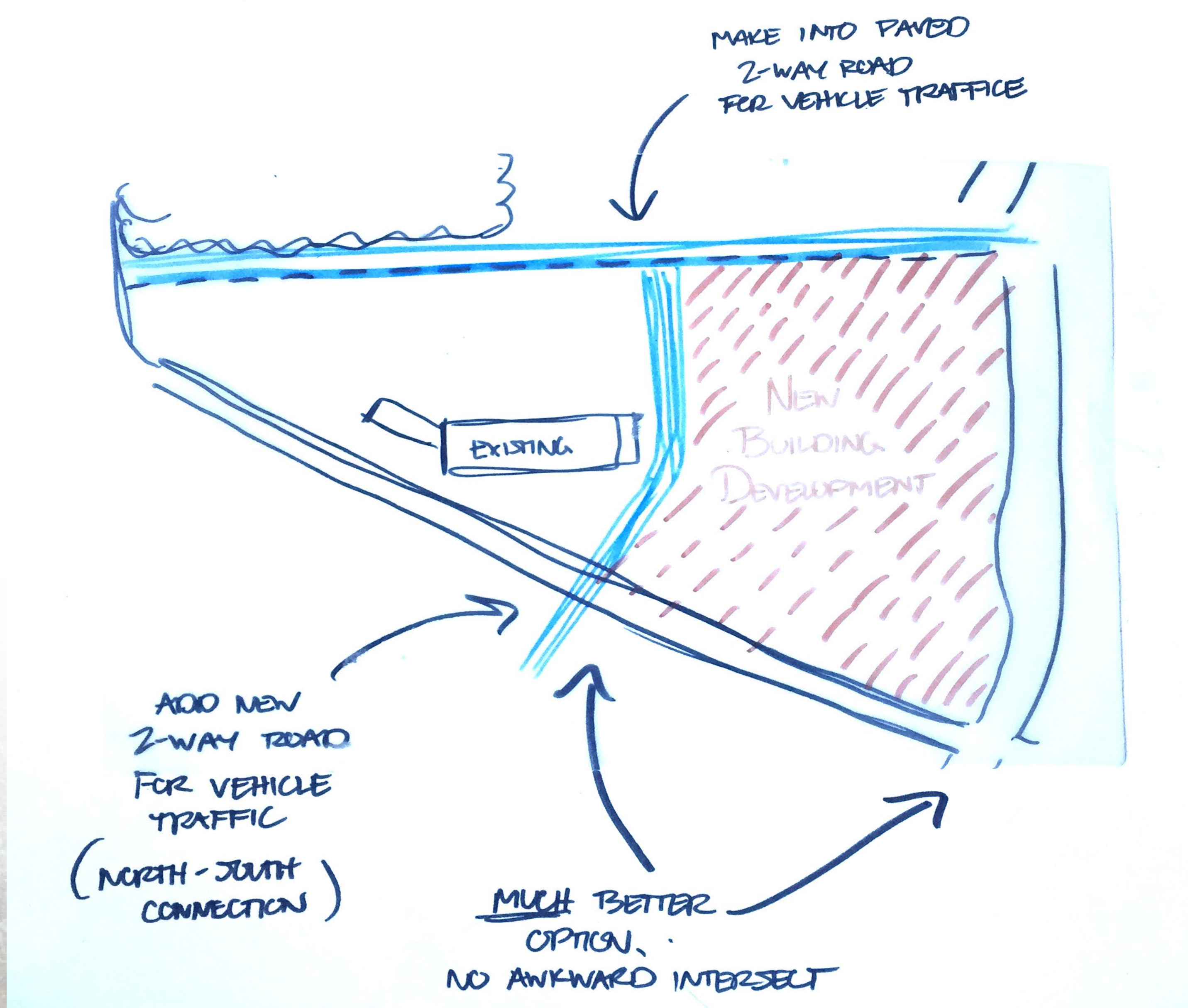
SMALL DIRT/GRAVEL ROAD. WOULD NEED TO BE WIDENED TO ACCOMODATE MORE VEHICLE TRAFFIC.
TINY DIRT "ROAD". NOT CURRENTLY PRACTICAL FOR ACCESSING SITE
ALTA/NSPS LAND TITLE SURVEY
GRAIN BINS/ ELEVATOR
MISSING AN EAST/WEST CONNECTING ROAD
SITE
MAIN NORTH/SOUTH CONNECTION ON THE SITE. NEEDS ADDITIONAL CONNECTIONS TO MAIN ROADS.
NEW CONST. IN THE WORKS
WENCK
SITE
UNIVERSITY TRANSITWAY
-NO PUBLIC VEHICULAR TRAFFIC ALLOWED
-USED BY BUSES, BIKES & EMERGENCY VEHICLES
-OPPORTUNITY TO EXPAND FOR MORE PEDESTRIAN/BIKE TRAFFIC?
↳GREEN-WAY?

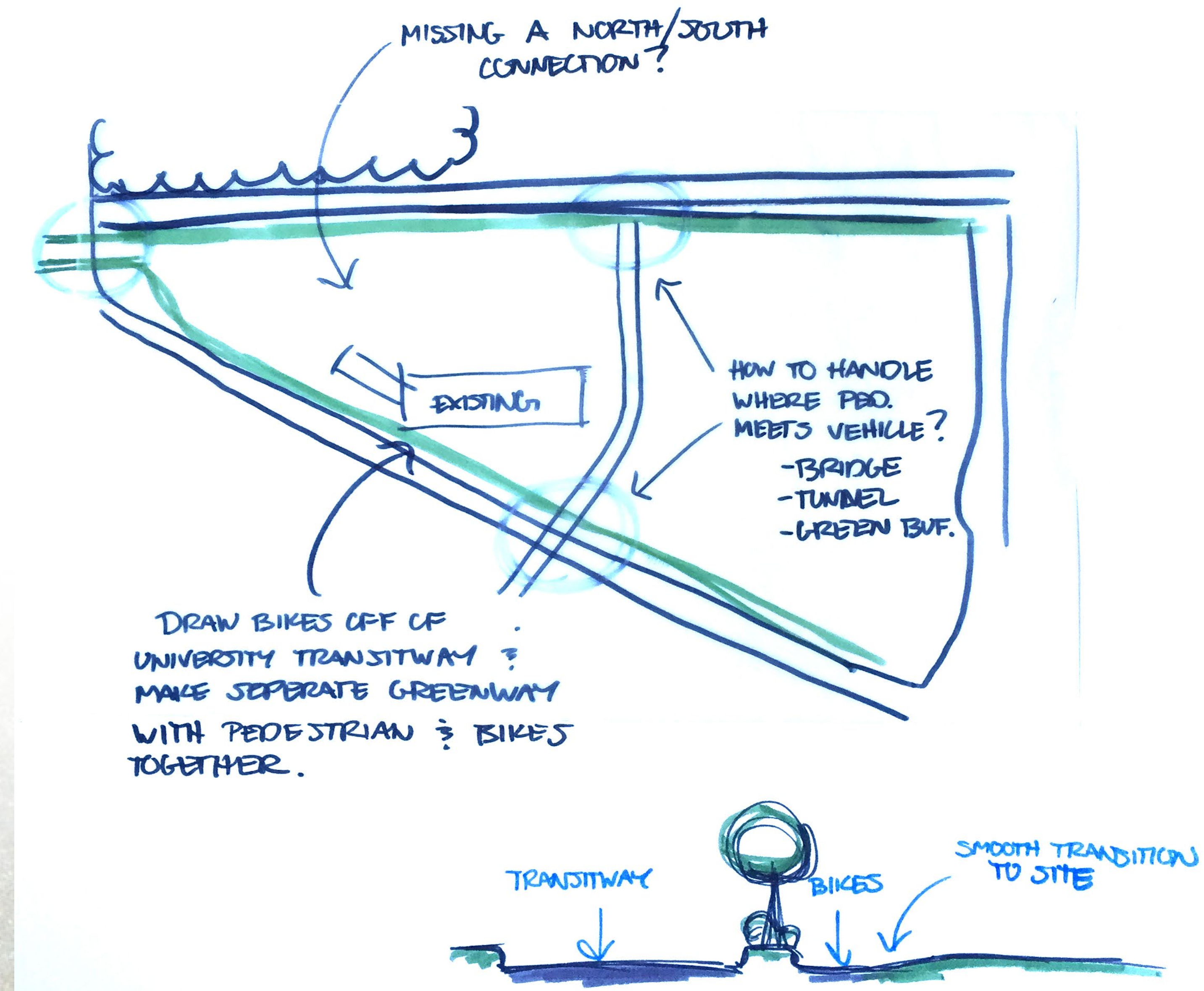
ADAPTIVE SITE:

THIS SITE DESIGN SHOWS ADAPTIVITY BECAUSE OF ITS CONNECTIONS. THE SURROUND AREA IS ALREADY UNDER HEAVY COMMERCIAL DEVELOPMENT, SO PROVIDING MULTIPLE ACCESS POINTS WILL HELP CARRY-OVER ACTIVITY INTO THE SITE. ALSO, PROVIDING MANY FORMS OF TRANSPORTATION ACCESS (BUS, CAR, BIKE, FOOT) GIVES FLEXIBILITY FOR WHAT THE FUTURE OF CITY OF TRANSPORTATION MAY HOLD.

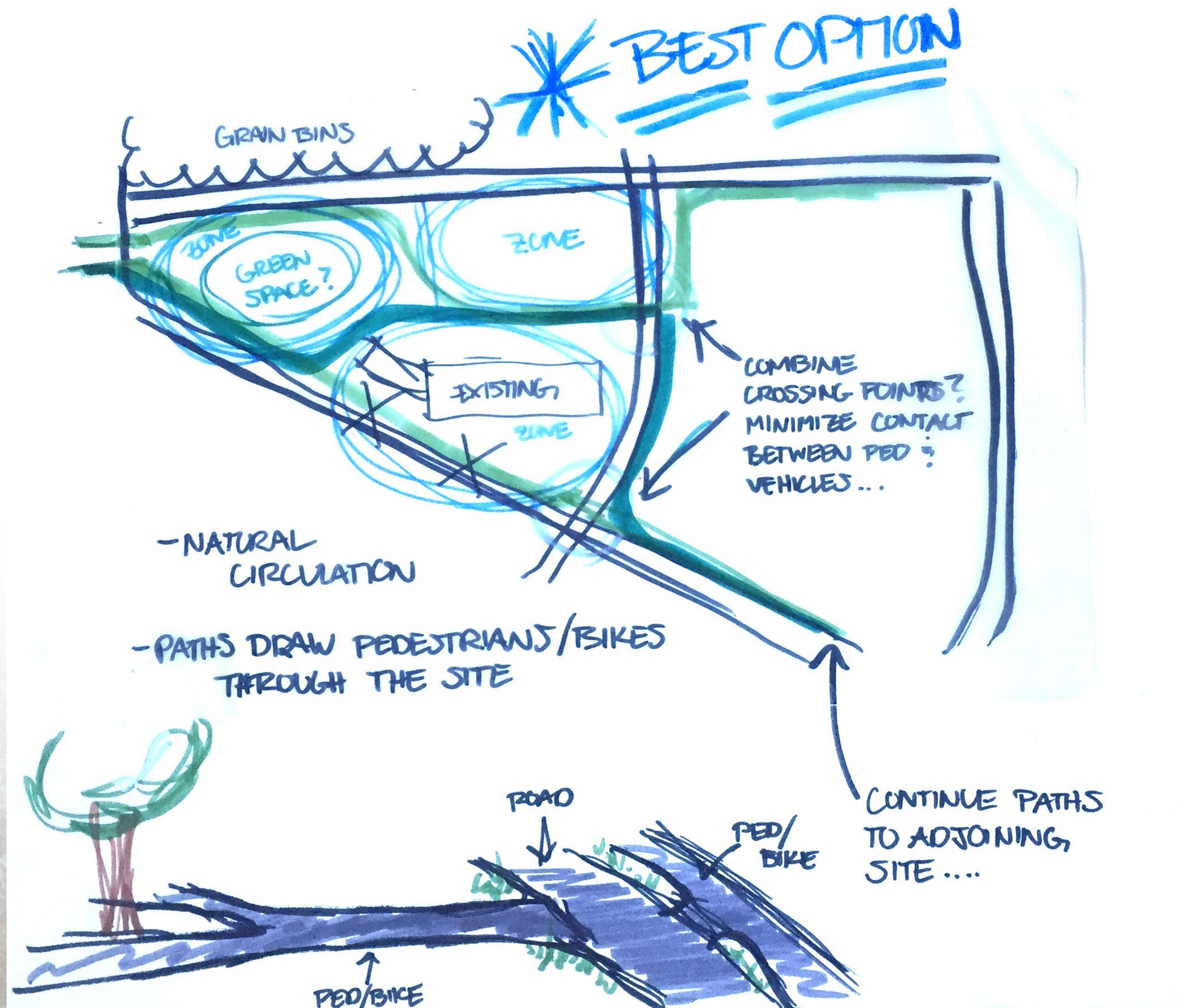


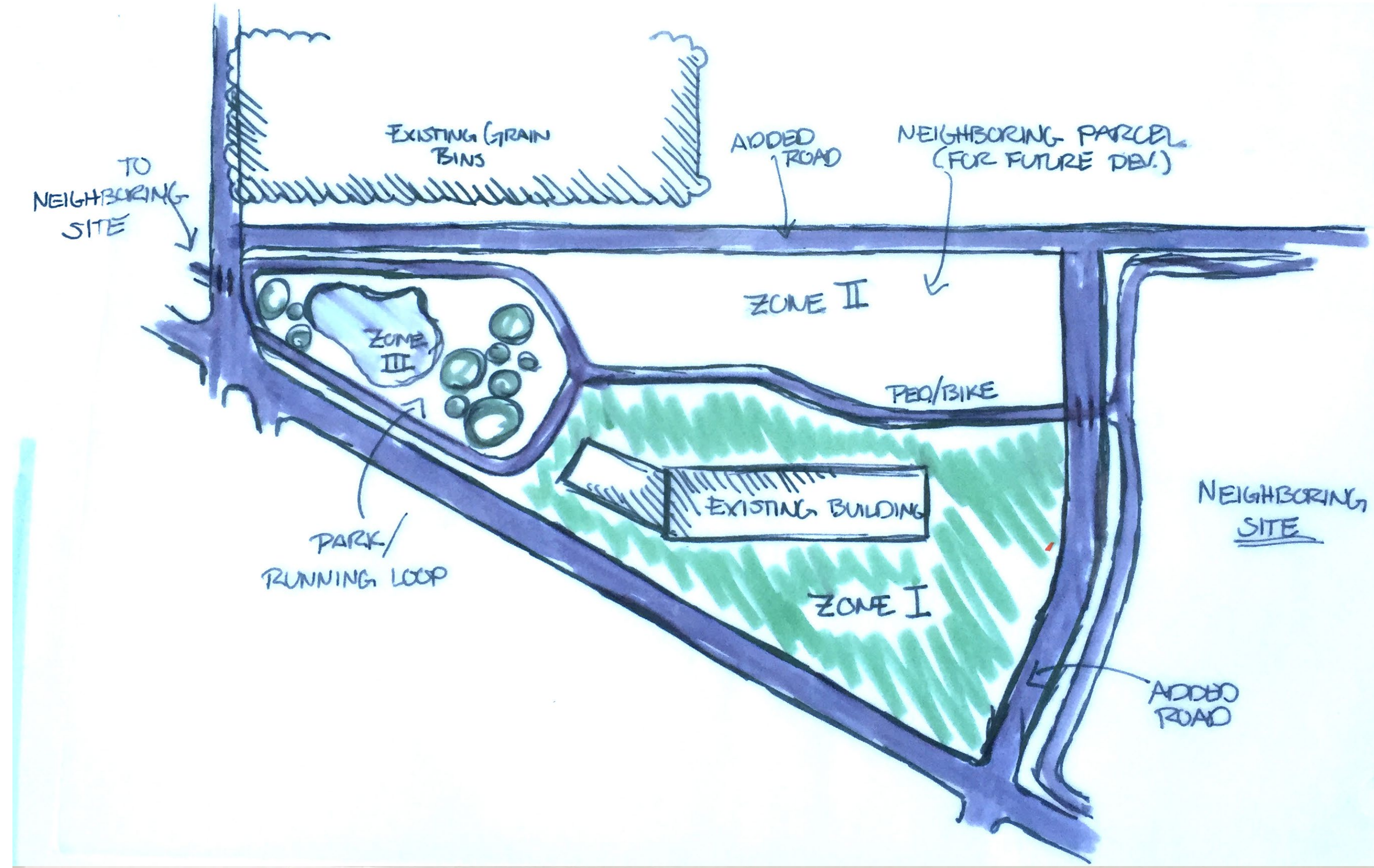


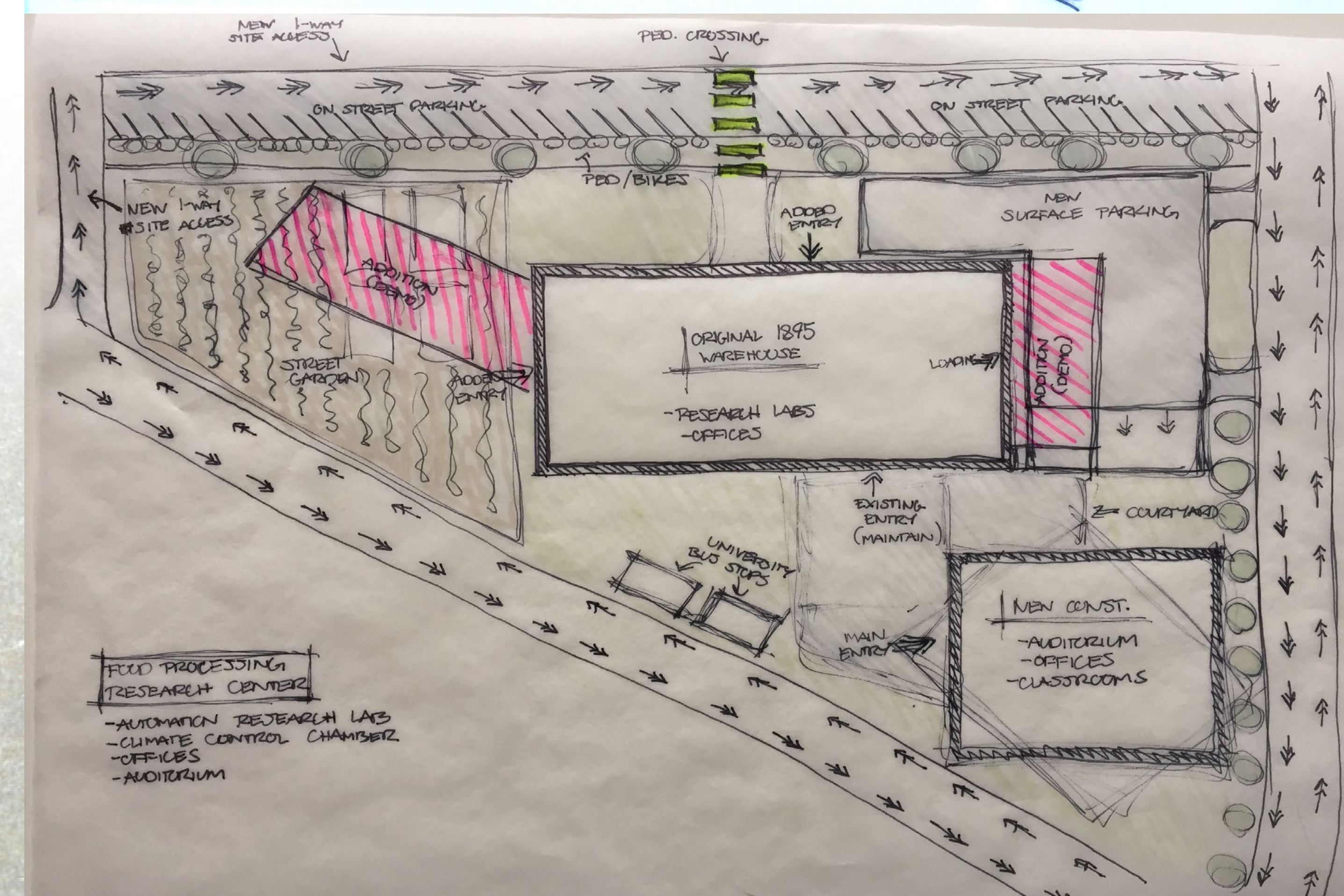

MAKE INTO PAVED
2-WAY ROAD
FOR VEHICLE TRAFFIC
EXISTING
NEW
BUILDING
DEVELOPMENT
ADD NEW
2-WAY ROAD
FOR VEHICLE
TRAFFIC
(NORTH-SOUTH
CONNECTION)
MUCH BETTER
OPTION.
NO AWKWARD INTERSECT

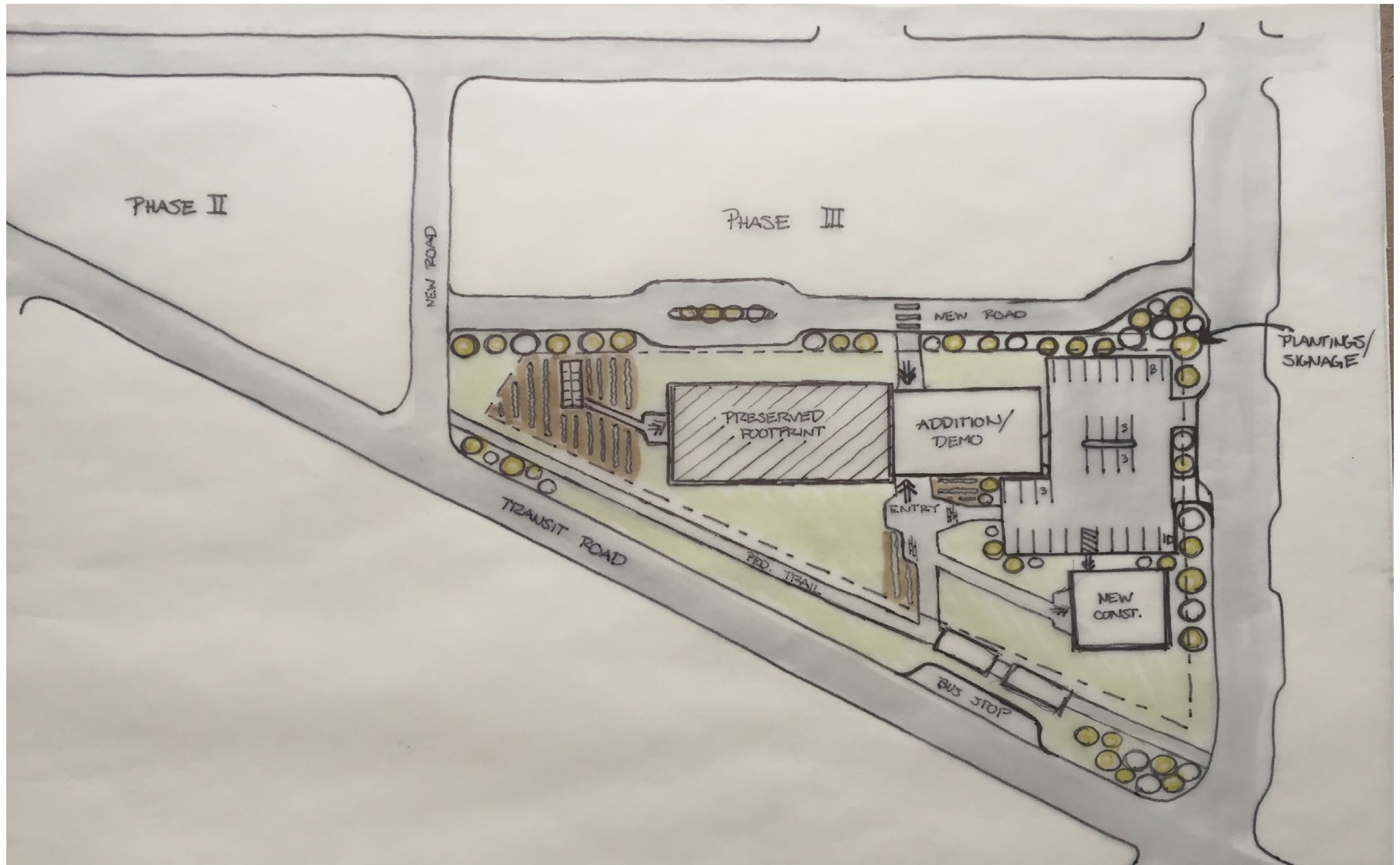

MISSING A NORTH/SOUTH
CONNECTION?
EXISTING
HOW TO HANDLE
WHERE PED.
MEETS VEHICLE?
-BRIDGE
-TUNNEL
-GREEN BUF.
DRAW BIKES OFF OF
UNIVERSITY TRANSITWAY &
MAKE SEPERATE GREENWAY
WITH PEDESTRIAN & BIKES
TOGETHER.
TRANSITWAY
BIKES
SMOOTH TRANSITION
TO SITE

Site Accessibility (Ped./Bike)

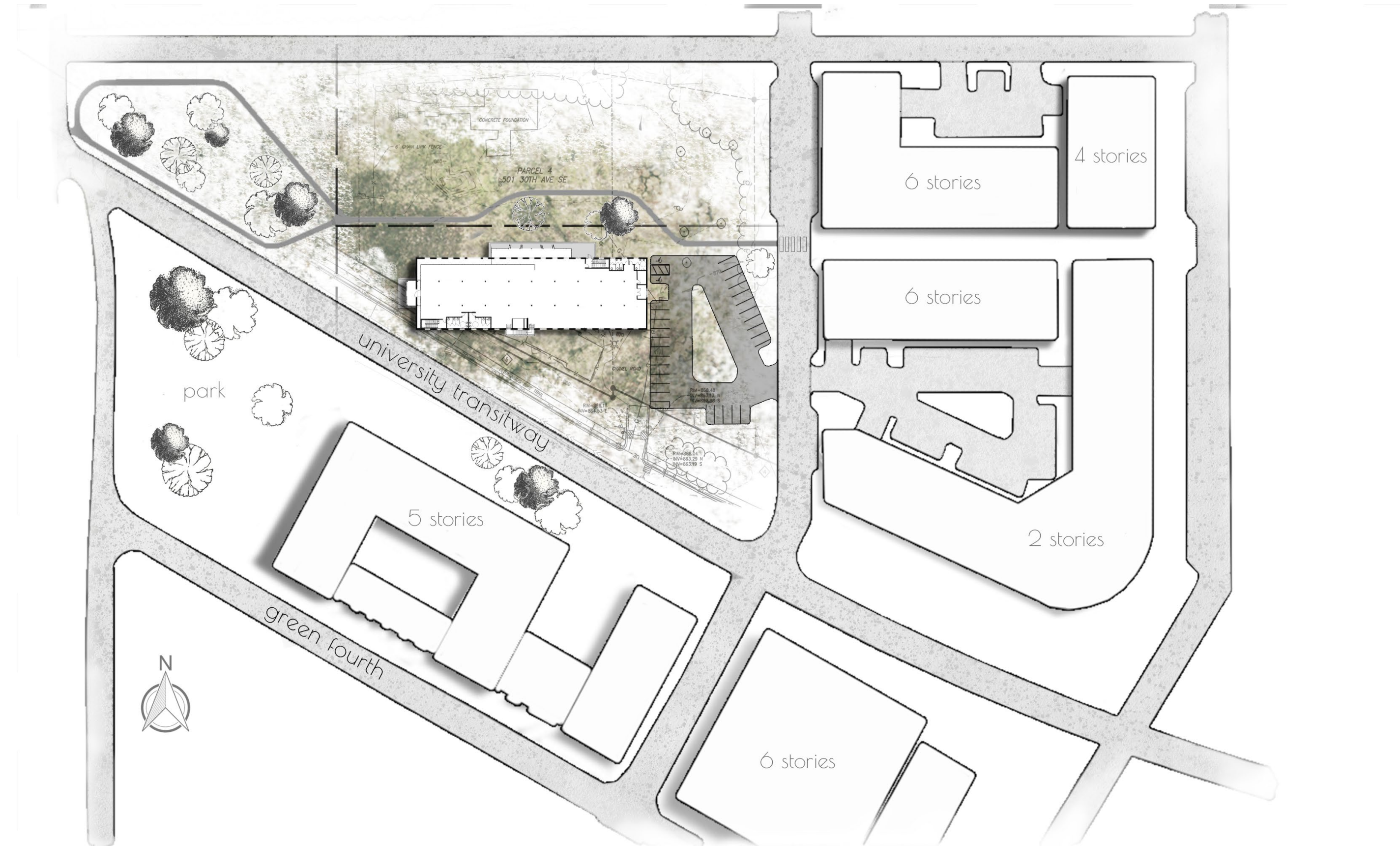







PHASE II
PHASE III
NEW ROAD
PLANTINGS/ SIGNAGE
PRESERVED FOOTPRINT
ADDITION/ DEMO
ENTRY
TRANSIT ROAD
PED. TRAIL
NEW CONST.
BUS STOP


PHASE II
PHASE III
NEW RD.
PRESERVED FOOTPRINT
NEW CONST.
TRANSIT ROAD
BUS STOP
PLANTINGS/ SIGNAGE


6 stories
4 stories
6 stories
park
university transitway
5 stories
2 stories
green fourth
N
6 stories

Sense of Place: Make a case for the importance of connecting to the place you are designing for through words

Sense of place has been talked about a lot in the past 4 years of my education, and I think it is an important skill that is hard to define.

Sense of place can mean the buildings connection to its surroundings, or the designer's attempt to reflect the culture of another time or place. It is one of those elements that has a different meaning to everyone, but without it the design will be clearly lacking.

For this project sense of place is about creating a design solution that is respectful and speaks to the existing structure. I think it is always important to respect the things that occupied the site with the new design. It is way of preserving the history, but also usually leads to great designs that further enforce the identity of the place.

Sense of Purpose: Make a case for why architecture is relevant to human culture in the 21st century

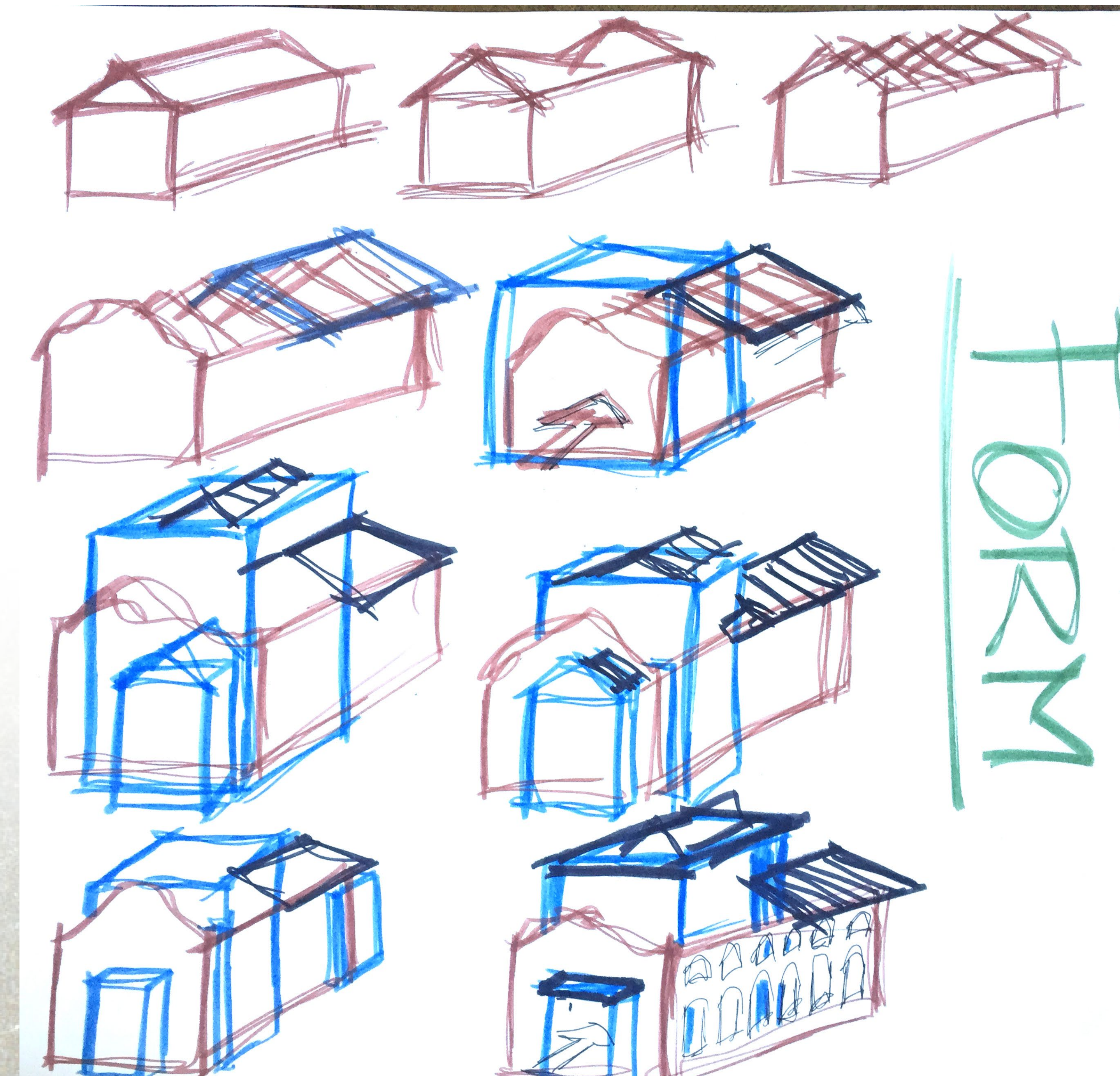
Historically architecture has played an important role in the development of culture and expression of technology. I don't think this has changed in the 21st century, as our environments continue to reflect our culture and expand our thinking about the built environment.

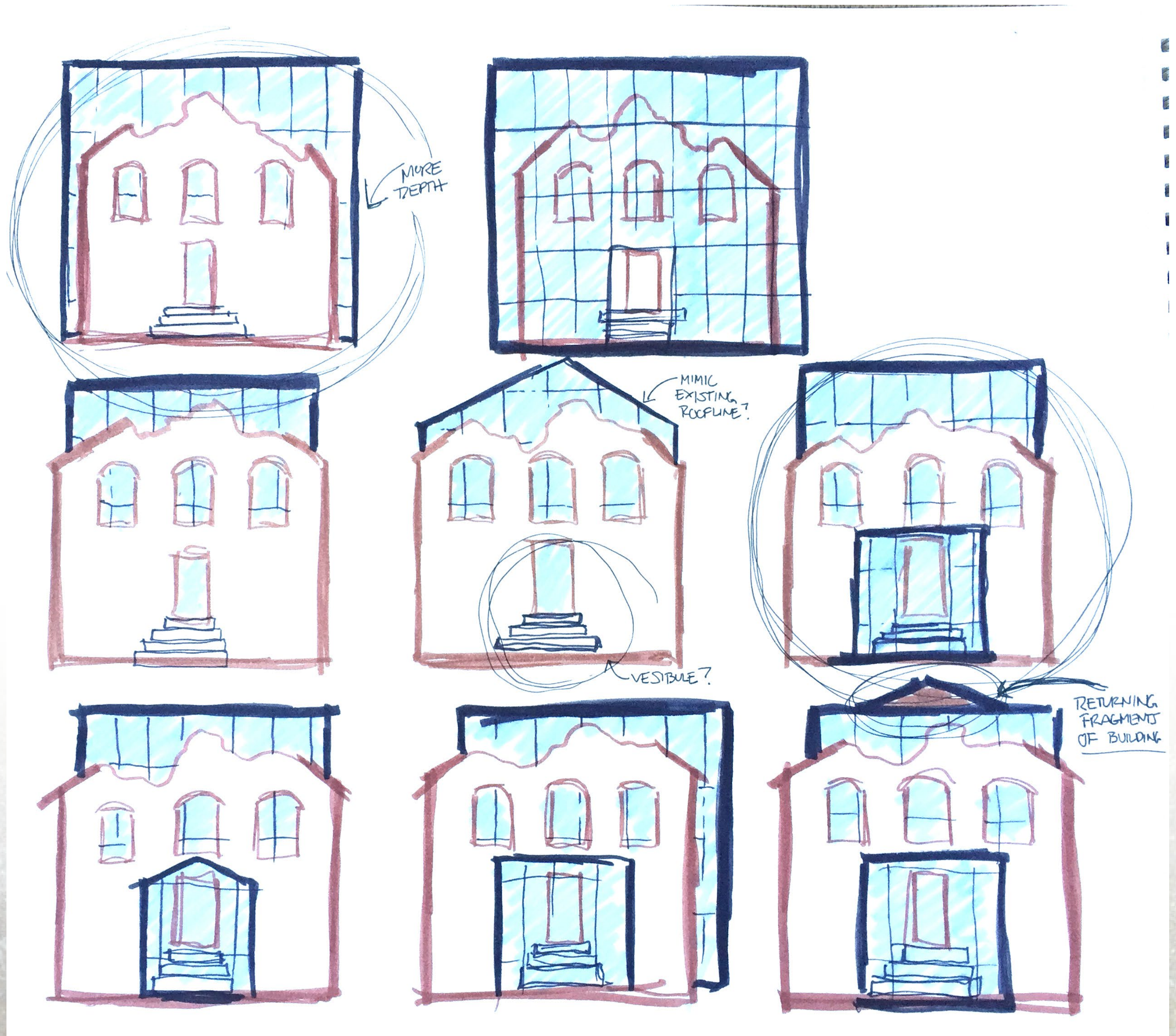
One of the major needs architecture addresses is the issue of sustainability. The building process is one of the highest contributors to wastes and energy consumption, which is a stat that we are realizing cannot be maintained for long. Architecture creates technologically advanced solutions to the building inefficiencies that taint the construction process.

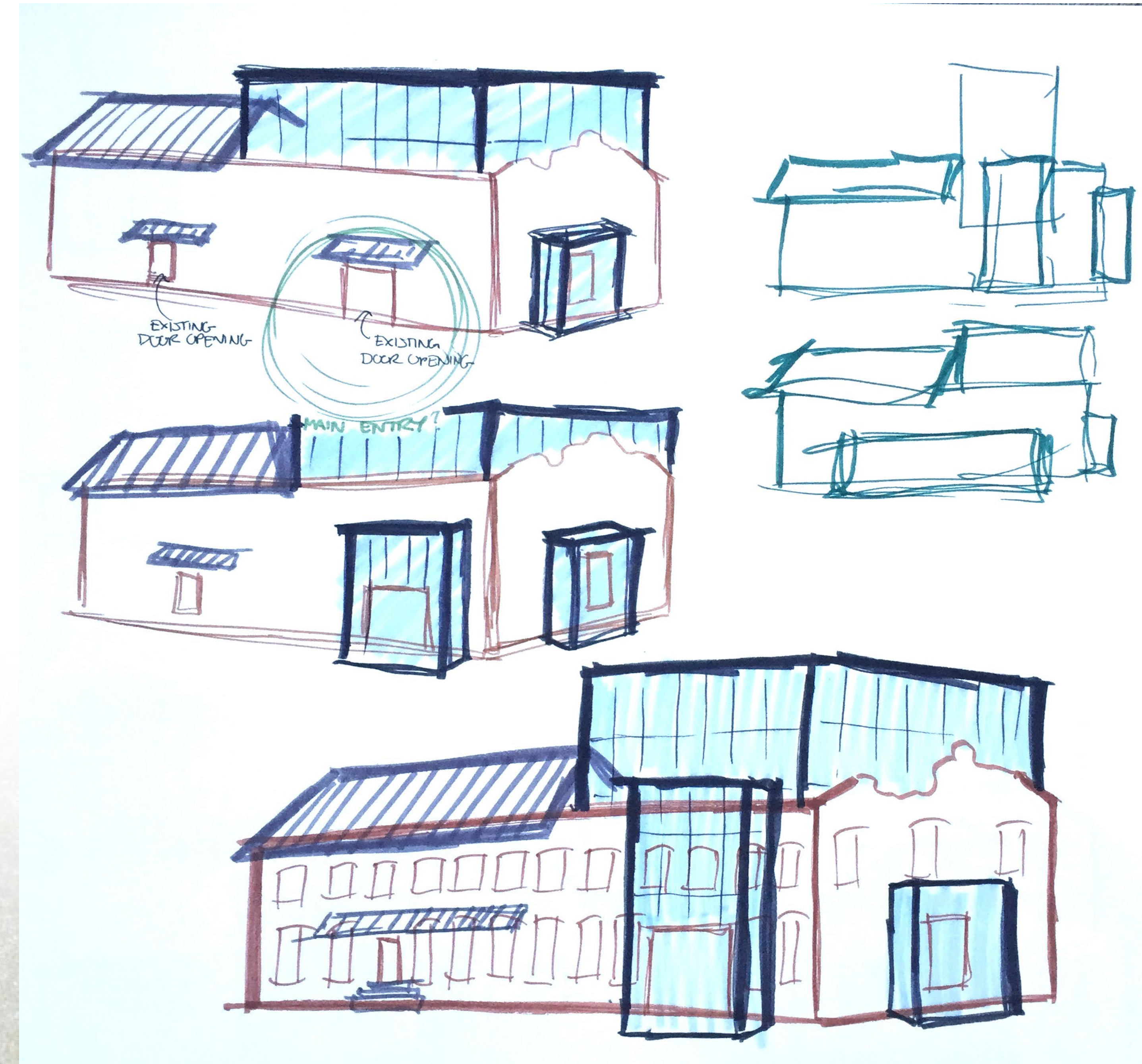
A second important aspect of architecture is the sense of place and culture that it has historically provided, and I believe will continue to provide far into the future. Spaces that speak of their period and the people who inhabit them are important artifacts that educate us about past lessons, and guide us to continue to explore and grow as people.

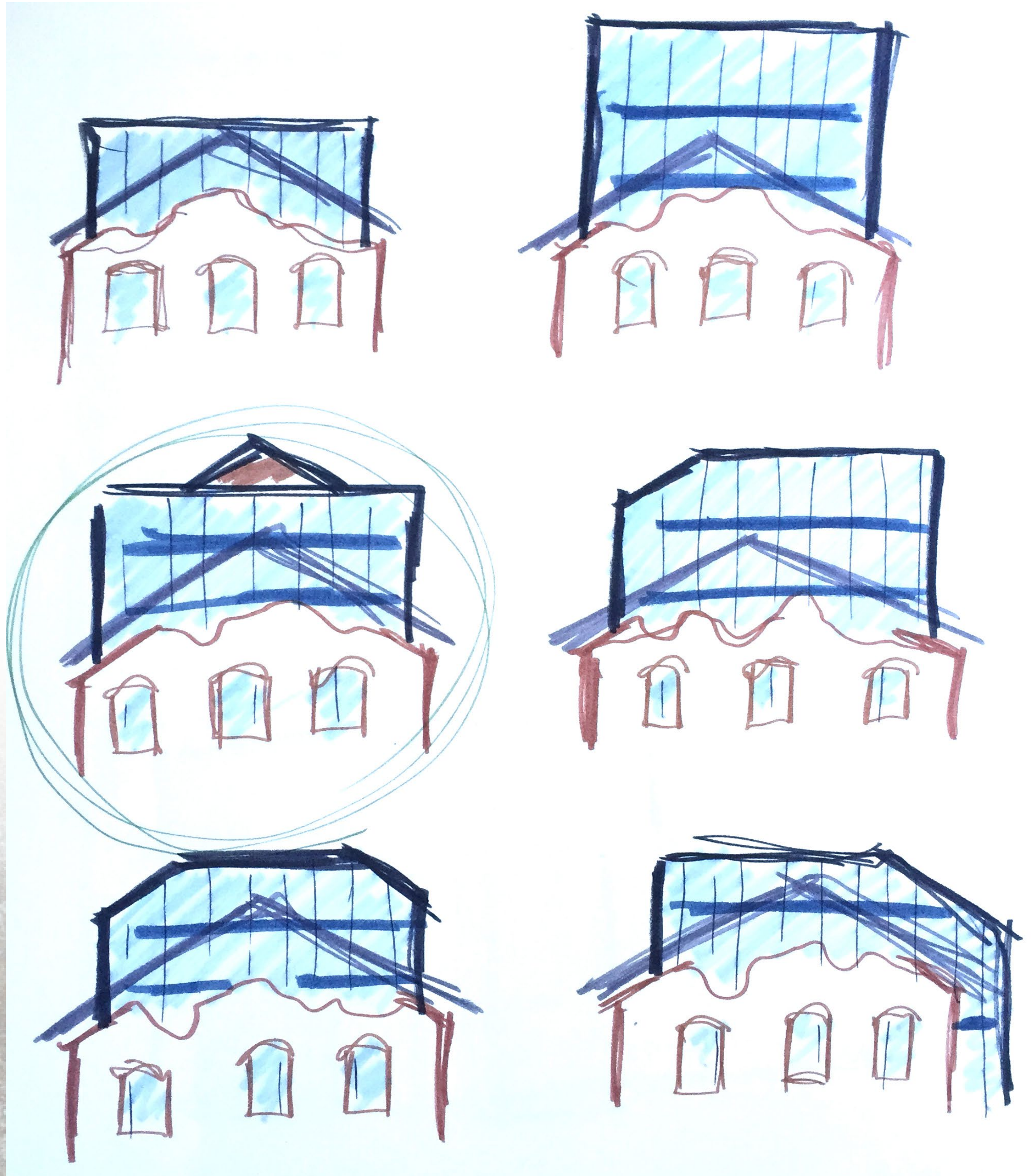
EXPLORATION OF FORM

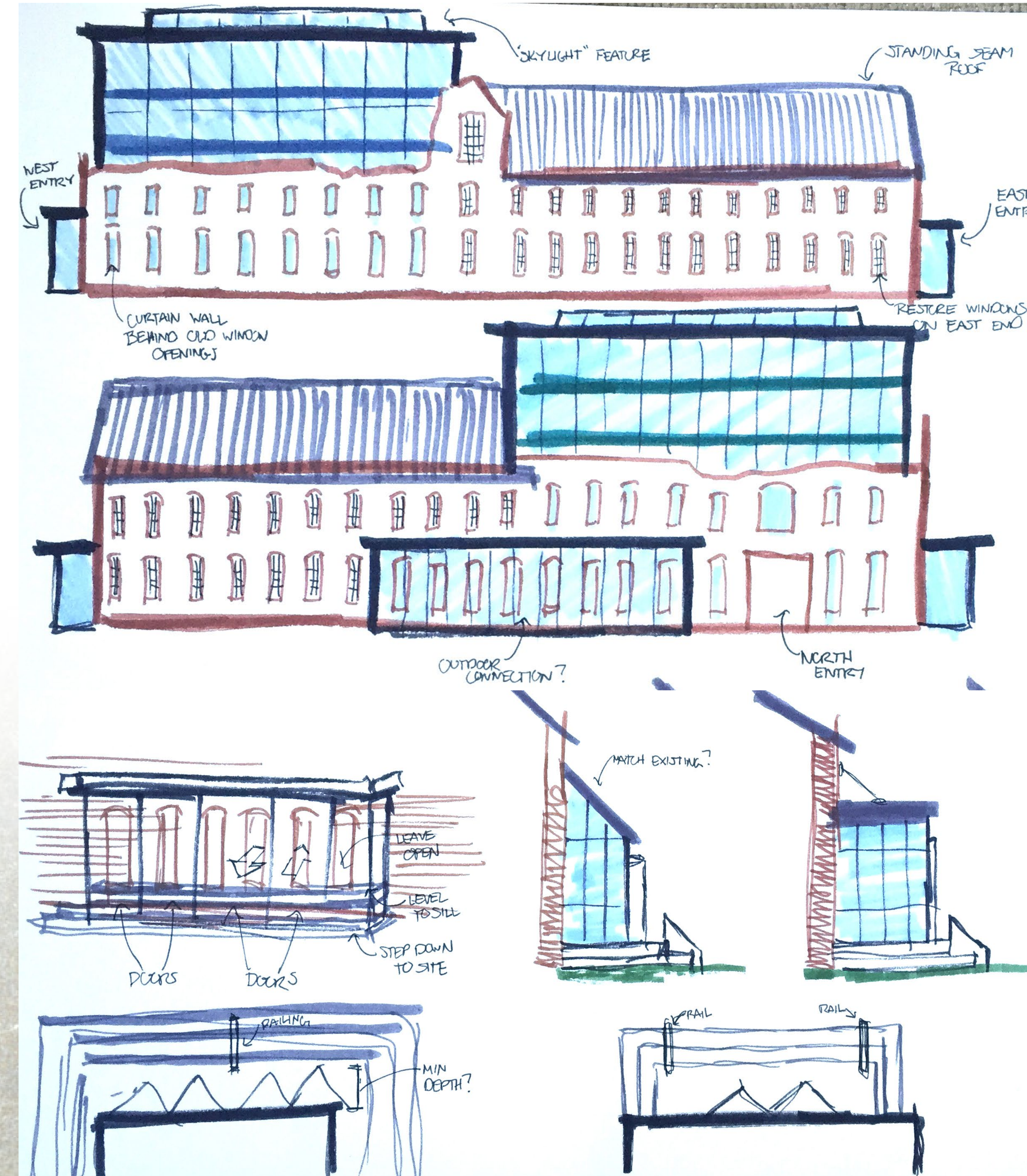
The Harris Building in its current state is moderately fire burned on the west end and missing its roof structure. The boxed region of the drawing above shows the mostly untouched area of the building. The two additions on either end were both later additions that will be taken off in this project, due to their poor construction and damage from vandalism.



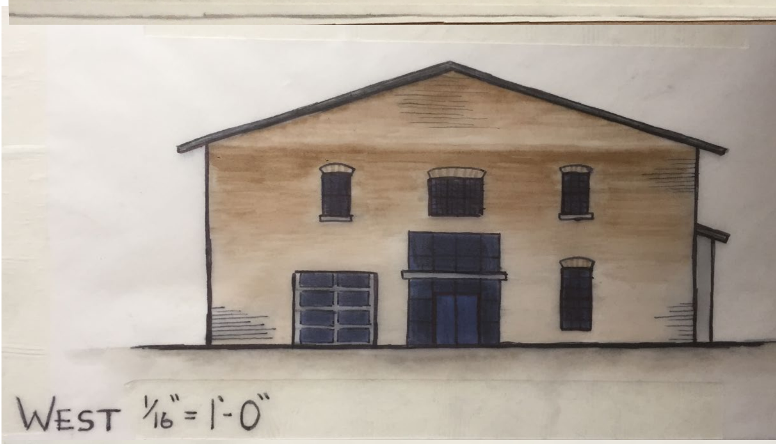

MORE DEPTH
MIMIC EXISTING ROOFLINE?
VESTIBULE?
RETURNING FRAGMENTS OF BUILDING

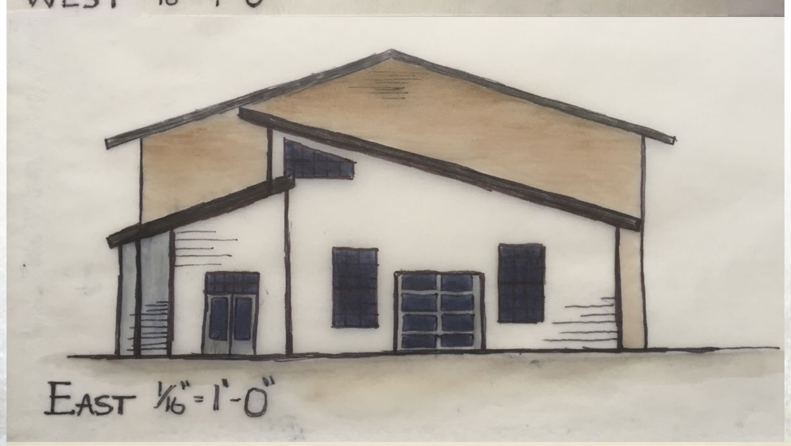

EXISTING DOOR OPENING
EXISTING DOOR OPENING
MAIN ENTRY?





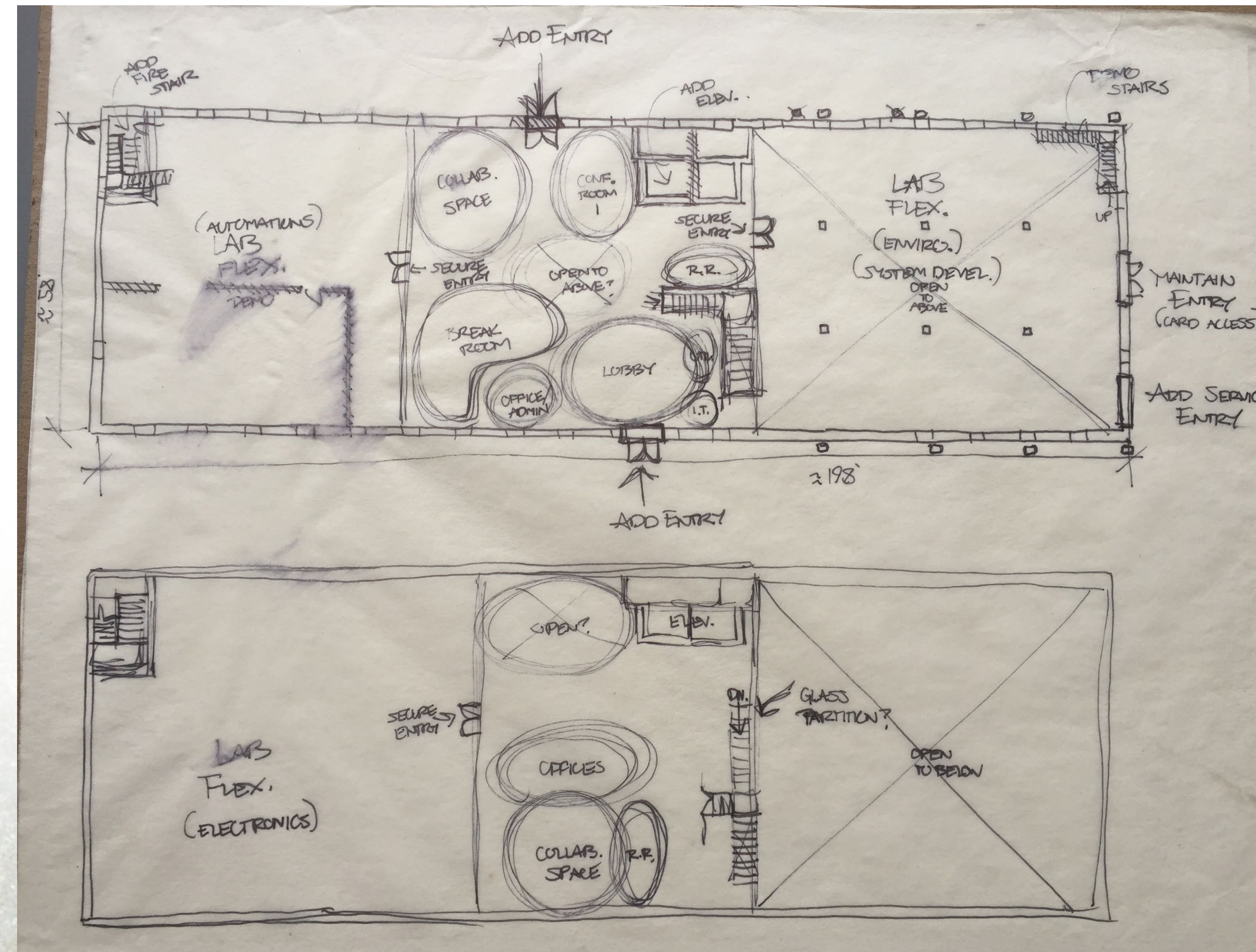
"SKYLIGHT" FEATURE
STANDING SEAM ROOF
WEST ENTRY
EAST ENTRY
CURTAIN WALL BEHIND OLD WINDOW OPENINGS
RESTORE WINDOWS ON EAST END
OUTDOOR CONNECTION?
NORTH ENTRY
MATCH EXISTING?
LEAVE OPEN
LEVEL TO SILL
STEP DOWN TO SITE
DOORS
DOORS
RAILING
MIN DEPTH?
RAIL
RAIL





This set of elevations are of a design option that I decided to scrap. After a midterm review, it was decided that the design could be pushed further to create a more coheasive looking building.

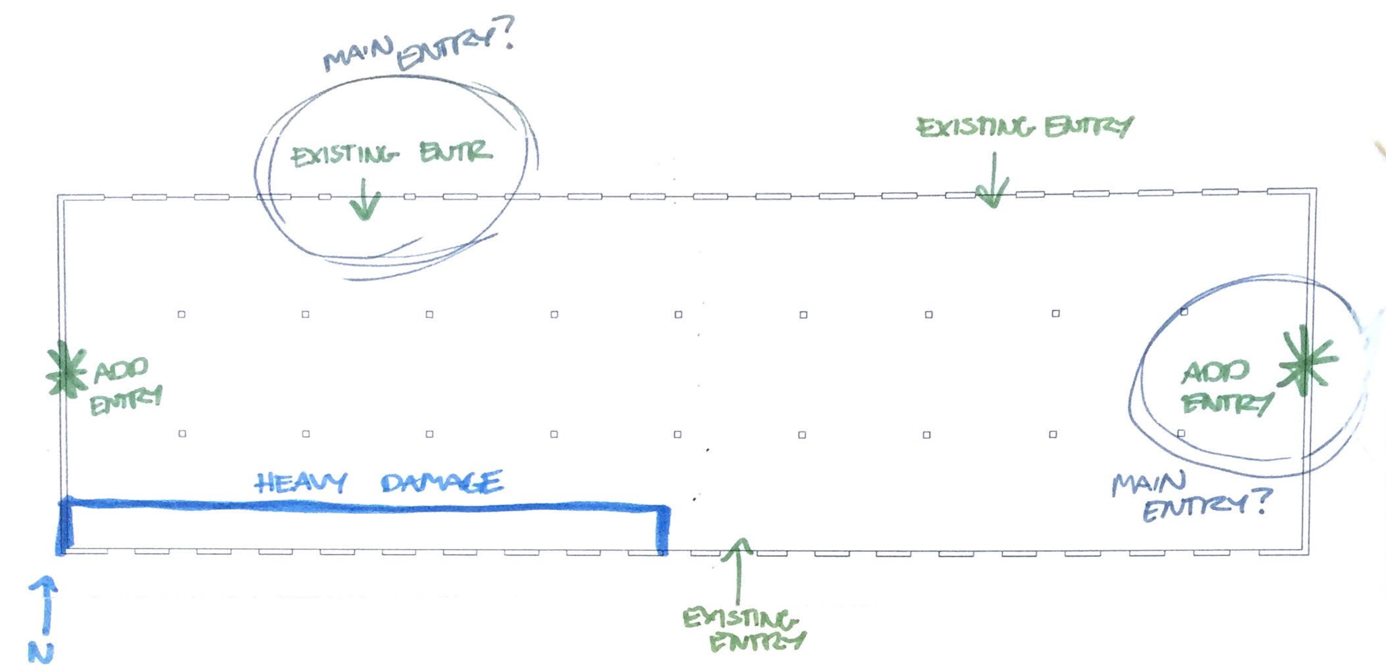
The next two pages of plans show the plan options that were being considered at this time, which were also abandoned.

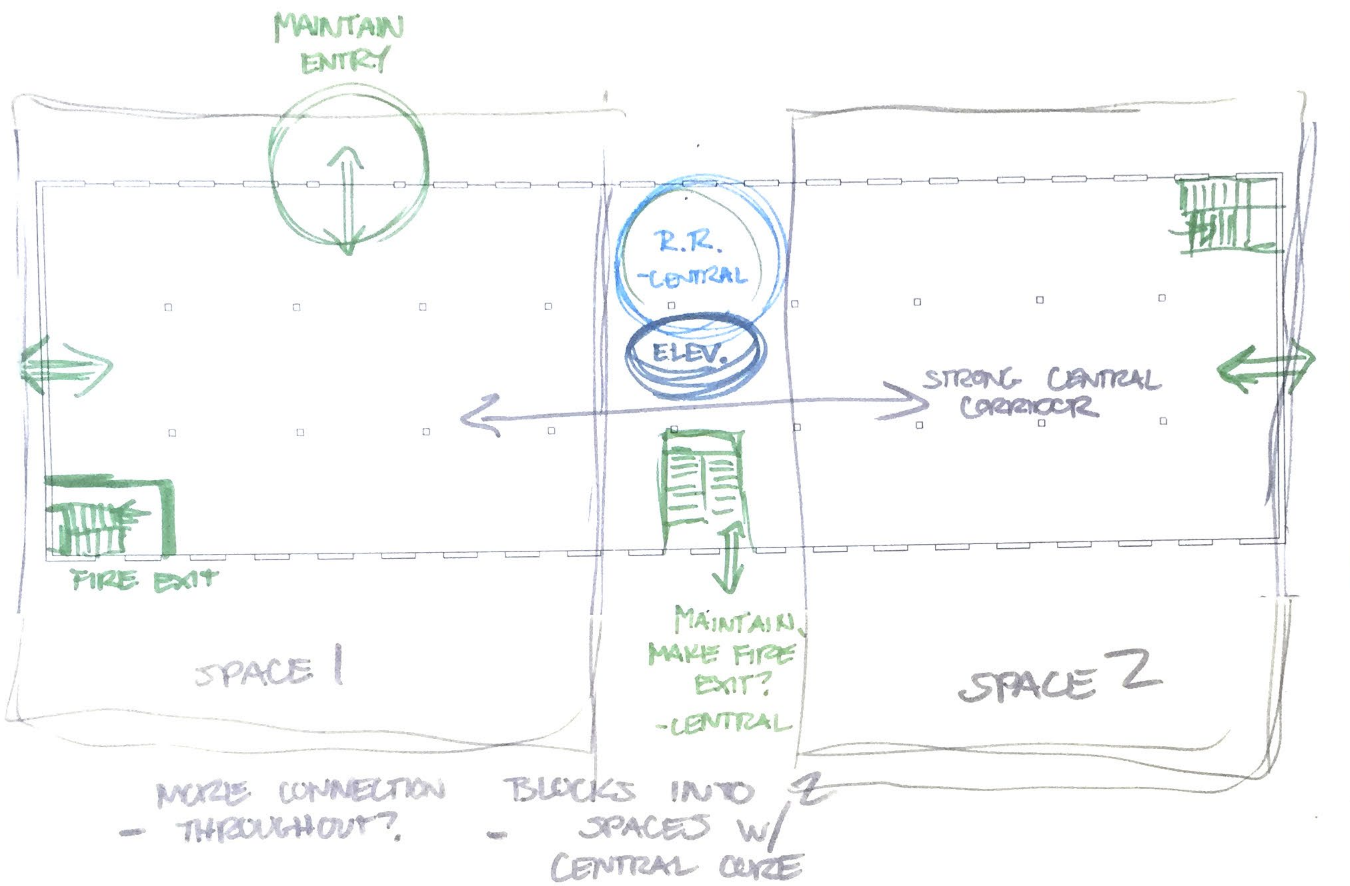


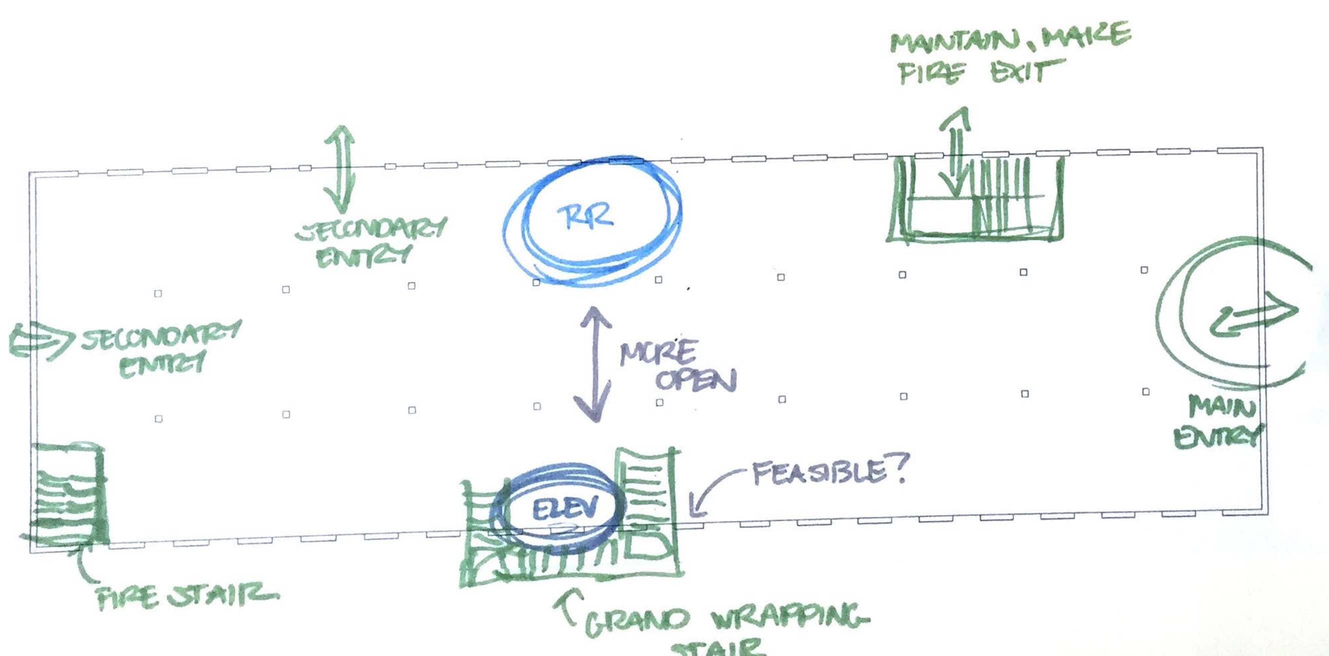
EXPLORATION OF SPACE

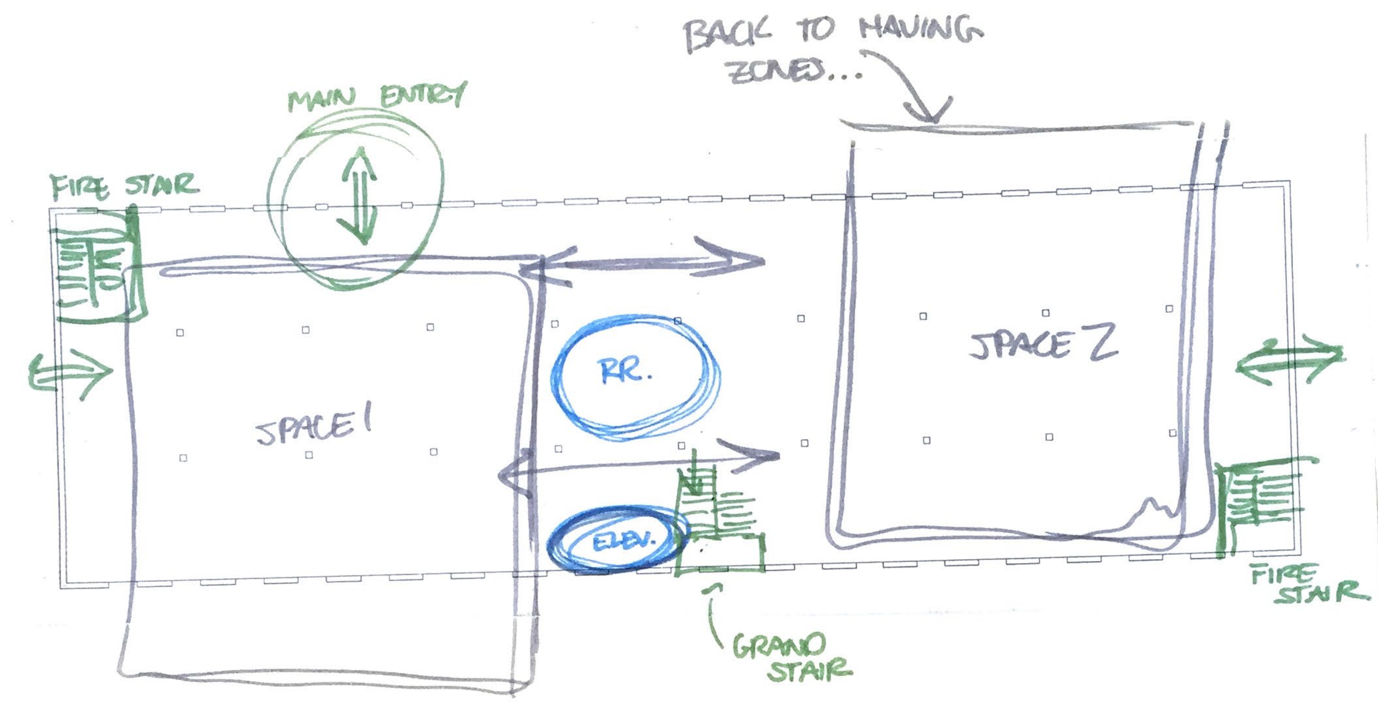
- MINIMIST FLOORPLAN
  - BASIC NECESSARY ELEMENTS
    - EGRESS
    - POINTS OF ENTRY
    - CIRCULATION
  - OPEN & FLEXIBLE
    - FEW PARTITIONS
    - AVOID INTERIOR BEARING WALLS

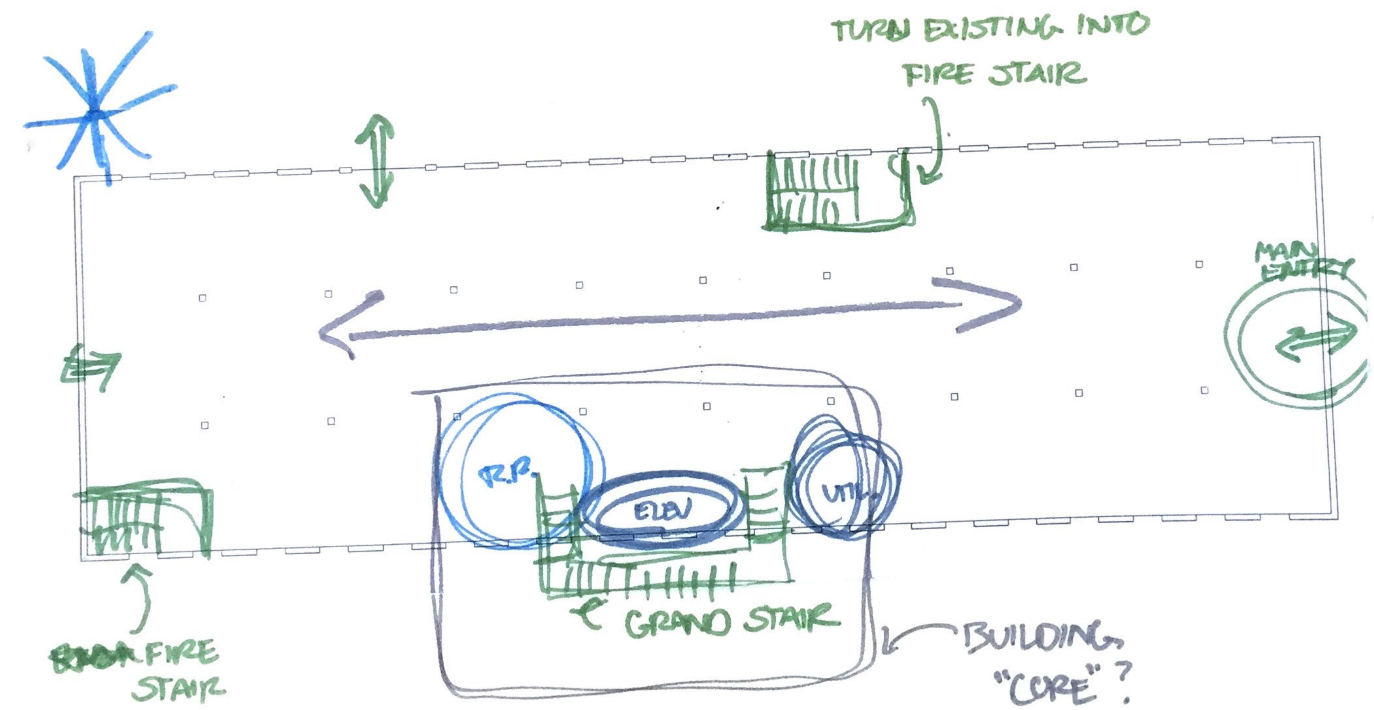
SPACES → -ELEVATOR -RESTROOMS
-VESTIBULES -UTILITY
-STAIRS

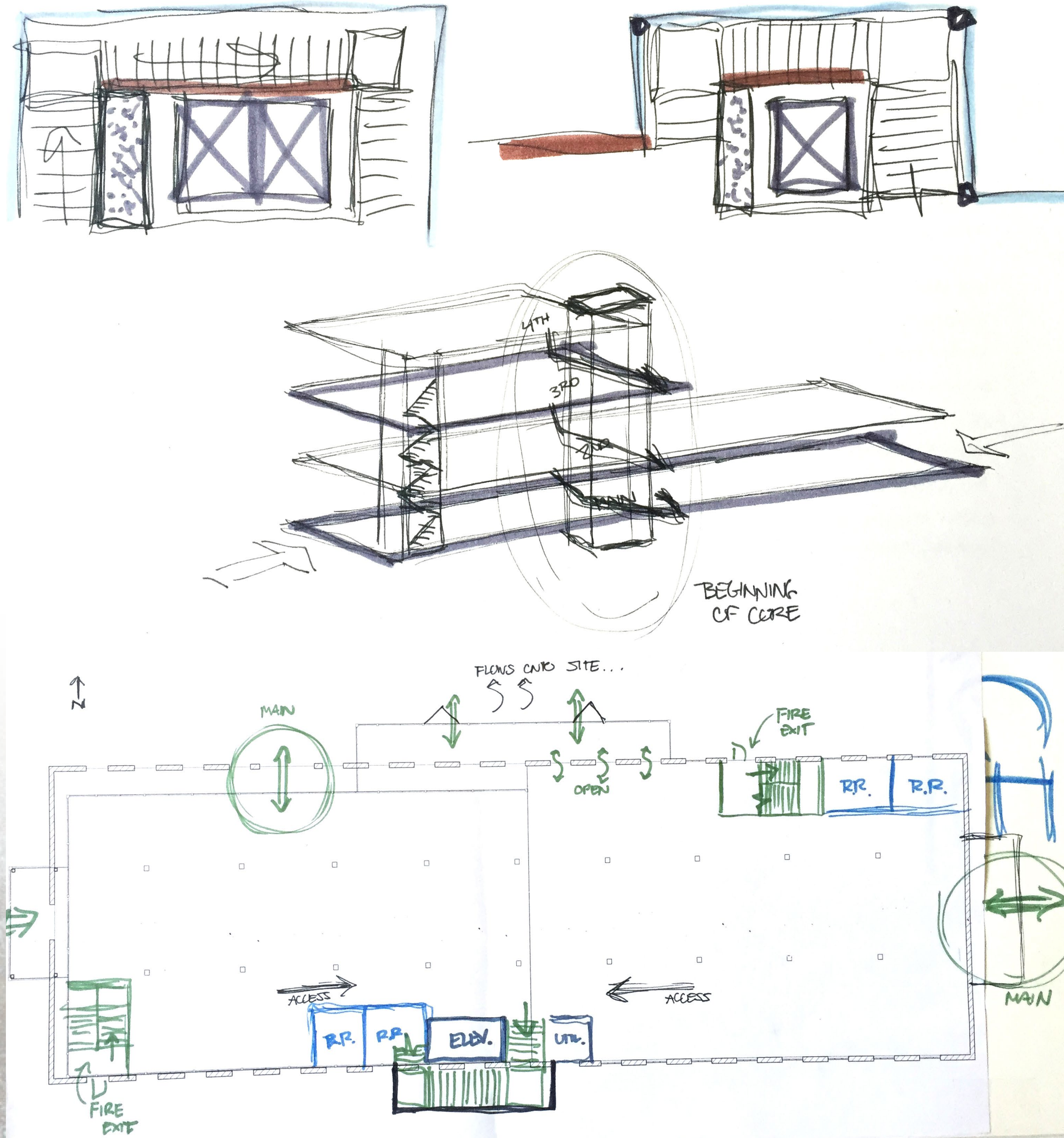



MAINTAIN ENTRY
R.R. -CENTRAL
ELEV.
STRONG CENTRAL CORRIDOR
FIRE EXIT
MAINTAIN, MAKE FIRE EXIT? -CENTRAL
SPACE 1
SPACE 2
MORE CONNECTION THROUGHOUT?
BLOCKS INTO 2 SPACES W/ CENTRAL CORE


MAINTAIN, MAKE FIRE EXIT
SECONDARY ENTRY
RR
SECONDARY ENTRY
MORE OPEN
MAIN ENTRY
ELEV
FEASIBLE?
FIRE STAIR
GRAND WRAPPING STAIR


BACK TO HAVING ZONES...
MAIN ENTRY
FIRE STAIR
SPACE 2
RR.
SPACE 1
ELEV.
FIRE STAIR
GRAND STAIR


TURN EXISTING INTO FIRE STAIR
MAIN ENTRY
RR
ELEV
UTIL.
GRAND STAIR
FIRE STAIR
BUILDING "CORE"?



Beyond Sustainability: Make a case for developing a new sustainable paradigm through human actions in writing

Sustainability can be approached from many different ways. Human actions are obviously at the root of all solutions, since it takes careful planning and purposeful decision making to create a sustainable building. I think that we need to be more aware of the long term consequences of our decision making, especially as designers.

The first step that I would suggest to take for architects is to educate yourself about the materials in which you are working with on a project. The embodied energy of materials is a powerful piece of data that can greatly change the priorities of a project. Such a large percentage of waste is created through the building process, so it only makes sense to tackle this issue first by minimizing waste and preserving material when possible.

Human Factors in Design: Architecture exists for human purposes: make a case for how people might relate to the solutions you are proposing

Part of the power of historic buildings is that people relate to them and find them to be suitable for many different uses. I think that playing up the many beautiful historic qualities of the Harris building will in itself drawing interest from most people.

A main goal, as stated previously, is to change the publics view on food processing. To do this, it is important that the building engages the public and has a feeling of transparency that communicates this goal. By having spaces that feel open and honest about what is taking place inside their quarters, it will help to grow the trust the of the public.

Being usable in general is also a great way to build positive relationships between buildings and their inhabitants. The floor plan should promote productivity and be somewhere that people enjoy coming to work and class.

Poetics in Architecture: Make a case for or against through words

Poetics can be found in almost anything depending on the approach you take. I don't think that architecture depends on any poetic analogies to exist, it is perfectly possible to design a building to meet its need without thinking about poetics. I do believe that it makes a design more successful to have a poetic inspiration and frequently revisit it during the design process.

At times this can be the biggest struggle in the design process, I think that designing poetically takes a lot of patience and practice. It also happens that you may lose touch with your initial inspiration and find yourself with a body of work that does not reflect your initial intention for the project. This is definitely frustrating, but I have always found it worth while to go back to your point of inspiration and re-work the design to reflect it.

PRESENTATION BOARDS

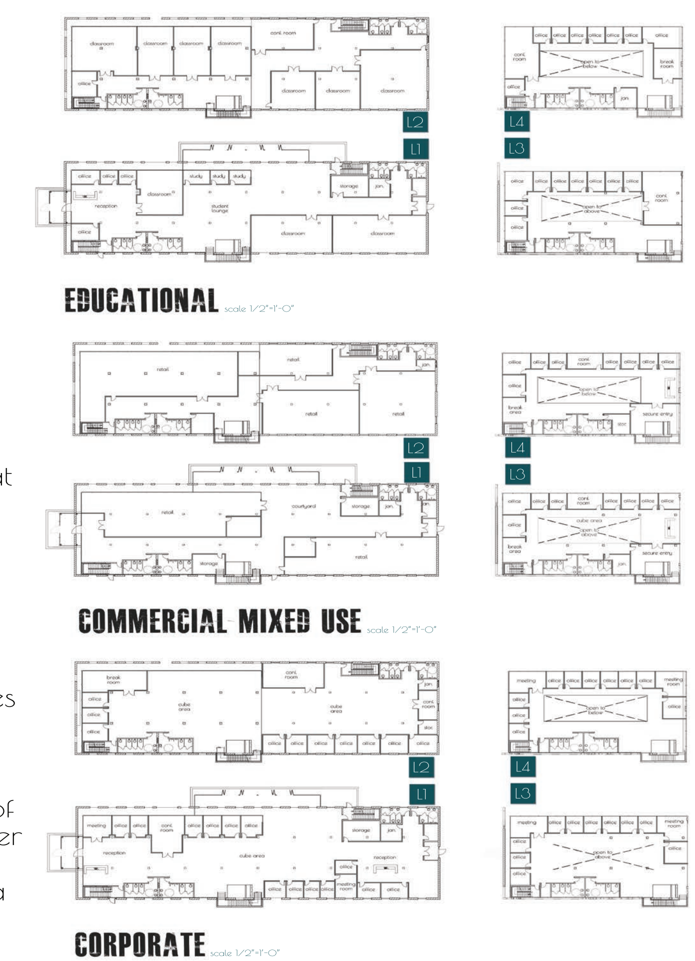
THE DAMAGES OF DEMOLITION

PROCESS: FORM SKETCHES

OPTIONS FOR THE UNKOWN

All we know for sure is that we don't know what the future holds. Part of that means that we must be imaginative in the spaces we provide, while also being considerate that buildings will most likely be used in ways we've never imagined in the future.

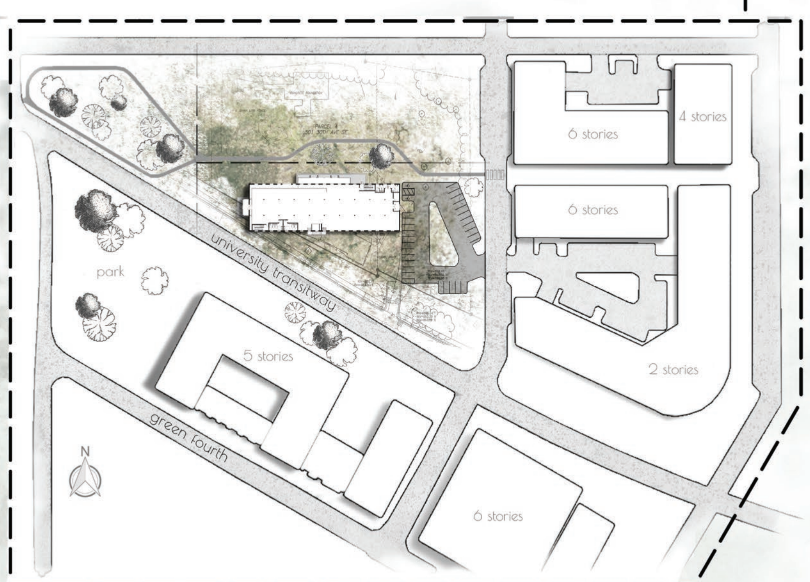
With the fastly changing technology that shapes our culture, all we as designers can count on is that we will always desire spaces that have basic instinctual qualities such as daylight, views to outdoors and thermal comfort. The floor plan options provided (right) are meant to show the adaptability of the building using only partition walls to alter the flow of spaces. This method allows for easy disassembly and reconstruction once a building faces a shift in needs.



The Damages of Demolition
Arch 772
Amy McDonald
Prof. Darryl Booker
Revit, Photoshop, Watercolor

'Intelligence is the Ability to Adapt' -Stephen Hawking

SOUTHEAST MINNEAPOLIS MAP

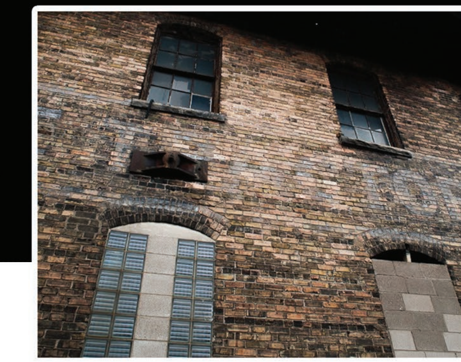


SITE PLAN AND FUTURE DEVELOPMENT

South Approach

Bathroom with Orifinal Fireplace Detail

4th Floor Space



Original Masonry Facade

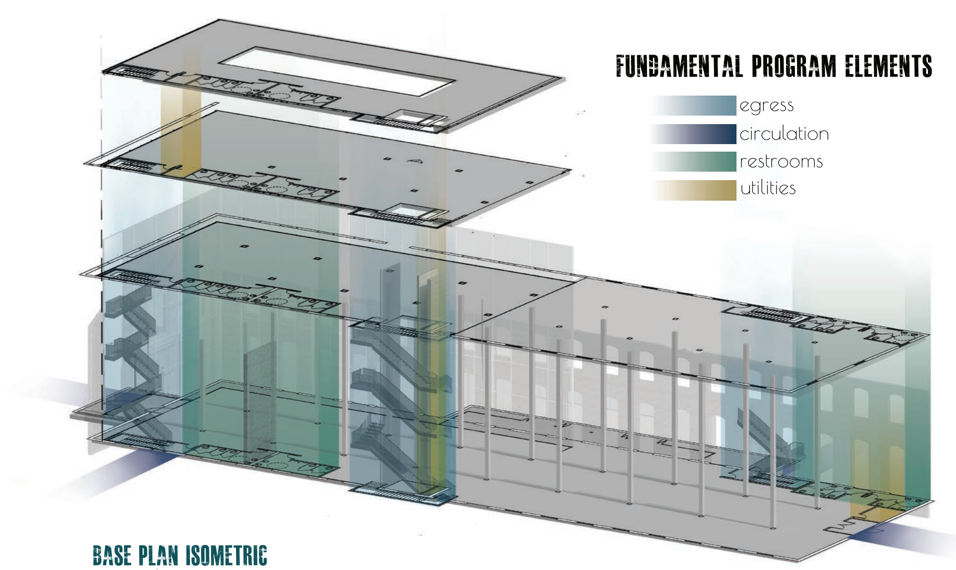
ADAPTIVE REUSE: THE SUSTAINABLE FUTURE

Adaptive reuse projects are transitioning from a design decision to a global need. As landfills are packed to capacity, the day approaches that we will not be able to demolish a building to replace it with something new. The decision to discard building materials before the end of their life cycle is creating consequences that outlast most of their maker's careers.

This thesis proposes an alternative solution to a project that was recently set for demolition in southeast Minneapolis. The Harris Machinery building has existed in the S.E.M.I. district since the late 1800's, an area that is now in the midst of a major redevelopment push.

The approach to this adaptive reuse design is to not build for a specific typology, but rather create spaces that are adaptable for a variety of uses. Since we do not know what the future needs of tenants will be, focusing on designing for a large spectrum of uses will help to expand the useful life of this space far beyond the average 50-year expectancy.

Four critical features (shown below) were identified when designing the adapted base plan for the Harris Building. Similar to the design process of many modern high rises, only fundamental elements are included to maximize the possibilities of each floor.



BASE PLAN ISOMETRIC

DIGITAL PRESENTATION

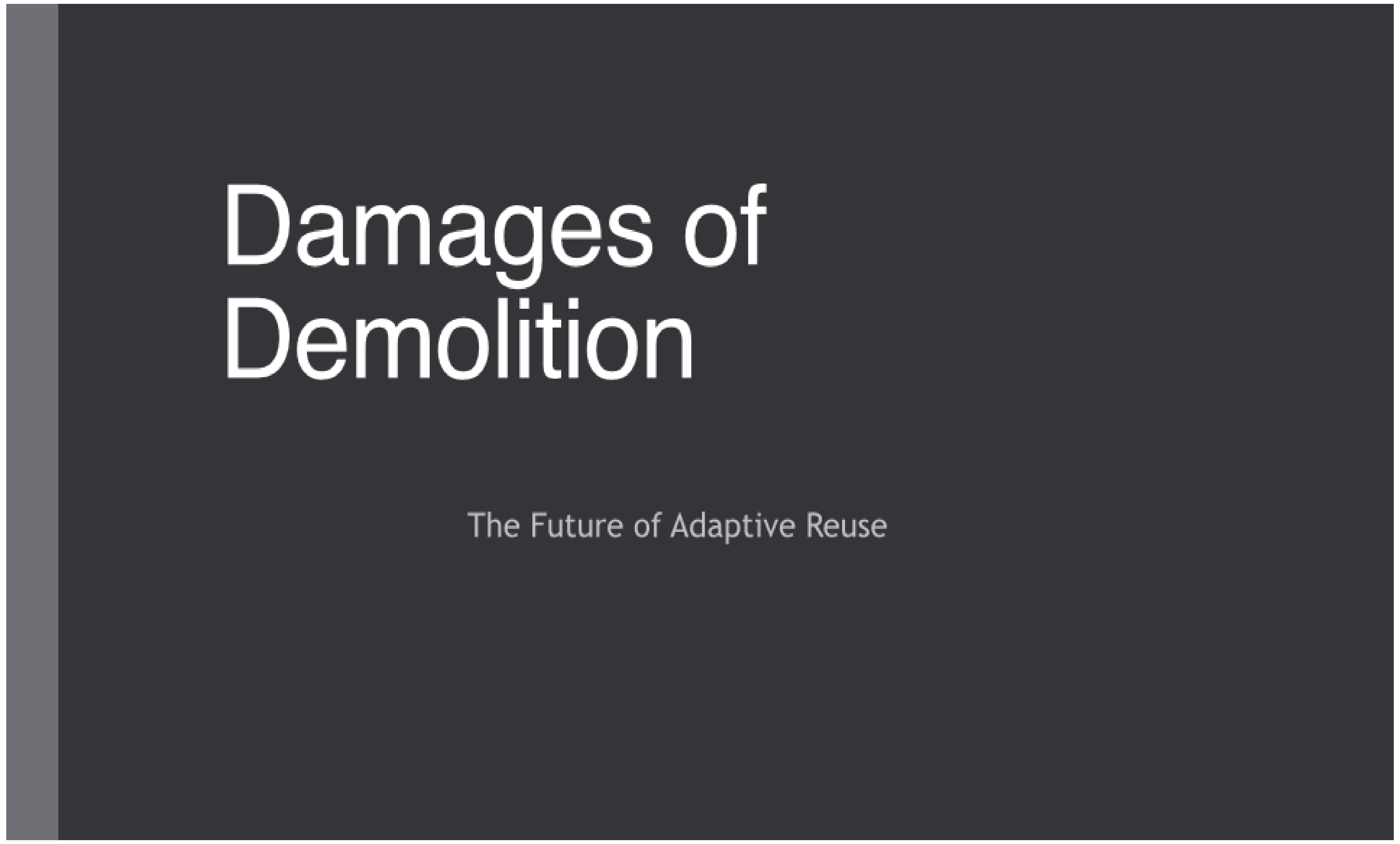


Table 12. Number of Years Required for New Buildings to Overcome Climate Change Impacts from Construction Process

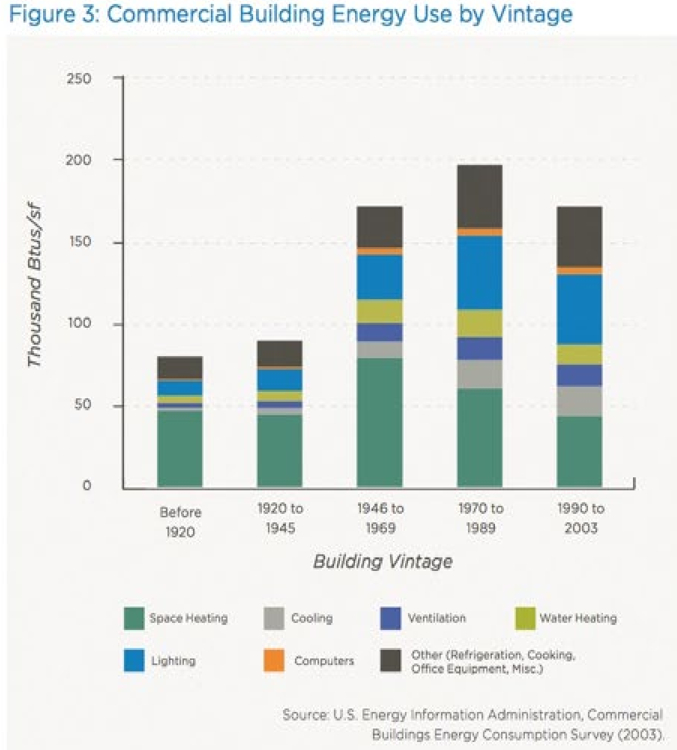
According to this study, it takes 10 to 80 years for a new building that is 30 percent more efficient than an average-performing existing building to overcome, through efficient operations, the negative climate change impacts related to construction. This table illustrates the number of years required for different energy efficient, new buildings to overcome impacts.

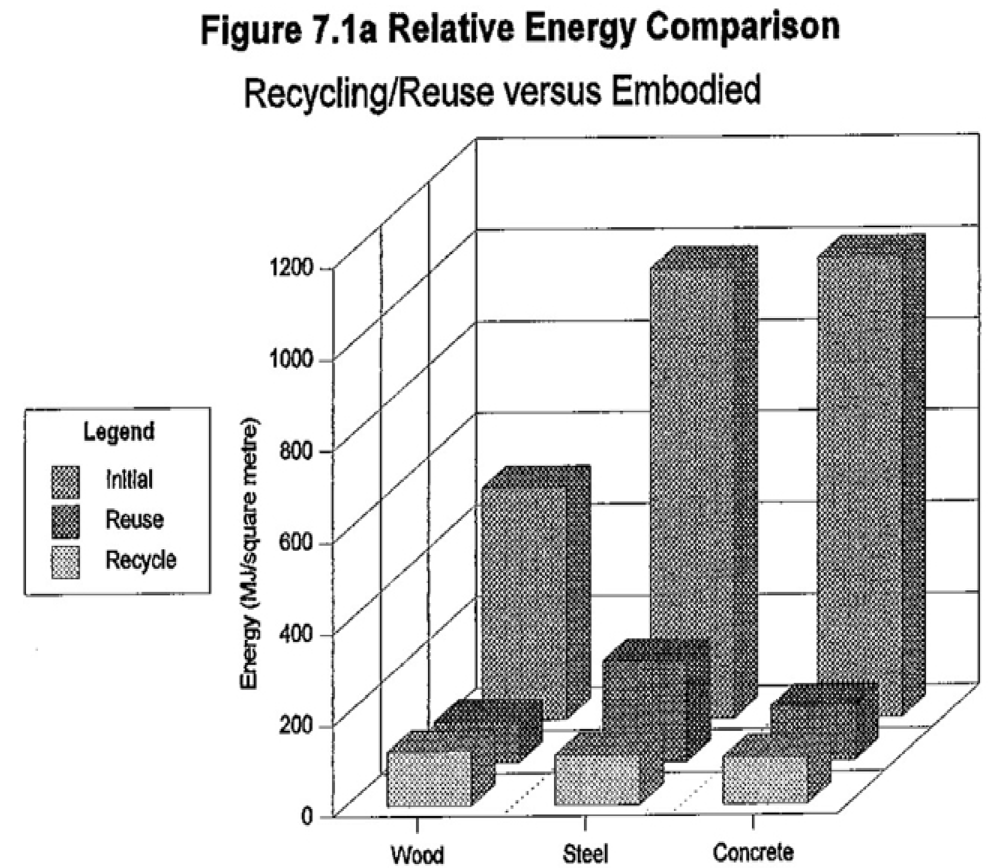
Building Type	Chicago	Portland
Urban Village Mixed Use	42 years	80 years
Single-Family Residential	38 years	50 years
Commercial Office	25 years	42 years
Warehouse-to-Office Conversion	12 years	19 years
Multifamily Residential	16 years	20 years
Elementary School	10 years	16 years
Warehouse-to-Residential Conversion*	Never	Never

*The warehouse-to-multifamily conversion (which operates at an average level of efficiency) does not offer a climate change impact savings compared to new construction that is 30 percent more efficient. These results are driven by the amount and type of materials used in this particular building conversion. The warehouse-to-residential conversion does offer a climate change advantage when the energy performance levels of new and existing building are assumed to be equal (see Figure 14). Thus, it may be particularly important to retrofit warehouse buildings for improved energy performance while renovating them. Furthermore, care should be taken to select materials that maximize environmental savings.

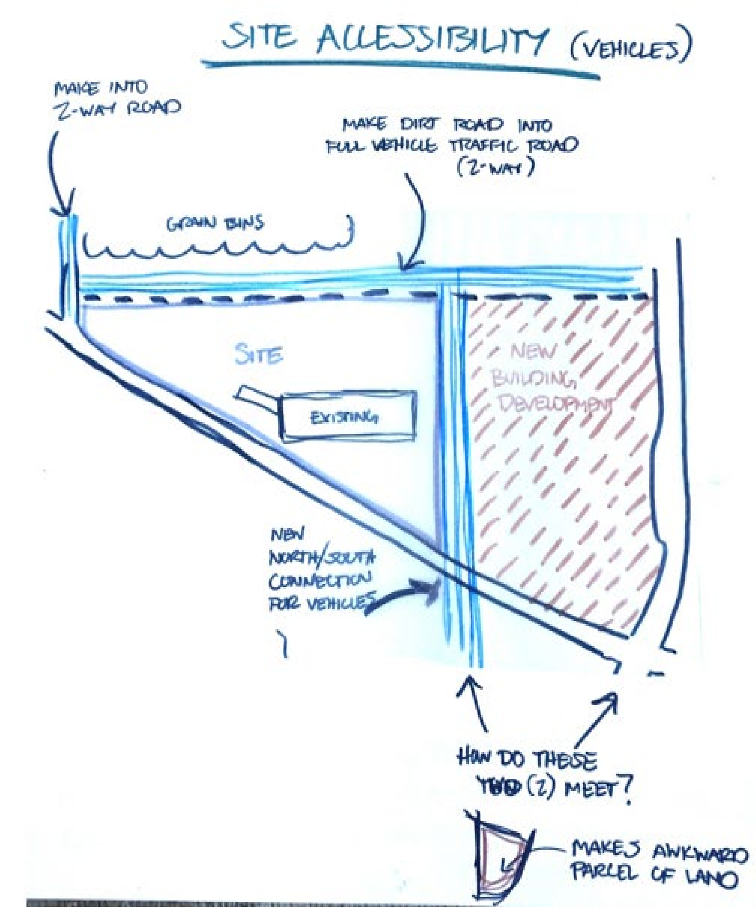
1. Economics
2. Structure
3. Culture

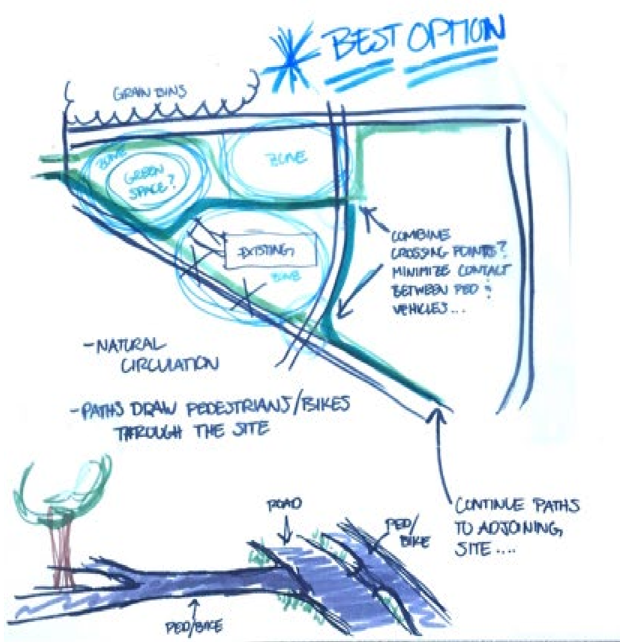
Figure 3: Commercial Building Energy Use by Vintage

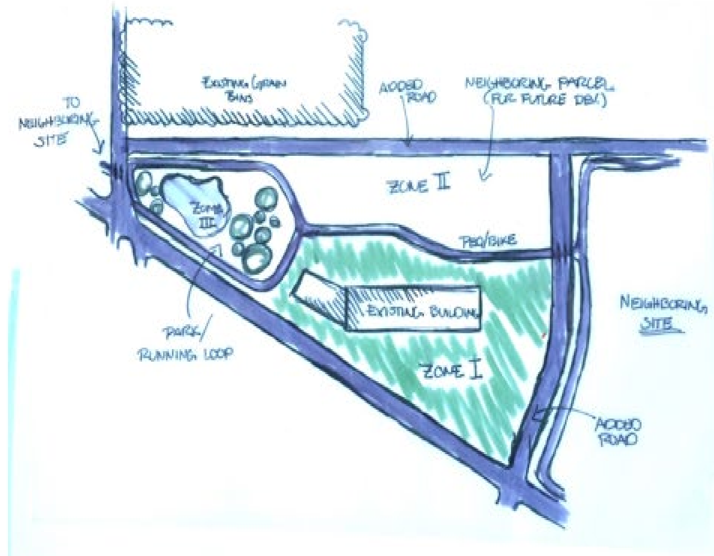


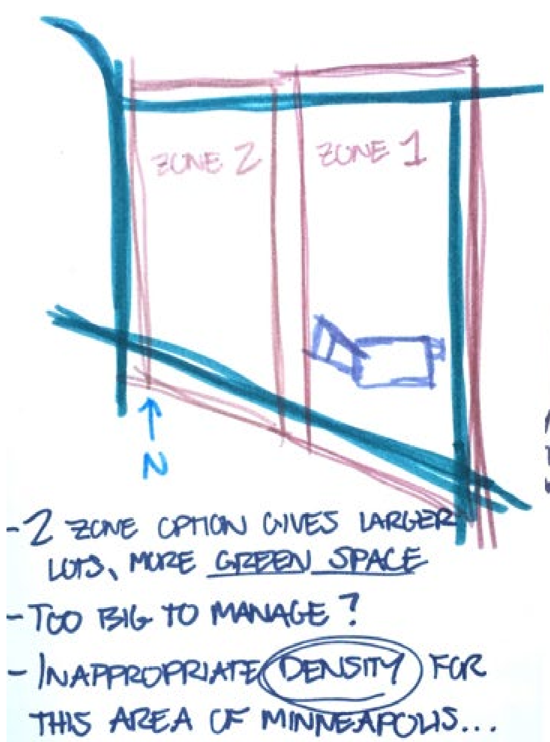


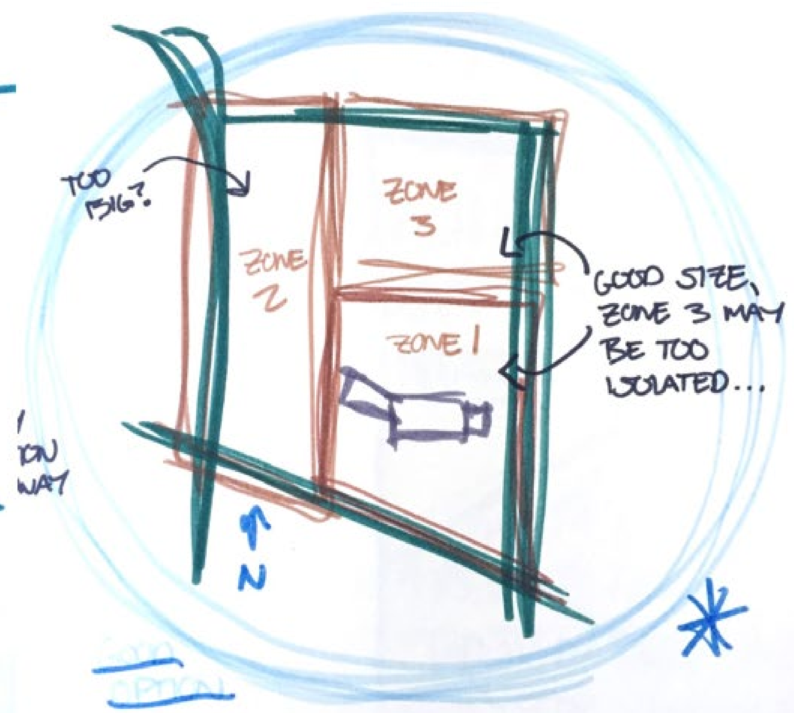
‘ Intelligence is the ability to adapt’ - Stephen Hawking

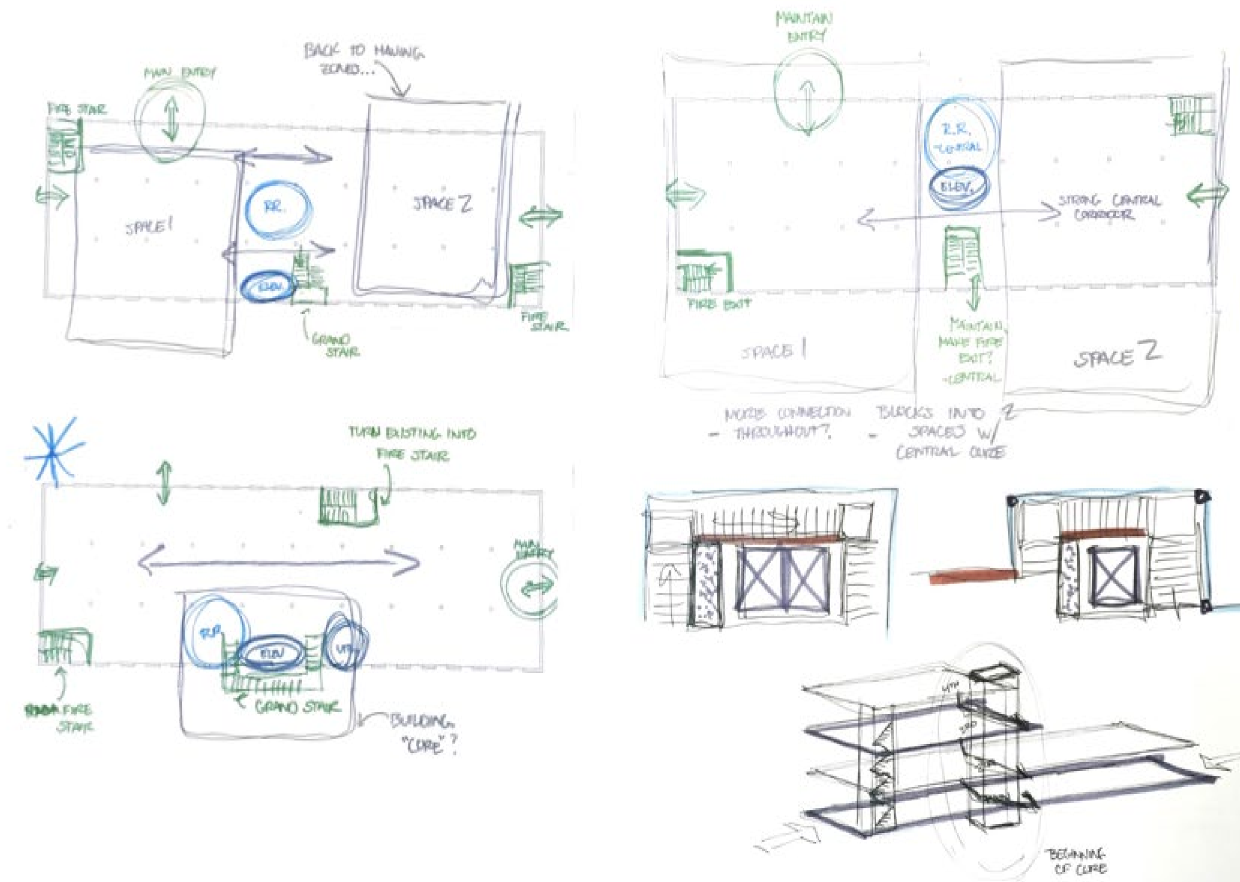


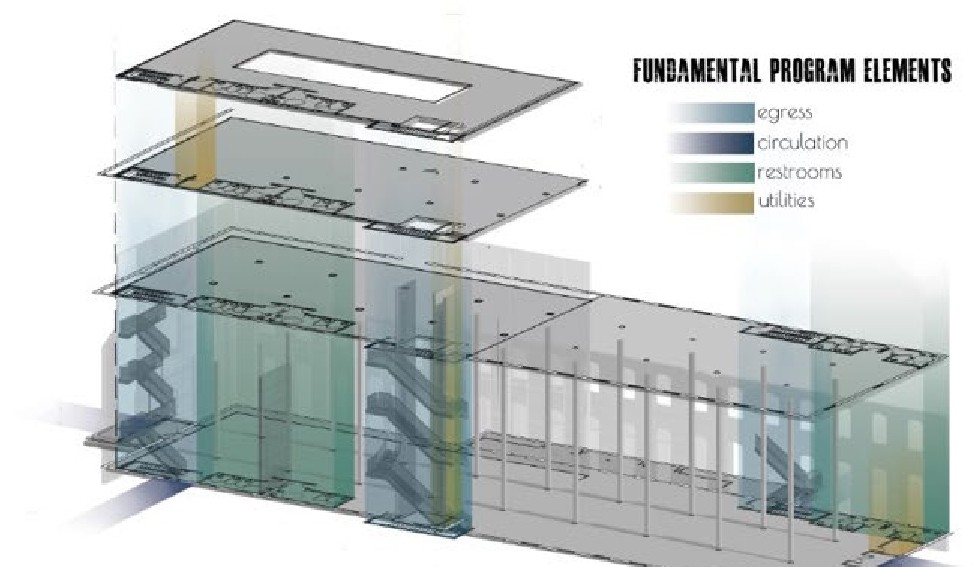




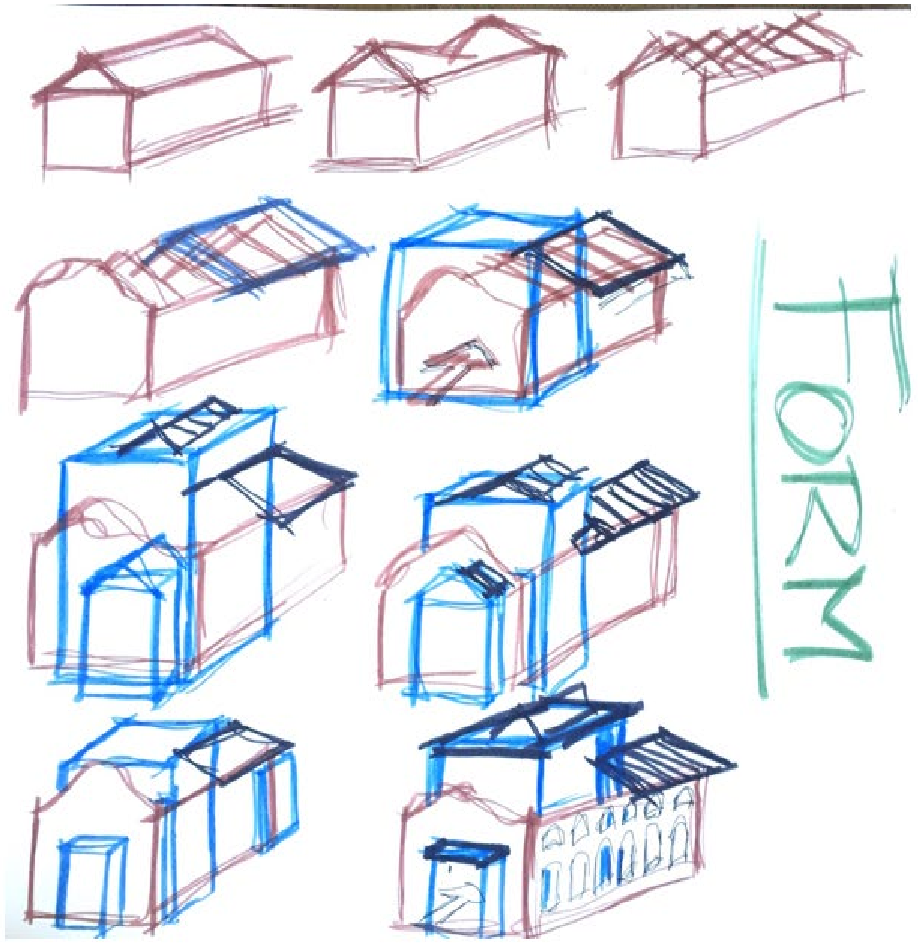








BASE PLAN ISOMETRIC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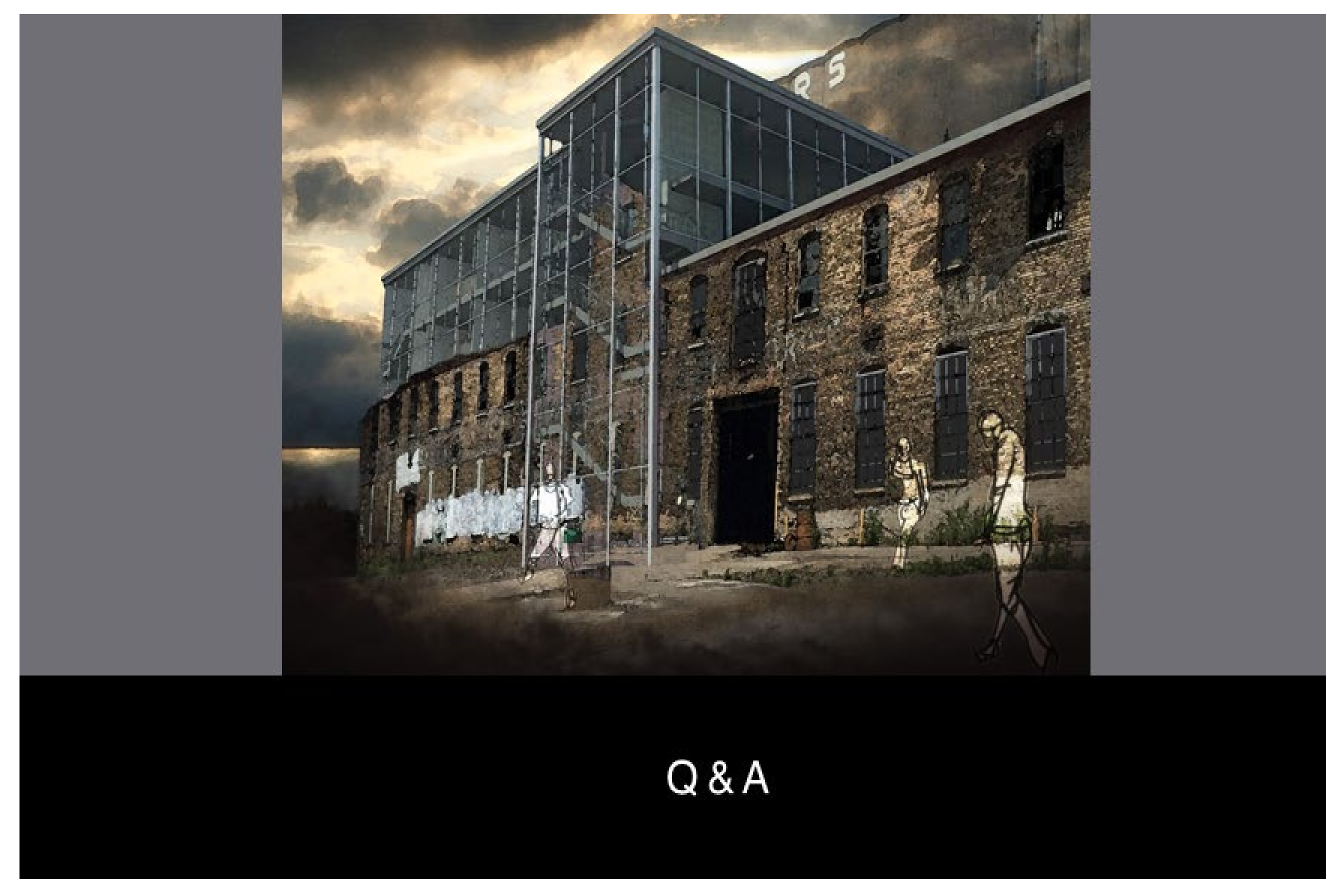
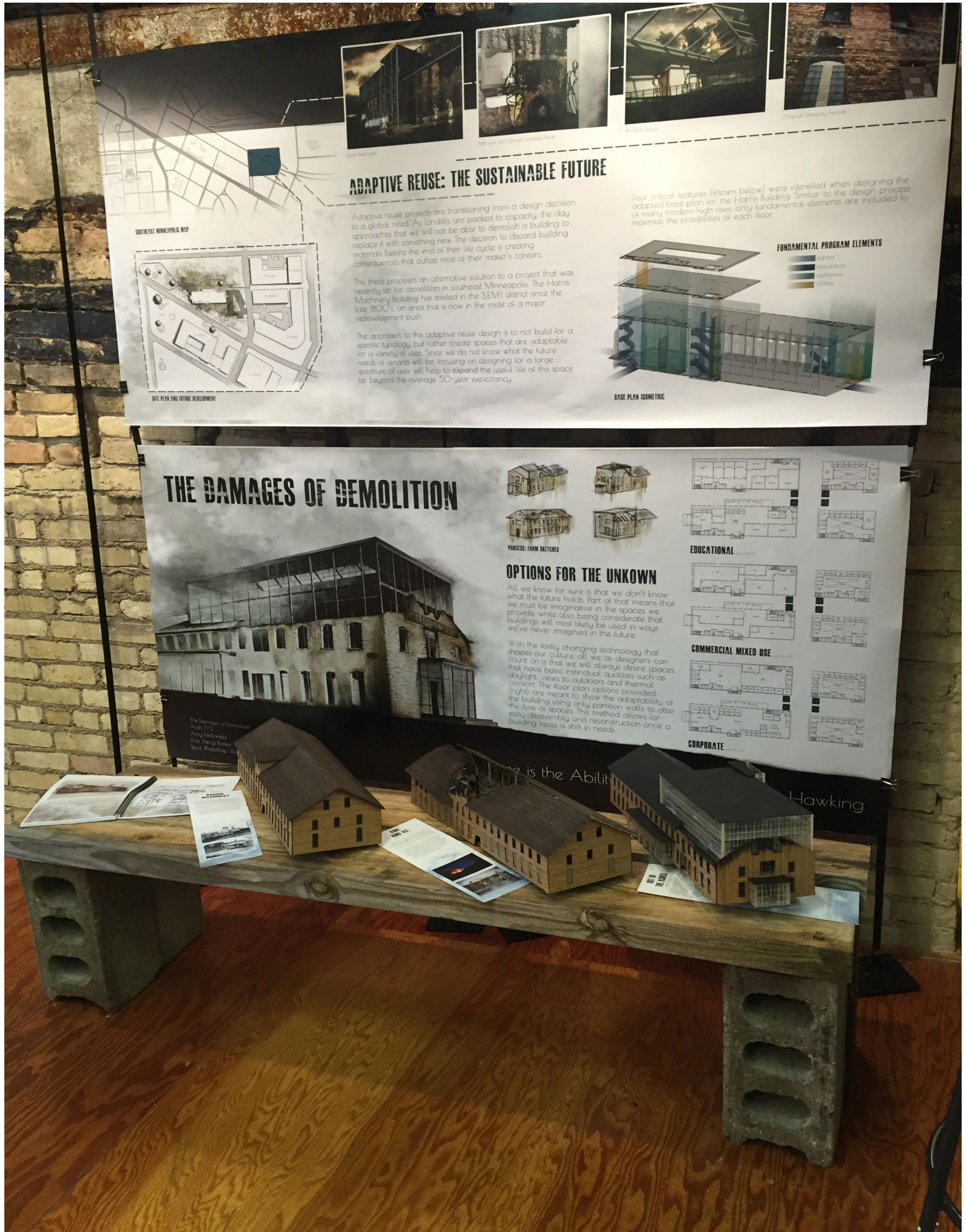
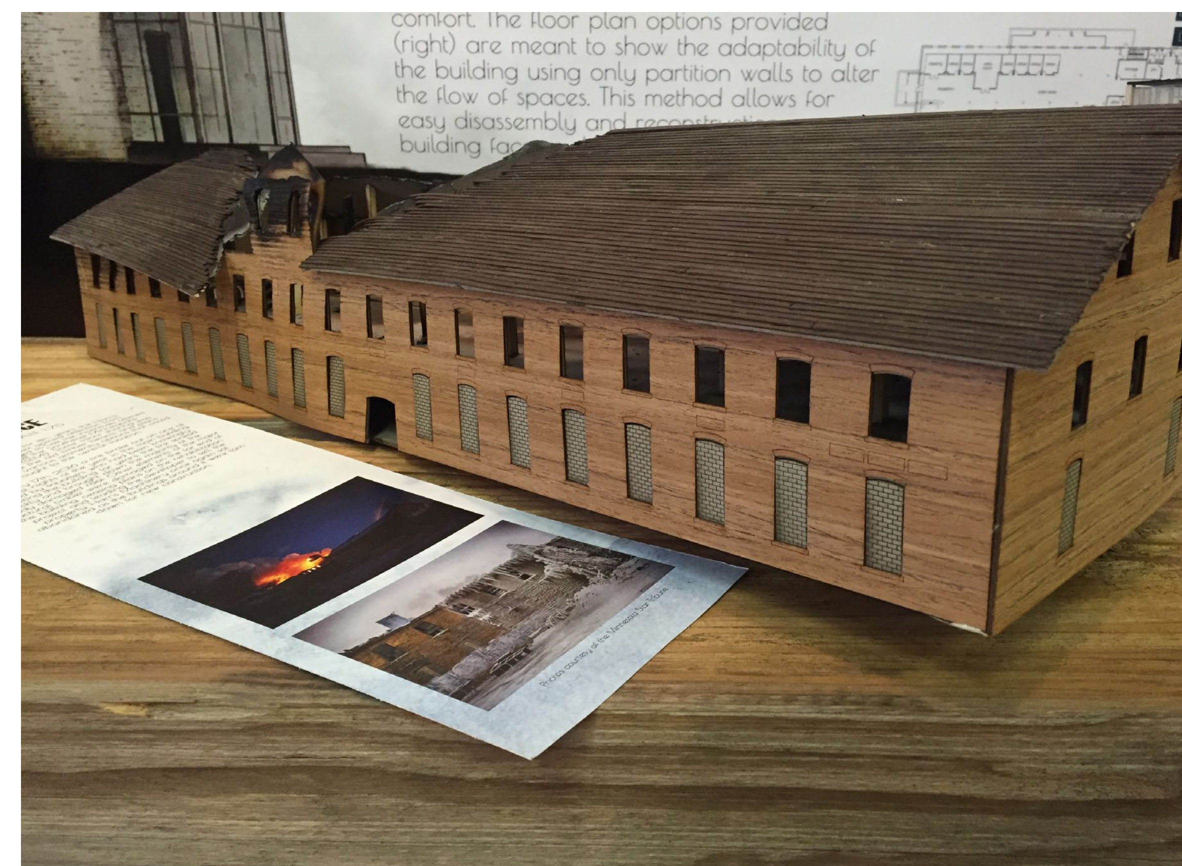

Q & A


ADAPTIVE REUSE: THE SUSTAINABLE FUTURE
FUNDAMENTAL PROGRAM ELEMENTS
THE DAMAGES OF DEMOLITION
OPTIONS FOR THE UNKOWN
EDUCATIONAL
COMMERCIAL MIXED USE
CORPORATE
Hawking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(right) are meant to show the adaptability of
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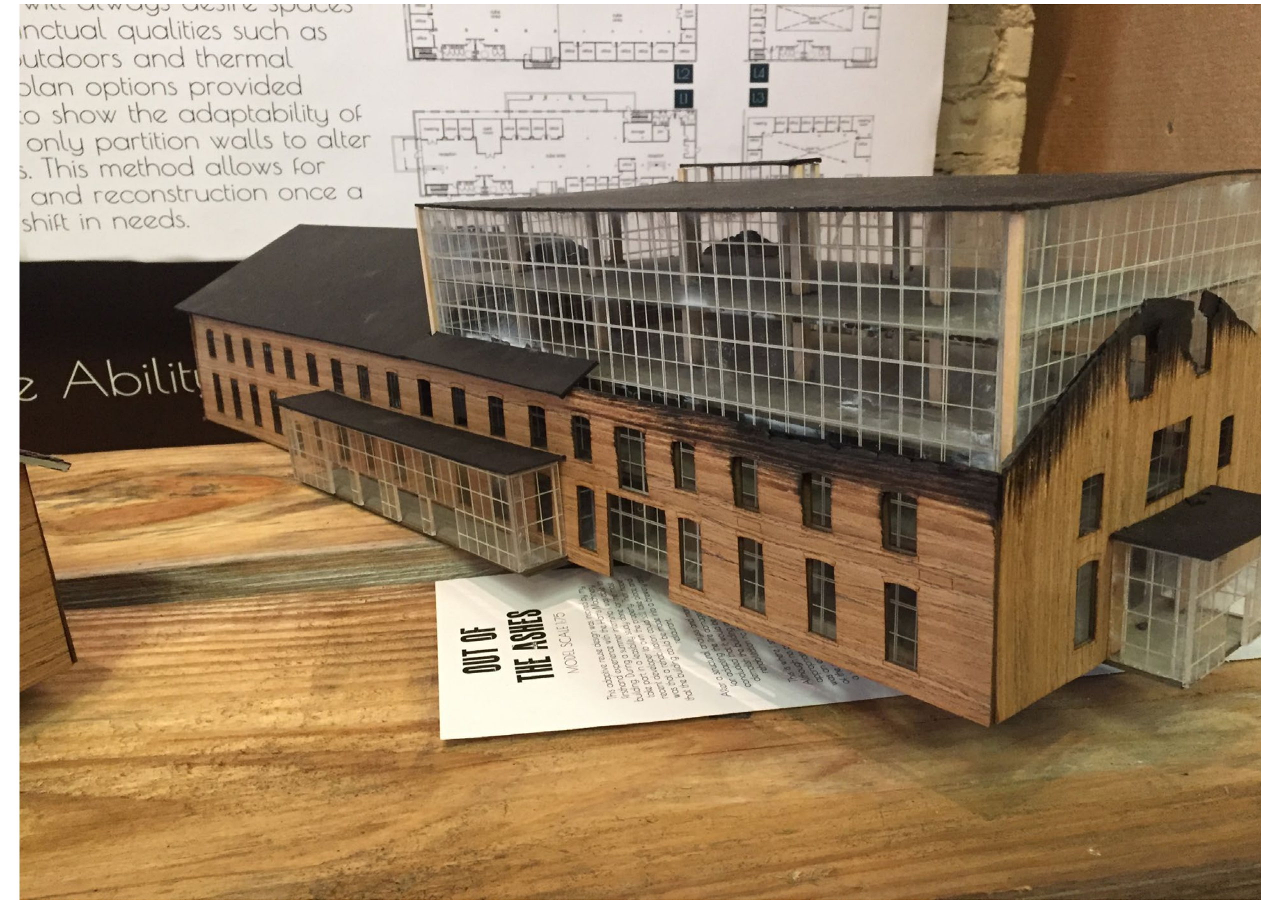
With the lastly changing technology that
'Intelligence is the Ability to Adapt' -Step
HARRIS MACHINERY
EXPLORATION OF FORM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that have basic instinctual qualities such as
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comfort. The floor plan options provided
(right) are meant to show the ad

ANNOTATED BIBLIOGRAPHY

America's Eroding Edges. (2016, July 07). Retrieved October 09, 2016, from http://forum.savingplaces.org/learn/issues/sustainability/climate-change

The Preservation Leadership Forum is a resource provided by the National Trust for Historic Preservation that gives home to important scholarly articles about the most relevant topics in preservation today. Materials include everything from designing for natural disaster to promoting cultural heritage. This forum is used as an example of programs put in place by the United States to educate professionals about best preservation practices.

Athena Sustainable Materials Institute. (1997). Demolition energy analysis of office building structural systems. Ottawa, Canada: Gordon.

This in depth analysis of the embodied energy of demolition is one of the most thorough to date on a relatively unexplored topic. Sample studies based on a generic office building design consisting of wood, steel and concrete structural systems are the test objects. Other elements such as climate and off-site works are also considered within the study, making its results a very good resource for designers. The results produced from the studied demolitions are provided in a clear manor, as well as in graphs that have been utilized within this paper. Conclusions drawn about the effects of recycling vs. reuse of materials shed light on an often overlooked decision in demolition.

Chen, Qingyan. (2011). Life cycle assessment of building materials. Building and environment, 45 (5), p. 1133-1140.

Published as part of an international journal that specializes in understanding the built environment, Life Cycle Assessment speaks on the importance of embodied energy in materials and encourages designers to be aware of their impact. It gives a well-written explanation of the Life Cycle Assessment process described within this paper. This is backed by more recent numbers on the waste management issue that is going on in America, primarily caused by the building industry.

Jansweg, S. (2014). Built environment: Cradle to cradle. Retrieved October 09, 2016 from http://www.c2ccertified.org/drive-change/built-environment

Cradle-to-cradle has been a revolutionary idea since its birth and has spread into many aspects of our culture. Materials and products that surround us on a daily basis are now part of a higher level of thinking about the consumption and discarding of resources. It would be impossible to speak about material life within this project without acknowledging the affect that cradle-to-cradle has had on not only us as designers, but society as a whole.

National Park Service. (1994). Preservation brief 35- understanding old buildings: The process of architectural investigation. Seattle, WA: T. McDonald.

The National Park Service has provided many documents giving technical information to preservationists, and I found Travis McDonald's to be particularly fitting for this topic. He provides a simplified guideline to help professionals begin the process of analyzing a historic building. Tips on dating materials and determining historic features also help guide more novice workers looking to analyze buildings as best possible.

National Trust for Historic Preservation. (2011). The greenest building: Quantifying the environmental value of building reuse. Seattle, WA: Frey, Dunn and Cochran.

This study I felt was a more modern counterpart to Athena's Demolition Energy Analysis. It most closely relates to the work being done within this thesis and gives extensive research on the true maintenance costs of a variety of old buildings. In addition to this, it compares these numbers to the results of similar new buildings, making it the ultimate designer's resource. Results and graphics about the energy performance of historic buildings were used in this paper as a comparative basis for maintenance cost.

Noblis. (2016). Life cycle assessment overview. Retrieved October 09, 2016, from https://sftool.gov/learn/about/400/life-cycle-assessment-lca-overview

Life Cycle Assessment is a very broad topic that can get lost in the details at time. This article does a good job of simplifying the process into manageable and understandable terms that are less overwhelming to the reader. Using Life Cycle Assessment is a great tool when trying to determine the useful life of a material and weigh the consequences of its disposal. Combining this with the cradle-to-cradle ideas is the approach used by this paper to best explain material life.

SNES Consultants. (1991). Solid waste environmental assessment plan. (p.4.15). Proctor

This assessment provides factual information about the wastes created by the American population. Statistics aimed towards the construction and demolition processes were used in this paper to draw attention to the flaws in our current building cycle process.

Tepper, A. (2015, April 16). Historic preservation. Retrieved October 09, 2016, from https://www.wbdg.org/design/historic_pres.php

The Whole Building Design Guide is another great resource for preservationists and was used as an example of a program put in place for assistance. This particular article on historic preservation touches on many other programs that have grown to be commonly accepted as reputable sources for information on historic preservation, such as the Secretary of Interior's Standards for the Treatment of Historic Properties. It also draws attention to the importance of understanding a building's history before any planning phases of the design begin, which is main focus of this thesis project.

Weeks, K. D. (1995). The secretary of interior's standards for the treatment of historic properties. Washington, D.C.: U.S. Department of the Interior.

As mentioned above, the Interior's Standards has become a classic example of preservation ideals in the United States. It's four treatments for historic preservation have changed the way architects and homeowners approach projects. It is a simplified guide that has educated a large audience on the importance of good practices within the historic preservation field. It was included as an example of programs set in place to assist preservationists due to its in-depth descriptions and widely accepted treatment methods.

STUDIO EXPERIENCE

2nd year.	Fall 2013, "Tea House", Joan Vordenbruggen
	Spring 2014, "A Place for Tap", Cindy Urness
3rd year	Fall 2014, "NDSU Library Competition", Bakr Aly Ahmed
	Spring 2015, "SC Johnson Laboratory", Bakr Aly Ahmed
4th year	Fall 2015, "Tower 679", David Crutchfield
	Spring 2016, "Marvin Windows Competition", Paul Gleye
5th year	Fall 2016, "In the Likeness of an Architect", Ronald Ramsey
	Spring 2017, "The Damages of Demolition", Darryl Booker

PERSONAL INFO

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"NDSU has been a place for personal and intellectual growth over the last 5 years. The faculty has provided me with a diversified education that I have confidence will take me far on my career path."