IN THE BLACK:

A STUDY OF FIRE

a university institute for the study of prairie, woodland and forest fires located in western colorado

undergraduate thesis by:
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WILDLAND FIRE RESEARCH INSTITUTE

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

By

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In Partial Fulfillment of the Requirements
for the Degree of
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Thesis Abstract

IN THE BLACK:
WILDLAND FIRE RESEARCH INSTITUTE

The project typology is a university institute for the study of prairie, woodland and forest fires located in Western Colorado. The thesis will examine the need for natural fire and the need to control fire in populated areas. In the black refers to the safety area in an actual fire fighting mission. The burnt area, or the black, is the safest place to be during a fire, as it has already burn and it will not burn again. The term in the black correlates itself to the research institute as a place that studies fire to make the environment and people safe form fire. The project is located by Eldorado Springs, CO. just south of Boulder. The total size for this research institute is 125,000 sf.

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a. theoretical premise research

theoretical premise research summary

For my theoretical premise study, I focused most of my research in three different categories and they were the hard sciences, architectural theory and philosophy. I focused on the hard sciences because my theoretical premise revolves around the study of fire. I think that it is important to know how a fire burns and how fire affects the ecosystem. With the architectural theory portion of my studies, I researched areas that dealt with expression and relationship factors. I felt that it is important to know how or what a building can say about its construction, its type of the forces that are acting upon the building. Understanding that every physical aspect of a building is a symbol or an expression to someone, at some point, I will try to portray certain meanings with my building. The third main category was philosophy, which is the pursuit of knowledge.

In the philosophy category, I selected ethics, determinism and phenomenology, all of which are different from each other. Ethics deal with the idea of proper choice, determinism is the idea that all natural events are already set in place by previous actions and phenomenology is the study of the richness of an experience through the first person. Ethics is an important part in every aspect of a person's life and as designers we need to be conscious of our decisions and how they will affect the environment, the people and the culture. With determinism, all natural actions are already destined because of natural law. This theory applies to the natural aspect of my theoretical premise. Due to previous actions that have occurred, the forests and the natural environments are in the conditions because of those previous actions. In this scenario, people are a free agent, which means that they are not tied to predestined actions; therefore we can positively affect the condition of the natural system by taking action today and rewrite history. The theory of phenomenology states that an experience can be directed, which means as designers we can persuade people to take a certain path so they can be exposed to an experience that we would like for them to experience. The other two premises are psychoanalysis and nature in construction. With the premise research, I was able to read and learn about different aspects that should/can have an impact on my design. These theoretical premises are discussed with more detail in the following pages.

a. theoretical premise research

psychoanalysis

Psychoanalysis is the study of the unconscious psychiatric processes in humans, developed mainly by Sigmund Freud. This theory studies how the unconscious processes differ from the conscious processes and laws. When a person is in the state of unconsciousness, such as sleeping, logical thought and feelings can shift in one's mind. Through this shifting, abstract associations can be developed, therefore objects of the unconscious can take on a meaning that they would not have in conscious, logical thought.

Through Freud's studies he postulated the idea that there are unconscious conflicts that involve impulse and these conflicts originate in child hood. One of Freud's most widely know complex's is the Oedipus complex, which is a child's desire to be with the parent of the opposite sex, while becoming a rival to the parent of the same sex. In correlation with the Oedipus complex, I will talk about the Prometheus complex which is presented in The Psychoanalysis of Fire. This complex, much like the Oedipus complex, starts out as a general prohibition and through maturity of the mind and body; one can deal with this complex. Unlike the Oedipus complex, the Prometheus complex is not associated with sexual desire; rather it is associated with fire. As stated by Bachelard "The Prometheus complex is the Oedipus complex of the life of the intellect." (Bachelard, 12). The Prometheus complex is the impulse, the desire to know more than our fathers and our teachers; the desire to prove that we have attained the intellectual level of our icons.

Bachelard's psychoanalysis of fire reveals that fire is a complex, multi-faceted object carrying many underlying meanings. These connotations include respect, reverie, purity, fire water and most of all sexual desire and fantasies. The following quote emphasizes that idea, "Among all phenomena, it is really the only one to which there can be so definitely attributed the opposing values of good and evil. It shines in Paradise, it burns in Hell. It is gentleness and torture…. It can contradict itself: thus it is one of the principles of universal explanation." (Bachelard, 7).

With a theoretical premise that revolves around the study of fire, I felt that it was important to realize that there are many different aspects to fire than just the flame. By understanding that people have and will have underlying ideas about fire, I will be able to use this to my advantage. Through my design and research, I will try to emphasize the good qualities, the purifying affects of fire, and distance the design from the bad qualities.

a. theoretical premise research

semiotics

Semiotics is an architectural theory that states that all buildings have meaning and these meanings are generated through a system of signs. Signs do not refer to the billboard plastered on the sides of some buildings, but rather the signification of a meaning to a person. In the introductory, I found this quote to be quite interesting "every building creates associations in the mind of the beholder, whether the architect wanted it or not" (Broadbent,125). The theory that a building can hold meanings is a reason for architects to understand and use semiotics in a way to enhance the design of a building. Semiotics is a theory that can be broken down into three categories; pragmatic, syntactic, and semantic.

The pragmatic level of semiotics deals with the origin, the uses and the effects of signs. According to Broadbent, architecture affects multiple senses at the same time, while other sign systems, like words, only engage one sense at a time. Because architecture can affect multiple senses, buildings are constantly sending signals whether to the people occupying the space or to individuals observing the building. The signals that are being transmitted to individuals, are not signals that are concrete, rather they are signals that are translated by the individuals and their past experiences. There are some signals that are translated commonly, such as proper lighting and temperature, that can be used in the building.

Syntax deals with the structure of the sign-systems, the way in which these systems are grouped together. Syntax, in the realm of language, deals with the formulation of sentences by their various parts. From this, there have been architects that have used the idea and tried to create rules for the formation of their architectural spaces. The architects created spaces based on geometry then created complex systems of interlocking these spaces. The idea was to create solids and voids that were geometrically related. The idea of generating architecture based on geometrical law might be irrational, but syntactic can be very successful when studying the configuration of architecture.

The last area to be covered is semantics, which deals with the application of meaning to signs. Broadbent stated that "all buildings carry a meaning in a semantic way" (Broadbent, 138).Semantics can be broken down into two categories, signifier and signified. Signifier is a material representation, like sounds or markings on paper, relating to the signified, which is the object or thing. The first connection between material representation and the signified was arbitrary and abstract, but through use it became the norm. For example a brick, when first created it did not ask to be called a brick; someone said that it should be called a brick and from then on people associated that object as a brick. This is how every building carries a semantic meaning, it holds within an object that has been signified.

With this theory, I understand that all buildings carry meaning in one manner or another. From this, I can try to create "proper" meaning and use semiotics to my advantage.

a. theoretical premise research

phenomenology

I walk carefully over the ice that covers the sidewalk. The previous sentence is a simple example of phenomenology, which is the study of consciousness as experienced through the first person. The use of "I" indicates a first person experience; "walk" describes the activity while "ice that covers the sidewalk" is the expression that indicates the object being experienced.

Phenomenology studies the richness of experiences, including many of the sensory qualities such as sight and hearing during the experience. Phenomenology also studies experience as one incorporates sensory qualities with objects of meaning, relationship to time and with regards to one's self.

As a way to study the richness of an experience, phenomenology utilizes a wide range of awareness including perception, memory, imagination, emotion, desire and action. As every experience evolves, it invokes and utilizes many of these experiential activities.

As humans, we have the great ability to experience both passively, visual, and actively, walking. Because of our ability to experience in different manners, experiences can be intentionally directed towards an object. For example, a person enters a room and on the opposite side of the room there is a sculpture. The placement of the sculpture is a way to direct the experience towards the piece by either looking at it or by walking over to the sculpture.

To gain the full experience of an activity, a person needs to be completed with the activity. While the person is performing, their sensory actions are recording the experience not as a whole but as a continuous piece. So when they are done with the activity, they can reflect and gain the full richness of the experience.

Practice of phenomenology describes, interprets, and analyzes structures of experience in a way that answers to our own experience.

Incorporating phenomenology into the design of the thesis project will be crucial to the success of the project. To design a building that has depth, I must design with the intention of creating an experience by directing people towards an object, using materials that have a meaning associated with them or more than likely a combination of the two. Understanding phenomenology will allow me to design spaces that are more than walls and ceilings; I will be able to create spaces that are rich with experience.

a. theoretical premise research

determinism

In relation to the theoretical premise, I will discuss determinism in terms of the basic idea. As I was reading through the Stanford article, it became clear that there were divergent ideas that did not pertain to my thesis project.

Determinism is the philosophy that every event is unavoidable because of preceding events and conditions combined with the laws of nature. Without tying events to the laws of nature, this philosophy would be more about prediction and fate. Using the laws of nature allows a person to "know" what will happen once an action has occurred. For example, at a very basic level, when a scientist drops a ball, they already know that the ball is going drop due to the laws of nature.

As a philosophy that "determines" what has and will happen, there is a great need for the philosophy to be intertwined with the physical sciences. These sciences; chemistry, physics, biology, etc; establish the basis for what determinism is and studies. The intertwining of the determinism philosophy and sciences allows a person to make the following quote, "Everything can be explained or everything that is, has a sufficient reason for being and being as it is." (Hoofer, 2). This quote reiterates the idea that actions, of the physical manner, can be and already been determined with the assistance of the laws of nature.

Because the way things have happened in the past, all future events are already destined to occur, is a strong statement. While reading through the article the question was raised, and discussed, dealing with the idea of determinism in regards to the human free agency. According to the principle of determinism, our actions should already be determined by actions that took place thousands of years ago. Through the idea of compatibilists (Hoofer, 16), it has been determined that there is a co-existence between physical determinism and freedom of humans. We, as humans, have the ability to make decisions that affect our lives, we are not predestined to make decisions or do actions. With this explanation, I came to the conclusion that idea of determinism is more focused on the physical laws because they can be equated and consistent unlike humans who have the ability to make their own decisions.

Determinism, in a conceptual manner, alludes to the idea that what is going to happen has already been determined by actions that have already been set in place. As the philosophy stated, the present is already determined by previous actions, so one must work to create the future. In regards to the thesis, sustainable principals need to be designed for the future and implemented in the present.

a. theoretical premise research

tectonics

Tectonics is the expression of the forces, structure and construction of a built object. The word is derived from the Greek word techne, which is an intended human action with a planned goal. Tectonics is the idea that we, as designers, need to think about the composition of the built entity. This idea is expressed by Eduard F. Sekler in the following quote about tectonics "When a structural concept has found its implantation through construction, the visual result will affect us through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building, yet cannot be described in terms of construction and structure alone. For these qualities, which are expressive of a relation of form to force, the term tectonic should be reserved." As this quote demonstrates, tectonics is the culmination of the entire design. It is visible in the materials and how these materials are connected and the manifestation of the structure through construction. Tectonics brings a building together, it is the thread that unifies the project.

The theory of tectonics can be broken down into three categories when being associated with the construction component. The first, tectonics is manifested by the nature and the properties of the construction material. For example, the use of steel for construction will have different physical and structural attributes than wood construction. This is the idea that material selection will have an impact on the expressive qualities of the project because materials like steel and wood, through their properties, have different expressive qualities associated with them. Second will be how these materials are joined during the construction process. Using different joining processes will have an impact on how the building will read after completion. Depending on the connection method, the building may seem light or it may seem heavy. The third is the visual completeness or satisfaction of the building. Once a building is completed, the completeness and coordination of the first two categories will be evident in the final composition. If a designer has an understanding of tectonics and used this principle in their design, the building should read as a whole and be visually satisfying to the eye.

Tectonics is an undeniable component of architecture, and it needs to be fully addressed in the design of the building. During the design of my thesis project, I will need to make sure that I am considering the tectonics of the building. I need to consider the expressive quality that I am trying to illustrate through my design. Tectonics needs to be relevant in the details to provide the building with a quality of completeness. Understanding tectonics, along with the other theory studies, will provide the design with depth and meaning, the project should be a multi-faceted and meaningful.

a. theoretical premise research

typology

Typology is the basis which our thesis revolves around. Through our case studies, typological research, we have been asked to understand what our typology means in a physical manifestation. We have been asked to formulate ideas based on the common aspects of the case study research. Studying the theory of typology will shed more light on what typology is and its relevance to the thesis. I will first look at how Argan explains typology and how it was created. Following the historical look, I will look at the modern interpretation of typology by Argan.

Typology is the idea that buildings of similar function are linked together through a series of similar characteristics such as shape, materials and orientation. The creation of typology has been dependent upon a series of buildings that have had similar formal and functional similarities. From these similar buildings, there is a process in which similarities are pulled from each example and the root form is then created. After these root forms are created, future buildings have a "standard" idea of what is anticipated of them during design and construction. For example, churches have traditionally been seen as buildings that are created of stone, have steeples and created with a sense of grandeur.

The idea of typology has been redirected by this article. Argan uses the following quote in regards to typology "type cannot directly affect the design of buildings or their formal quality" (Argan,243). This quote seems to dismiss the idea of typology in the modern world, but from reading the article, it seems as though Argan is saying that typology may not be the influence that it once was. Later in the article he states that "typologies will always fall into three main categories: the first concerned with a complete configuration of buildings, the second with major structural elements and the third with decorative elements." (Argan,244). The architectural theory of typology has undergone a transformation in the past decades. Typology was once the norm from which a building was derived from and compared to after its completion. Now, typology seems to be an iconic name that is attached to a building, a reference for what a building might include, not what a building should be.

Typology, as a study and application to the thesis process will be vital in understanding the nuances of my building type. As this article illustrates, the philosophy of typology is changing in the modern world and may not be relied heavily upon for material types and shapes of buildings like it once was. Even though typology may be on the verge of being relegated to just a classification system in modern design, a person still can use the idea to better understand their building type.

a. theoretical premise research

architecture, nature and the constructed site

While perusing through an architectural theory book, I came across the theory of architecture, nature and the constructed site. This theory was a small section in this rather large book, but I found it rather interesting and read an article by Tadao Ando, Toward New Horizons in Architecture. Ando believes that architecture is supported and enhanced by meditative thought, a process that reveals the depth and complexity of the world. Ando believes that architects need to move past modernism and into design that utilizes history, taste and ornamentation. He believes that the mechanical and lethargic creations need to be replaced with abstract liveliness, a thought provoking architecture. There are four areas that Ando discuss; transparent logic, abstraction, nature and place.

Transparent logic is the contemplation of the origin of the project and determine the spirit of the design. Designers need to determine what is important about a project and enhance that special character. By delving into the project, the project will expose nuances and design opportunities that will create a unique design.

Secondly, Tadao talks about the use of abstraction in a design. He feels that one must have an idea that can be abstracted and applied through out the building. By doing this, you catch the essential qualities of the idea while creating a building that has depth and meaning.

Nature is a greatly appreciated and used component of eastern architecture. Nature is composed of the four elements; water, wind, light and sky, and Ando believes these elements are important to incorporate into the design. There is an intimate relation between people and nature that needs to be present in the designs and this relation can be expressed by de-emphasizing the boundaries of man and nature. One should allow people to intermingle with nature, not create a barrier as to torture the people by showing them nature but keeping them from it. Unfortunately, much of western civilization is not in a position to blur the lines of nature and built forms in their designs. Ando believes to overcome this obstacle, designers need abstract the elements. Designers need to create a space that has the essence of wind or sky and metaphorically use this essence throughout the structure.

The last idea is place. Ando says that every time a building is constructed, there is a new landscape that has been created. The original landform desires for a built feature that understands the essence of the site. A designer must understand the site and utilize it as much as possible so the building may become a part of the new landscape, not an object placed on a site.

As Tadao Ando has pointed out, the creation of a good project depends on the use of the natural elements and their integration into the project. To create depth in a project, one should really study the project and determine its intricacies to use throughout the entire project.

a. theoretical premise research

design, ecology, ethics and the making of things

This article, by William McDonough, discusses the changes of design over the past years and what he believes needs to be changed in the profession of design. I used this article as a research tool because of the ecology and design principals that are interlaced through the discussion. As I was reading through this article, I determined that there three areas of ecology and design that would be useful for the study of my theoretical premise.

Through our years of education we have been exposed to the idea of sustainable design but not necessarily the idea of natural design. There are three traits that can be learned from natural design. The first would be the fact that everything we need to work with is already naturally occurring like rocks and wood. The second idea is that all the energy needed to run nature comes form the solar system, which does not reserve or borrow energy. Thirdly, biodiversity, the system that creates balances to prevent catastrophe. To apply these three ideas to design, McDonough believes that waste should be turned into to product for future use and re-use. He believes if objects are consumable, once they are used they should be used as consumable's for other organisms. To help eliminate waste, McDonough believes that durable products like cars or TVs should be returned to the manufacturer once the product has been fully utilized. Once the objects have been returned to the manufacturer, the durable products can be disassembled and used in future products.

The second area to be studied is the idea that architects, past and present, work with two elements, mass and membrane. With proper understanding of mass and membrane, designers from the past were able to apply these elements in a beneficial manner, such as creating the adobe wall and the fabric for the Bedouin tent. The final idea is thinking about the future. McDonough gave examples of what he has done in his design work that has promoted a forward thinking approach. In one of his designs he incorporated multiple materials that were recycled or used from previous projects. The same design, he calculated the energy requirements to build and run this building and then had the owner plant 6,400 acres of forest as a way to offset the changes to the climate.

I believe that there are many valuable theories that can be taken from this article. I think that I will incorporate the ideas of nature design. For my design I will try to use materials that can be re-used in the future or be returned to the earth, like wood products. Through my case studies and this article, I will need to focus on properly using mass and membrane through my building. The idea would be to create a structure that would not rely on mechanical subsidiaries for energy needs.

a. theoretical premise research

ecology

Ecology is the study of the relationships of plants and animals to their physical and biological environment. With my thesis, I feel that it is important to know and understand what fire does and does not do to the biological environment that it sweeps through.

Across the United States, United States Geological Survey (USGS) scientists have been studying the affects of fire, or the lack of fire, on the ecology of the forests. Through their research, scientists have discovered historically that fires usually occur on a 3-8 year cycle. Since the turn of the 20th century or so, the fire suppression principles have greatly altered the fire cycle as some forests have not seen a fire in 100 to 130 years. This is a great concern for the scientists because fire was a natural part of the forest prior to the enactment of the suppression principles. Without the typical fire cycle, forest floors are becoming littered with foreign shade tolerant plants and fire fuel. The liter on the forest floor is posing a great threat of wiping out an entire forest, with the thick underbrush present, new trees are not able to get started and the thick underbrush is a ladder fuel that might carry a fire to the tree canopy, killing the mature trees.

With the regular fire cycles, the fuel loads are reduced and the floors are cleared for new trees to start growing. Not only do regular fires keep have the forest floor clean, they also replenish the soil with nutrients. Currently scientists are working on methods of reintroducing a regular fire cycle for many of the forests in the United States. Since some of these forests have not seen a fire in a substantial amount of time, it will be difficult for fires to be introduced without causing a catastrophic fire. To add to the problem, there are many houses and communities that have sporadically sprung up in on the edge forests, making it hard for scientists to protect the personal property and manage the smoke from the fires.

Up to this point I have focused mainly on the plant aspect of ecology, but animals too are affected by the fire. Animals are capable of dealing with wild land fire; generally they are able to escape the wrath of the fire. Not having fire is a greater issue for the animals.
The animals are accustomed to certain food sources, and without fire new species of plants grow and change the plant framework of the forest. The animals rely on the original ecological habitat and without it; the animal species may become endangered or extinct.

Understanding the affect fire has on ecology, one can make decisions in regards to fire management. As demonstrated, fire is a beneficial component to the health and welfare of the forests. Using this information for my thesis, I am better equipped to make proper decisions about forest sustainability and the prevention of catastrophic fire.

a. theoretical premise research

chemistry

Chemistry in a broad overview is the study of the composition, structure, properties and interactions between matter. Chemistry is the perfect tool to understand fire, the basis for my thesis, and the intricate elemental interactions that occur.

The chemistry of fire is more specific than general chemistry. Fire is a rapid chemical change between fuel and oxygen. Form this rapid change, combustion occurs. To create combustion, there needs to be three elements present, oxygen, fuel and heat/ignition, without any of these elements combustion will not occur. Fuels, in a wild fire, are typically solids such as wood, leaves and brush. Oxygen for the fire is present in the surrounding air, which is about 21% oxygen and most fires only need 16% to burn. The most common ignition source for a wild land fire is lightning, but nine out of ten fires are started by people, directly or indirectly(Hall,3). During the process of combustion light, heat and gases are produced. Once combustion occurs, a chemical chain reaction takes place which allows this reaction to be self fueling. Once the chain reaction occurs and flames are present, the fire will be able to sustain itself by preheating the fuel around it and then expand to that fuel.

There are different aspects that affect the rate in which a fire burns. The largest condition that affects the rate of burn is the fuel which depends on the density, water content, shape and size of the fuels. Heavier fuels, like trees, take longer to preheat and burn, but once they lighted they burn for a long time, unlike the light fuels, leaves, which light easily and burn quickly.

Weather also has an affect on the chemistry of a fire in a wild land setting. Elements such as wind, sunlight and high temperatures help promote the growth of a fire. Wind can add oxygen to the fire, allowing it burn hotter; while sunlight and high temperatures help preheat the fuels making it easier for the chemical reaction of fire to occur. Although temperature can help a fire it can also hinder a fire. When the temperature drops, the chemical reaction of fire has to do more preheating on its own and slows down the growth of the fire; also when the temperature drops, humidity increases which further slows down the growth of a fire. Besides weather, terrain can and will have an affect on fire and the chemical reactions associated with fire.

Chemistry is one the base sciences for understanding fire. It is important to have a basic, general understanding of how fire interacts with the elements of a forest, wooded area and the prairie; as a way to direct what the thesis process might be and help generate a conclusion.

b. typological research

b. typological research

case study series and typological summary

Coming into the case study series I did not know how a wild fire research facility functioned. Knowing that there are very few wild fire research centers, I directed my investigation towards research facilities that studied the natural elements. I wanted to use these types of centers as a way to guide my program, as they should have similar functioning spaces with a wild fire research center. While doing my studies, I looked outside the United States at two case studies. Using these two case studies, I was able to see other countries design philosophies and research ideas when it came to the natural environment. I also included a museum in my research because it dealt with the natural environment in its exhibits and it also had a well designed site. During the course of the studies, my theoretical premise wasn't affected; rather my understanding of the premise became greater.

With my research common characteristics started to become evident. Many of my case studies had been designed and influenced by the sites on which they sat. The buildings seemed to be at peace with their sites, they used the contours, vegetation and other existing conditions to create a harmonious balance, rather than sitting precariously on a hill or a flat piece of land. To my surprise, many of the research facilities had places for public interaction, exhibition spaces or auditorium spaces for presentations. Prior to my research, I was unaware that so many of these facilities had places to teach and interact with the community. When studying the spatial configurations of these institutes, it became clear that there was a conscious effort to separate the research component from the researchers' offices. It seemed as though the architects wanted to create separation between the two functions to allow relaxation when away from the laboratories. Almost every research facility had laboratories that were climatically controlled. The amount of these controlled laboratories varied based on the research taking place, some facilities were all controlled where are others only had a few spaces. As a functional characteristic, many of the facilities were compact, this allowed for easy movement from one space to another.

Along with common characteristics came the uncommon characteristics. To my surprise there was a wide range materials used in each of these buildings. Some structures were almost completely built out of concrete while other buildings were predominately glass, and there was a varying range in between these two extremes. Along with the material usage, natural light usage also varied greatly with the case studies. This is partly due to the research that is being performed, but in the spaces where light could be allowed there was great fluctuation among the buildings. I believe that the underlying conceptual ideas were evident in most of the facilities. From what I could see, most of

the buildings had a single concept that carried through the entire building, from the formation of the spaces inside and out to the materials used.

I believe that all the buildings used the site to its advantage when it came to site orientation and placement on the site. Surprisingly though, the climate didn't affect the buildings as much as I thought it might. The NCAR building and Greenland's nature institute are good examples of this. I.M. Pei's building was designed to keep the harsh winter winds out by being a thick, heavy construction, while the nature institute had substantially more glass in a climate that colder and harsher than the one in Colorado. From the case studies, it appears that culture did have an affect on the buildings. The two case studies from outside the United States were more focused on sustainable approaches and designs than the case studies with the borders. I think this shows that many of the other countries emphasize green design in the work, while in the United States there are projects that utilize green design; the strong emphasis is not present.

As mentioned before, many of the buildings functions were very similar to each other. For the most part, many of the buildings had research facilities, offices for the researchers, places for the community involvement and spaces for literature such as libraries. The spatial relationships of these buildings seemed to be very similar to each other as well. There was the common idea to separate the offices from the research labs, mainly to allow the researchers to separate themselves from the rigors of laboratory work. With community interaction common in most of the buildings, separate paths of the community and the researchers were important. By creating "zones" for each group, the community never impeded the work of the researchers and the scientists never interfered with the communities desire to learn and interact in these spaces.

Analyzing these case studies over the last few weeks has shed some light on the research facility. I was able to understand some of the relationship patterns that take place, also I was able to the diversity of design that these facilities have. I could see the common and uncommon characteristics of these buildings and from them I will be better decipher what will and wont work with my design intentions.

b. typological research

iowa laser laboratory

introduction:

The building complex is composed of five visually and structurally independent spaces. The complex is located on the University of Iowa campus in Iowa City, Iowa. The five buildings encompasses a total of 136,000 s.f. with a building cost of $129 s.f. and a total cost of $17.5 million dollars. Like many of the designs by Frank Gehry, the complex has a crystal configuration to the office component while the research portion of the complex is reserved and tranquil. Interior spaces include large atrium spaces

iowa city, iowa

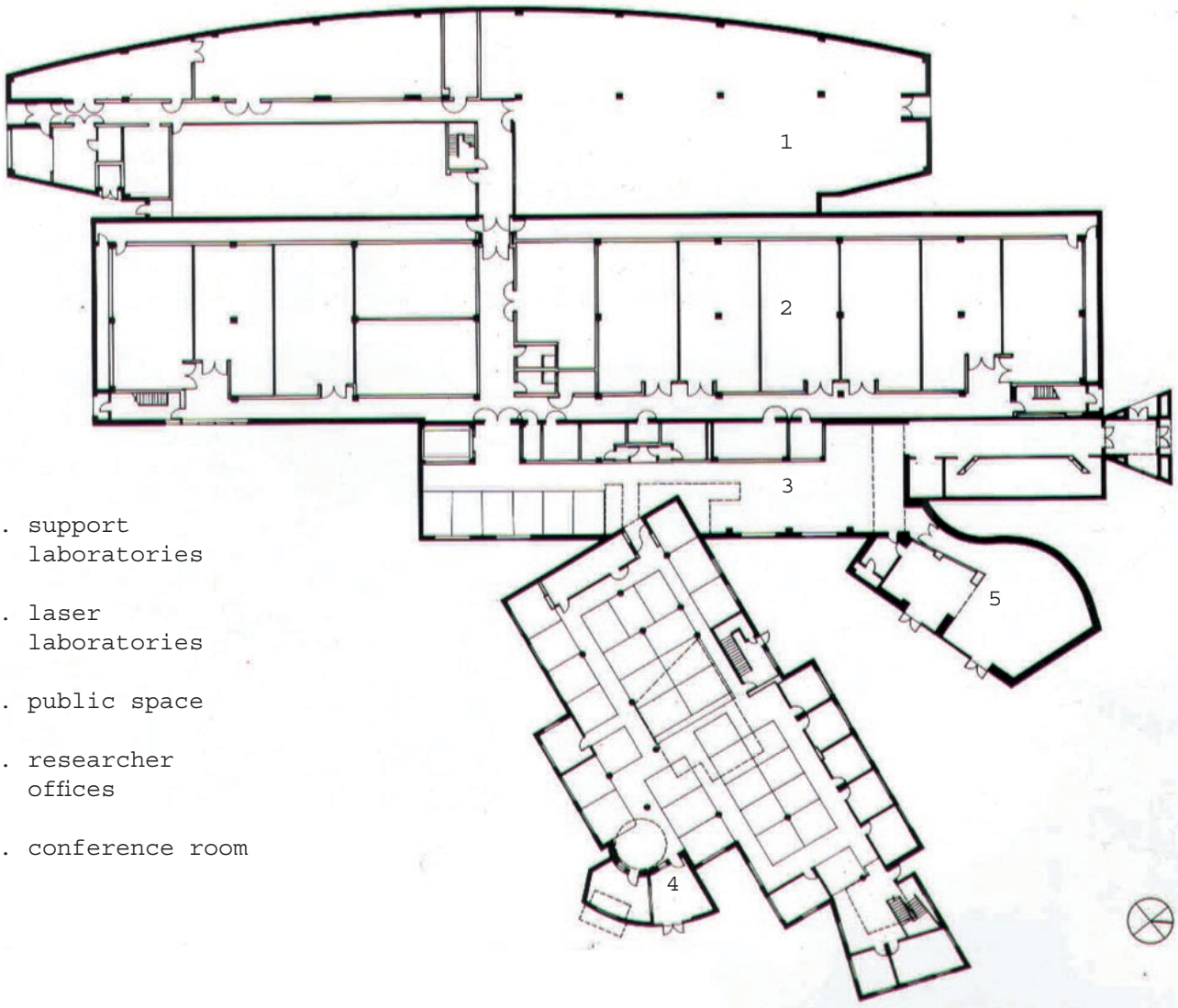
frank o. gehry & partners

1992

136,000 sf

$17,500,000

cost: $129 sf



1. support laboratories
2. laser laboratories
3. public space
4. researcher offices
5. conference room

derived from the crystal like exterior.

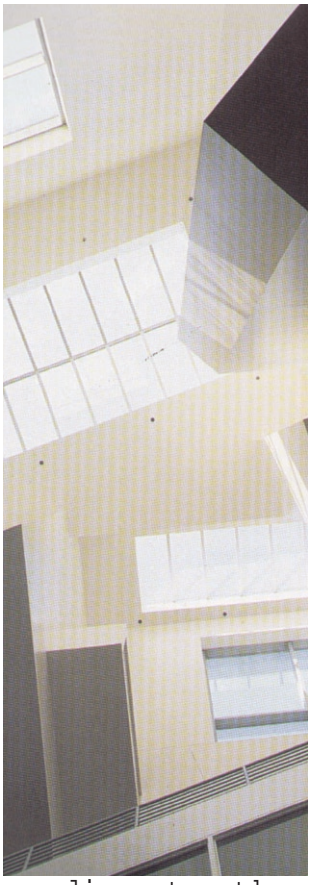
The program is expressed through the five independent spaces. The program includes primary research labs, support labs and mechanical spaces, public sector, office spaces for the scientists and a conference room.

research findings:

Research lab areas are highly controlled with no exterior windows in the research areas. Offices for the scientists are separated from the research area as a place to retreat and reflect. The building complex has a public component for display and education. The building takes advantage of views from the site to the adjacent river.

Spatial configuration of the building is unique when compared to the other buildings. The footprint of the building is spread out reducing efficiency and minimizing scientist interaction. Exterior material selection for the five buildings are not drawn from existing materials or site conditions.

The five building complex does not



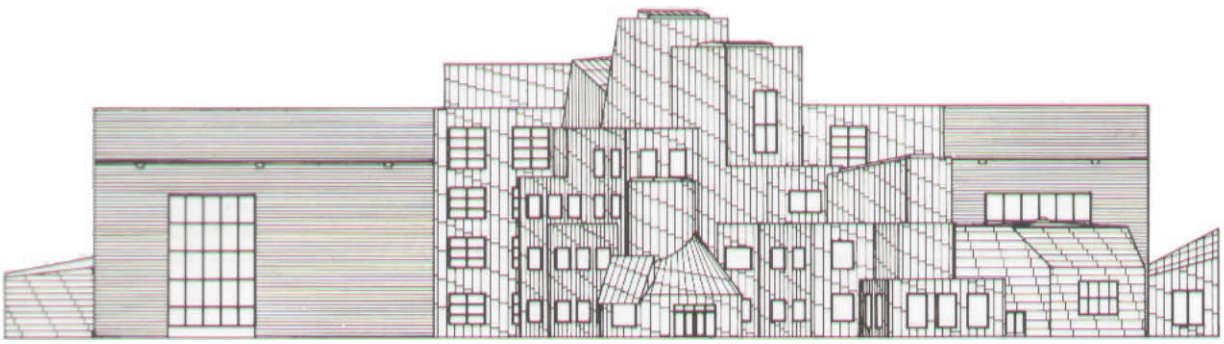
appear to be designed with the intent of green architecture. Materials that are used and opening configurations do not appear to be utilizing natural energy resources.

analysis:

The Frank Gehry building illustrates the expression of individuality of spaces. The five building complex was designed according to the specific need for that individual space, ranging from the structure to the exterior treatment.

conclusion:

This research building by Frank Gehry demonstrated the necessity for highly controlled research spaces. This is relevant throughout the treatment of the exterior facade, no windows in the research portion of this building.



b. typological research

national center for atmospheric research

introduction:

boulder, co

pei cobb freed & partners

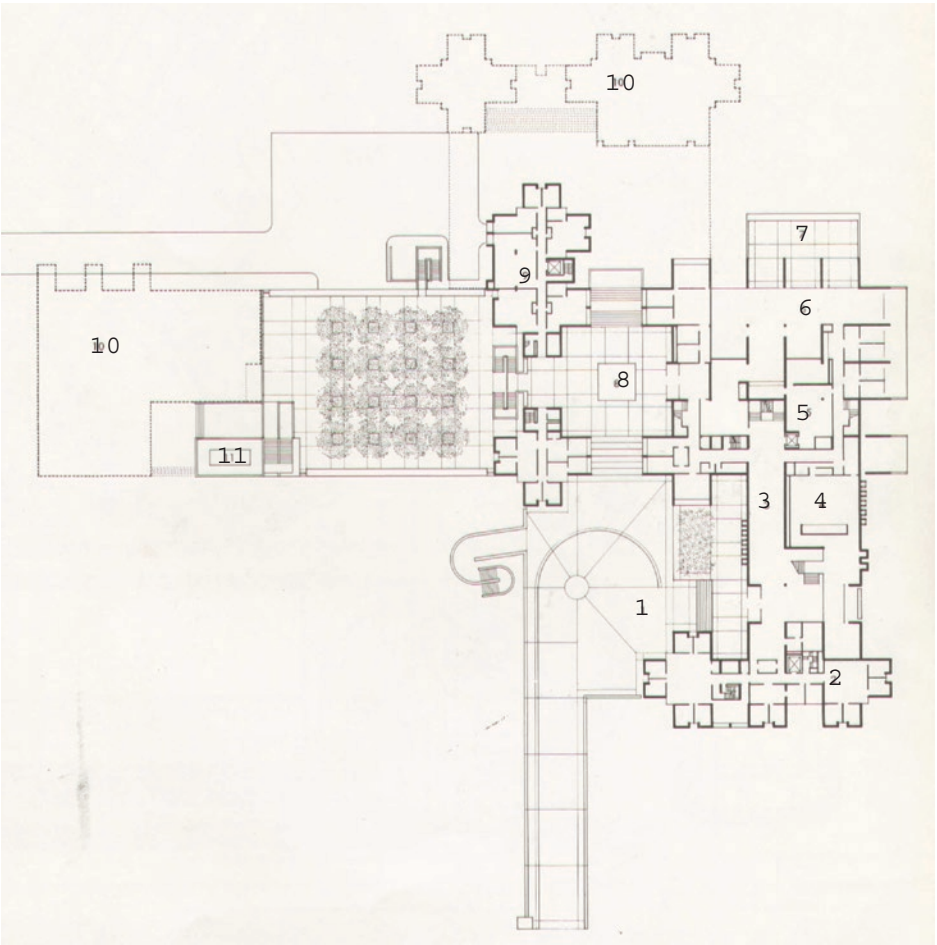
1967

243,000 sf

NCAR is a research institute dedicated to the study of atmospheric forces through out the United States and the world. The research center is set on a bluff adjacent to the Flat Iron Mountain Range near Boulder, Colorado. At 243,000 gross sf, the NCAR is a large research center allowing for extensive research into multiple areas, the spaces are broken down as follows:

214,000 sf indoor space

- 193,140 sf original building
- 69,000 sf office/labs on seven levels
- 10,000 sf library
- 6,000 sf exhibition lobby
- 5,000 sf major lobbies (3)
- 6,000 sf computer room
- 1,700 sf commons/conference
- 8,000 sf dining
- 5,000 sf storage
- 20,000 sf lab/ computer addition
- 1,300 sf outdoor dining



1. main entry
2. offices
3. lobby
4. meeting room
5. kitchen
6. dining room
7. terrace
8. pool
9. laboratories
10. future laboratories
11. cooling tower

b. typological research

national center for atmospheric research

One of the distinguishing characters of the building is the exterior, which is constructed with the use of simple vertical shapes to unify the building with the site instead of fighting for presence. On the interior, the spatial configuration for the scientists' offices and work spaces are unique in regards to movement and proximity. The spatial configuration is described as the principle of indeterminacy by Werner Heisenberg,

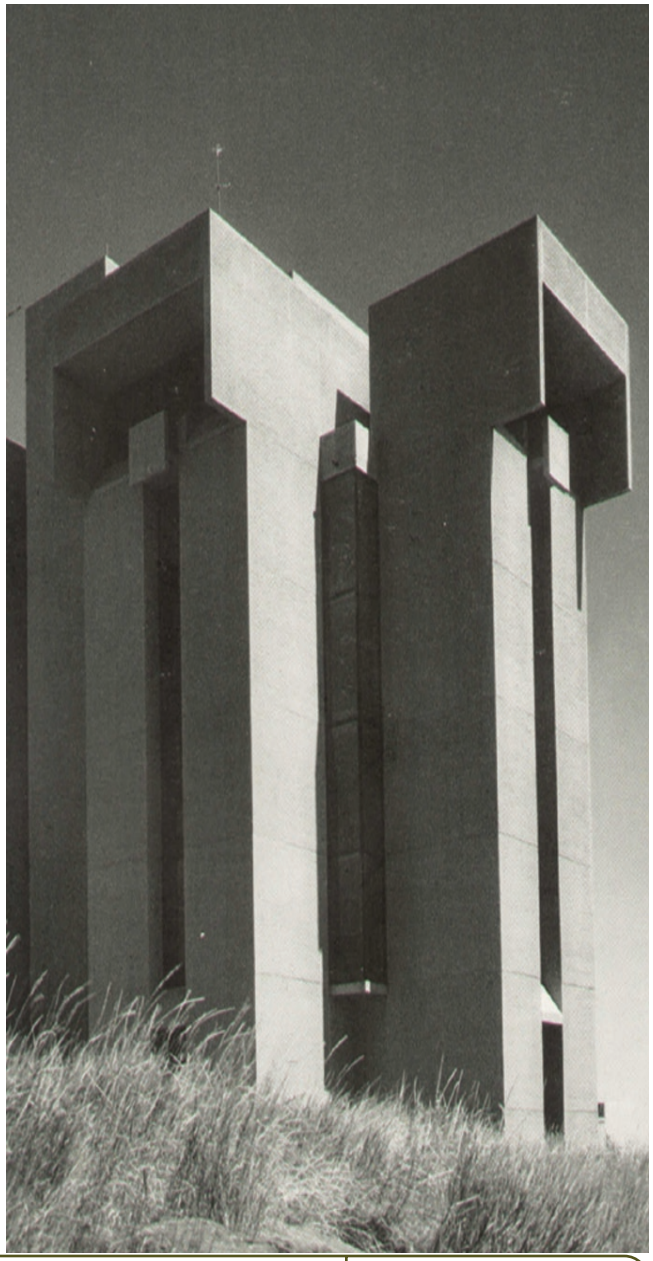
"The ways we go about observing or measuring the behavior of natural forces actually influence the ways in which those forces reveal properties and characteristics to us."[Marlin, 2].

Walking from the parking lot to the building, people are required to interact with the building and the site. As you walk along the path, the building opens up and frames views for the individual then the path takes you to the next framed view as a way to create excitement about the building and the context.

research findings:

This case study, along with the majority of the others, has created research spaces that are close knit with minimal light in the research areas. The offices are clustered together, yet separated from the labs, to create scientist communities that are compact and efficient for further thought and interaction among each other. To promote the research being conducted within the walls of the facility, NCAR has a large community component that is integrated into the building and site functions. Material usage and site integration was a major design endeavor that many of the case studies executed very well.

Unlike many of the other case studies, this building uses very little glass, 10%, throughout the entire building. When glass is



used, or any opening for that matter, it frames a specific view that is important to the nature of the experiments and understanding of natural forces.

NCAR respects and responds well to the site as the building uses concrete to protect itself from the harsh winter elements as well as to ground the building into the surroundings. The building becomes more than a structure on a hill, it in itself becomes a rock outcropping that relates to the massive scale and coloring of the near by mountains. The building also respects that the site was used by animals and humans, prior to its construction, by incorporating walking trails that meander through the site lead you into the mountains in the background. By having a large community component of more than just a room, the building becomes a cultural center for the members of the community. From first hand experience, the site becomes an interactive display for children to experience the wonders of nature through the research demonstrations and activities held on site.

Through the material that I have read and viewed, I believe that I.M. Pei was trying to create a new way of conducting research. Pei wanted the individual scientists to become lost in their studies, while being able to communicate easily with fellow scientists as way to enrich the studies being conducted at the building.

b. typological research

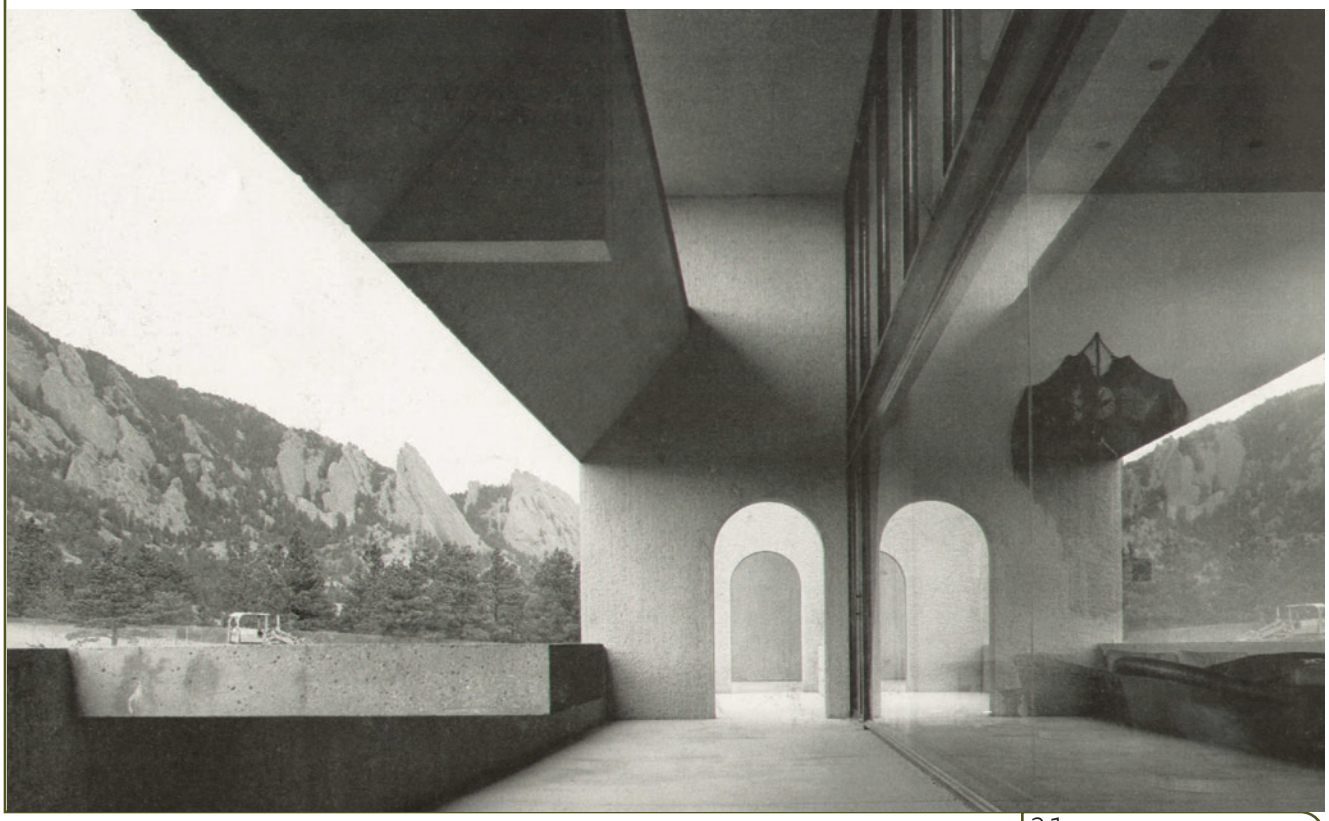
national center for atmospheric research

analysis:

Through the proper use of site and materials, any site scale issues can be dealt with from the massive mountain scale to the personal entry sequences of the building. The NCAR illustrates that a research center can be more than just a place for scientific studies, it can be a place that is inviting and interactive for the public. The research functions as a public space and a scientific endeavor without the two ever interrupting each other.

conclusion:

This building showed that a research facility can also have public interaction without hindering the research. This building shares many of the same climatic conditions as my site.



b. typological research

salk institute

introduction:

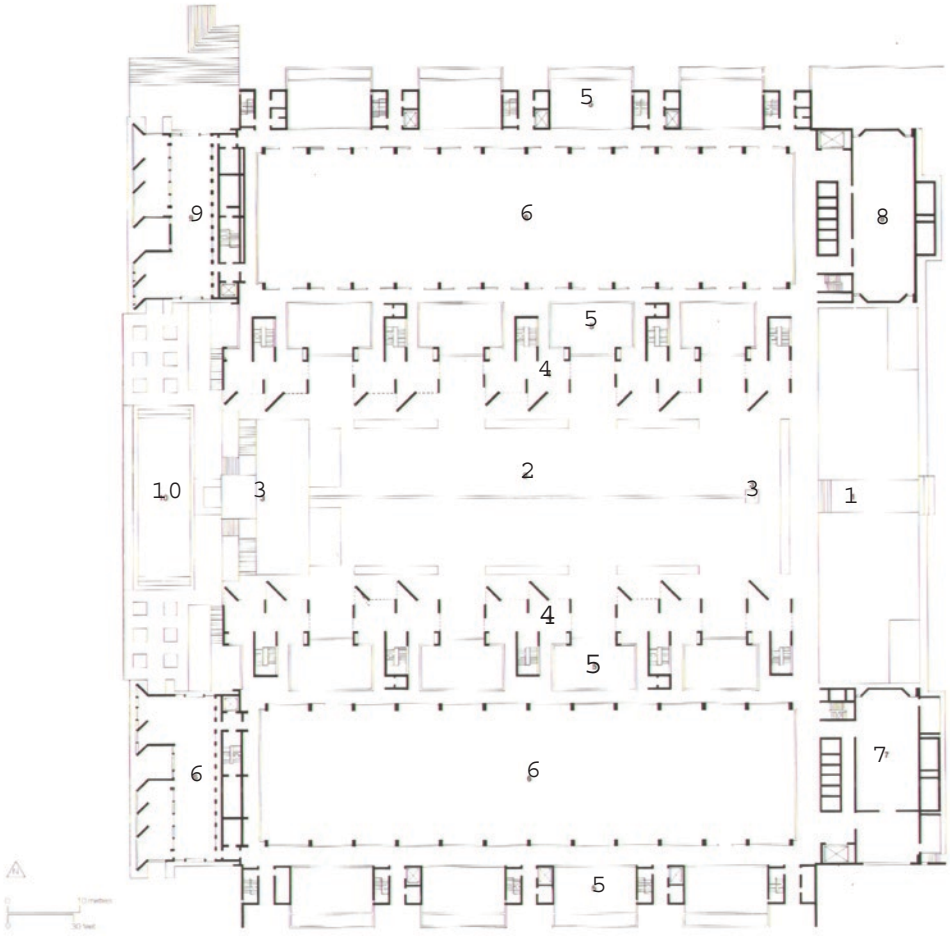
la jolla , ca

louis kahn

1965

411,580 sf

The Salk Institute, a biological research center. The complex is comprised of two six story tall mirrored laboratories. Each laboratory has a footprint of 60’-0” by 245’-0”; in between the laboratories is the 90’-0” by 270’-0” travertine courtyard space. In total, with all the auxiliary spaces, the Salk Institute is a massive 411,580 sf. The research complex is perched on a ledge above the pacific ocean, creating astounding views towards the ocean and back towards the distant hillside. There are a couple of unique aspects associated with this research complex; the first would be the individual spaces



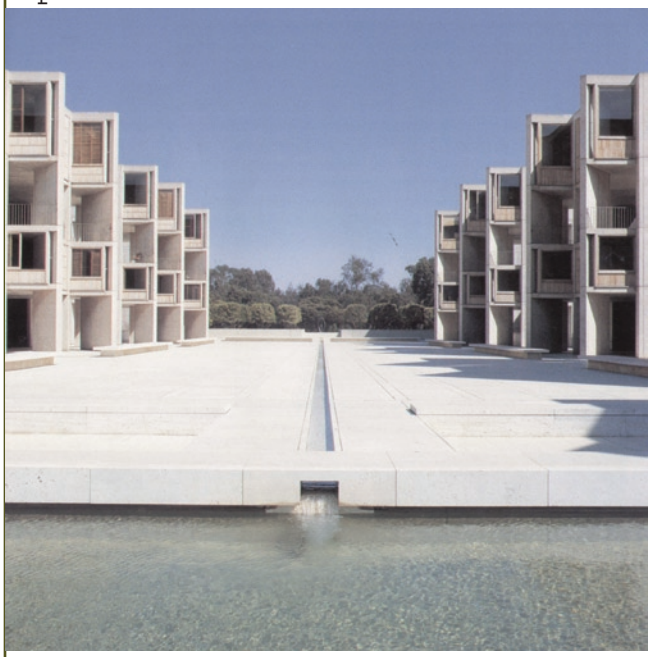
1 entry
2 central court
3 fountain
4 portico of studies
5 light well
6 laboratory
7 mechanical
8 photo lab
9 library
10 terrace

salk institute

for each researcher, all of which have views towards the ocean. Unlike most buildings, the habitat able floors alternate with mechanical floors allowing for greater flexibility in the future for the habitat able spaces. Major programmable elements are laboratory spaces, offices, portico of studies, a library, courtyard, and mechanical spaces.

research findings:

Among the case studies, a major emphasis has been placed on individual studies for scientists to use as an escape from the laboratory research. Like the other case studies, Salk Institute does a wonderful job of creating a separation from the research areas with the use of individual study spaces that overlook the Pacific Ocean.

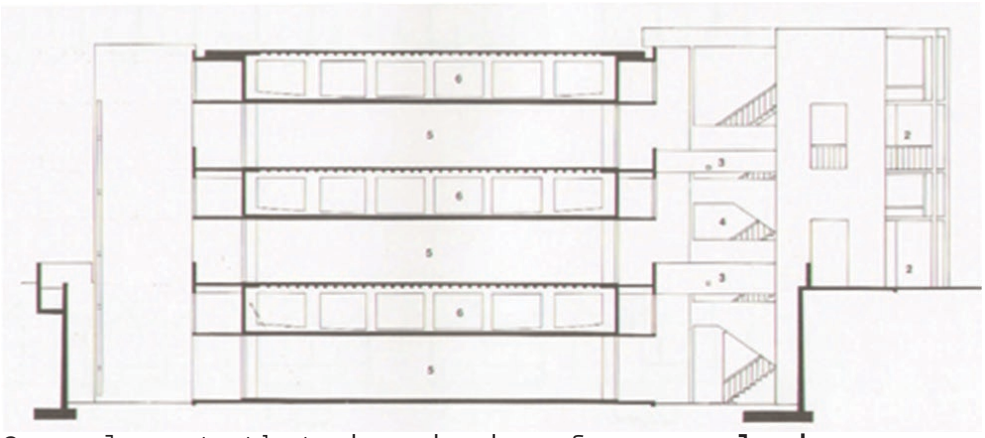


To promote the idea of the spaces being separated, the studies are located on the mechanical floors instead of the research floors and the spaces are linked with a bridge that one must cross over to metaphorically leave the their worries behind them. The research that is conducted at the Salk requires a high degree of consistency, which has been seen in other case studies; therefore the lab spaces have no exterior openings.

Unlike many of the case studies, the laboratory floor plate contains no internal vertical structure allowing for a highly flexible and forward thinking space. To accomplish this column less floor plate, the mechanical floor was introduced, also not seen in other case studies. The combination of these two elements created a space that makes this research institute very unique.

b. typological research

salk institute



One element that is missing from the Salk institute is a meeting place and without this space there is no formal place for the sharing and transferring of information at a personal level.

To combat the weather elements at the site, Kahn used cast-in-place concrete for the exterior walls and floor plates of the structure. The use of concrete created a thick exterior wall to withstand the forces of the elements while creating a surface that does not require routine maintenance.
The Salk institute was designed with the idea of humanizing science, a place where "Picasso could come to visit" [Steele, 12] as stated by Jonas Salk.

analysis:

After reading the comments made by Louis Khan and analyzing the construction, the detailing, the spatial relationships and context of the institute, a person can see the humanizing of science come through. I can see that highly technical areas can have very personal spaces relatively close without endangering the work that is taking place. This case study shows a forward thinking that needs to be in place for any building that wants to be functional and adjustable in the future.

conclusion:

This facility illustrated the need for separate, individual spaces for the researchers.

b. typological research

international research institute for climate prediction

introduction:

The International research institute is a 27,556 sf building located on the campus of Columbia University in New York. The building functions as a research center as well as classroom space for the university. IRI is a single story building that curves to fit the contours of site. The building uses stones and heavy timber construction as a way to set the building into the surrounding context. Since the institute needs to function at the university level, the programmed spaces include classrooms, state of the art 200 seat conference hall, laboratories, offices and computer rooms.

new york city, ny

rafael vinoly

1999

27,556 sf

$10,000,00

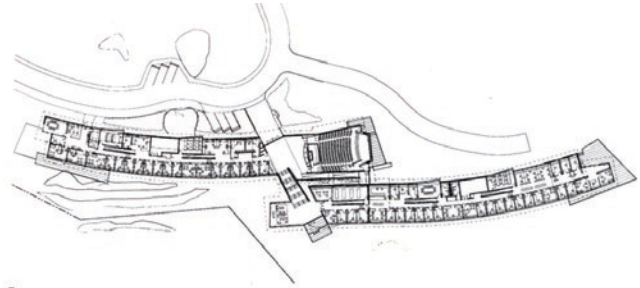
cost: $363 sf

research findings:

This building utilizes the surrounding context as a design directive. Like many of the case studies, the IRI follows the contours of the site harmonizing the building with the landscape. To enhance the harmony with the landscape, Vinoly used natural materials and sloping roof planes that resonated with the contours of the site. The prevalence of community interaction in other case studies

is also prevalent with in the IRI, with the 200 seat conference hall there is interaction between researchers, students, faculty and the general public.

Unlike many of the other case studies, the necessity to control light throughout the building is not as prevalent. The halls are exposed to daylight through a clear story opening in the roof trusses and most of the interior spaces, have windows allowing light penetration.



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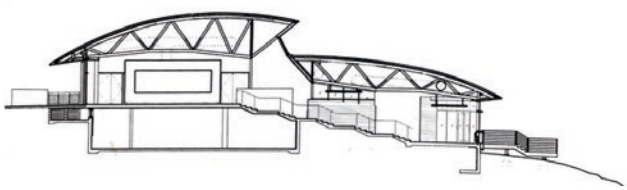


As mentioned earlier, the IRI responds well to the environmental factors. The institute utilizes daylight as means to light the interior spaces. The building curves with the contours of the site, allowing the site to function almost as if the building isn't there. The use of the stone work acts as a way to buffer heat loss/gain through the building walls. With the build-

ing being set in a wooded area, the trees act as a shading device during the summer and during the winter when the leaves are gone, the trees allow light penetration but help minimize the winter winds.

I believe that Rafael Vinoly wanted to create a building that treads lightly on the site where it was built. With the use of curves and natural materials, Vinoly used a design palette that let the building be one with the site and not overshadow the context.

analysis:

The internal layout of space appears to be a little more traditional, with two long corridors that have spaces to each side. In the other case studies, there was an emphasis on creating compact spaces and getting away from the long corridors.

b. typological research

institute for forestry and nature research

introduction:

The institute for forestry and nature research is a center that has intertwined the principals of ecology and architecture as a means of sustainable design. The entire building, except the library and kitchen, is without climate and ventilation control.

netherlands

behnisch, behnisch & partner

1998

121,050 sf

$24,000,000

cost: $198 sf

The spaces are controlled by properly arranging plants and water elements in the greenhouse areas. The building is placed within a commercial agricultural zone where the soils have been over fertilized and few natural elements exist. The building, excluding the enclosed gardens is a total of 121,050 sf at a cost of $198 sf with the total project cost of $24 million dollars. The distinguishing characteristics for this building would be the incorporation of greenhouse elements as a sustainable design approach. This building is predominately composed as a glass box which is a stark contrast to the other buildings. Spaces in

this building include a library, offices, conference center, restaurant/kitchen, standard laboratory, climatized laboratories, covered gardens and theme gardens.

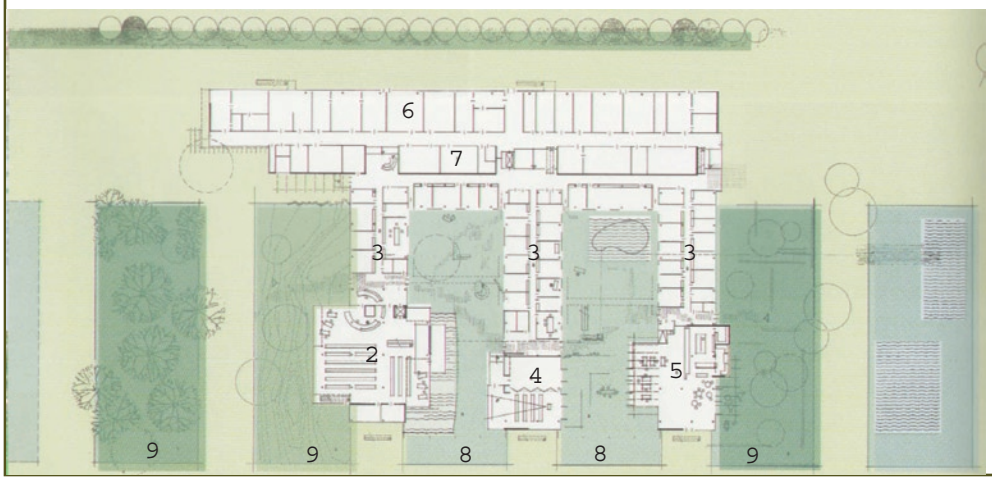
research findings:

Programmatically, this building shares many characteristics with the other case studies. The design focuses on compactness with its spatial relationships, which has been seen in other case studies. There is still the separation of research space and office space to allow the scientist to retreat from the rigors of laboratory work. Many of the other case studies use daylight for internal lighting for spaces like offices and community interaction.

This case study brings to the forefront the integration and use of green design. The material palette has changed from previous case studies; the materials and detailing throughout this building imply economic and ecological advantages. The enclosed gardens are not programmed spaces, as a way to invite the use of these spaces by everyone. Every workroom in this facility has a window and is designed for visual comfort for the individual in the space. Many of the other research facilities are dependent on mechanical air supply; this building utilizes fresh movement through the windows.

Every detail of this building is geared to be environmentally friendly. Using the large atrium spaces the designers have created a large buffer zone to control heat loss and gain during the course of the year. The building utilizes heat recovery systems, when possible, during the cool months to eliminate the need for artificial heating systems.

Since the interior courtyard/garden spaces are not programmed for certain uses, the building eliminates social boundaries by allowing everyone to access these spaces. There isn't the feeling that one does not belong in this complex. With the building being so



1. entrance
2. library
3. offices
4. conference
5. restaurant
6. std. lab
7. climatized lab
8. covered grdn
9. theme grdn
10. roof terrace

b. typological research

institute for forestry and nature research

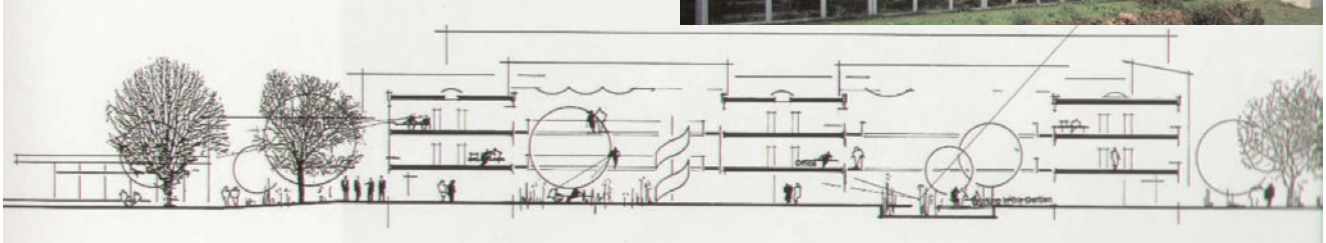
geared towards green design and utilization of natural resources, the center is trying to promote a change in the way individuals design and occupy spaces.

analysis:

This case study shows the material usage of a research center does not have to be concrete. The material palette lends itself to sustainable design and the benefits of using natural energy as a way to maintain living conditions within the research center. The integration of natural elements with in the design envelope promotes a healthy and relaxing space for the scientists once they leave the confines of the laboratories. Even though this building uses an extensive amount of glass on the exterior, the center illustrates how research can be achieved without losing quality or functionality as one might suspect.

conclusion:

Contributions made include green design, utilization of proper planting arrangements and material usage. This design focused on the utilization of the environment for almost everything, there are very few mechanical systems in this building.



b. typological research

Pinngortilaleriffik (greenland's nature institute)

introduction

Greenland's nature institute is a 21,520 sf building located near Nuuk, Greenland. One of the distinguishing characteristics would be the location of the site. The building is integrated at the top of a rocky knoll of the mountains. This case study has severe weather conditions that needed to be dealt with during the construction and design of this facility. The building contains offices, library, archives, exhibition space, laboratory/depot, garage, meeting room and a canteen (atrium).

Nuuk, Greenland

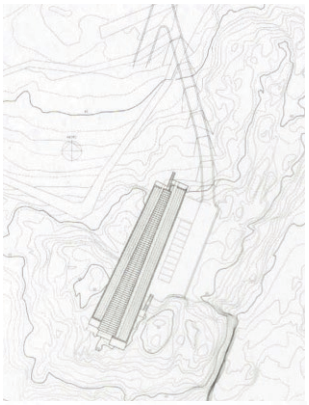
KHR AS Architects

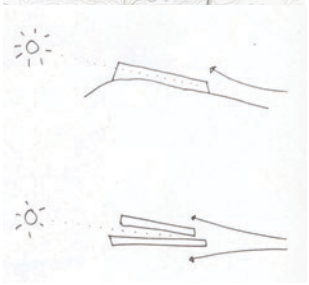
1998

21,520 sf

$6,000,000

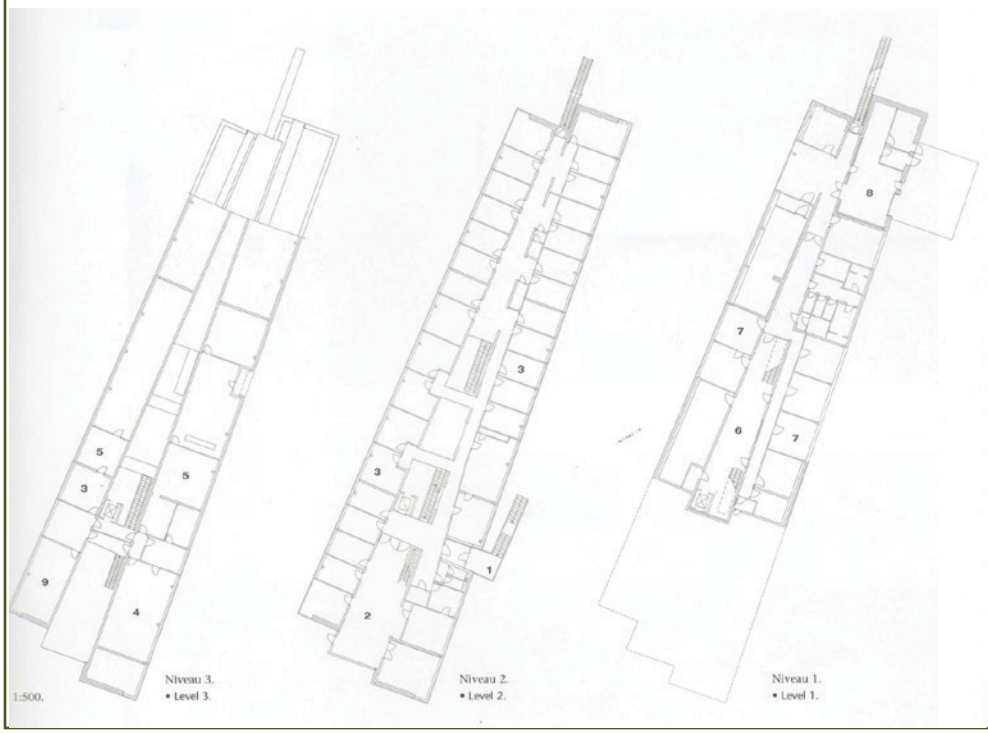
cost: $279 sf





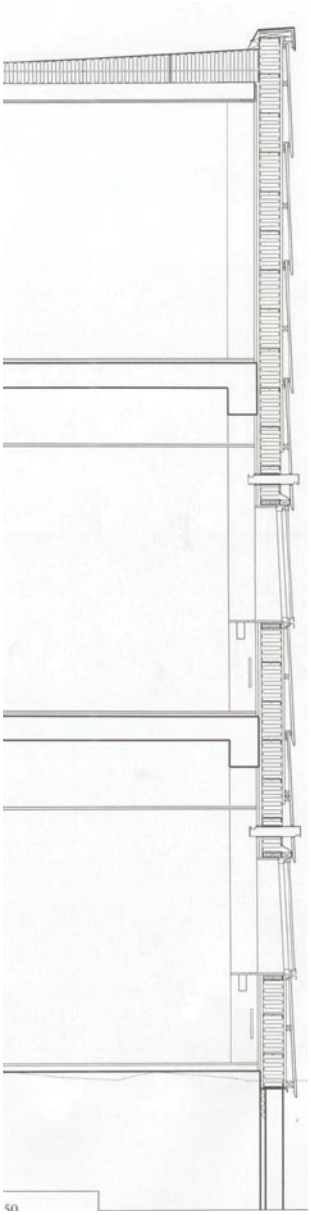
Research findings

Like many of the other case studies, the nature institute incorporated the building into the surrounding site. KHR AS used the surrounding mountains to influence the exterior and interior spac-



1. main entrance
2. canteen
3. offices
4. library
5. archives
6. exhibition space
7. laboratory/depot
8. garage
9. meeting room

es of the building. Even though this building is located in a rural setting, there was still the need for community and exhibition spaces as a way to educate the community as they interacted with the building. The use of concrete as a major construction element is a very common practice among my case studies.



The material cladding on the exterior of the building was different than any other; it was a cedar shake that sealed itself naturally. In many of the other buildings there was a complete separation between employees and the general public, where as this building appeared to have the capability of interaction between the two groups.

The building was designed around the environment. The orientation of the building allows for the cold winter winds to flow around the building reducing the amount of heat loss. A large center space, with offices opening up to it, allows the building to use natural air circulation and eliminating the need for mechanical ventilation.

b. typological research

Pinngortilaleriffik (greenland's nature institute)

The meeting room, canteen and the library all have high ceilings which eliminates the need for mechanical ventilation. With heavy interior walls and lighter exterior walls, the building utilizes passive heating.

I believe that the design of this building revolved around the nature and the use of natural elements. The designers were conscious of their surroundings and what the function of the building was.

Analysis

This cases study shows that passive heating is capable in any weather condition. With proper site utilization and the use of proper design strategies, a building does not need to rely heavily on mechanical equipment.

Conclusion

This building illustrates that it is possible to use sustainable design in a harsh environment.

b. typological research

museum of the earth

As I was searching for case studies that were related to my theoretical premise, I stumbled upon the Museum of the Earth. The Museum of the Earth is a supplementary study for my research. I used this case study because of its site conditions and how the architects incorporated parking into the area. The site is situated on a 6 acre site that slopes towards a lake. The flow of water was an important expression and functional aspect of the site design. Water management for the site mimics what is happening in the surrounding mountains. The site utilizes berms and natural elements to funnel the water down and through the site. Pedestrian and parking functions are incorporated into the site so the people visiting the museum must interact with the site and appreciate the design. The parking spaces are tucked into the side of the hill so when people are driving by the site, they only see the museum and not the multitude of parked cars.

ithaca, ny

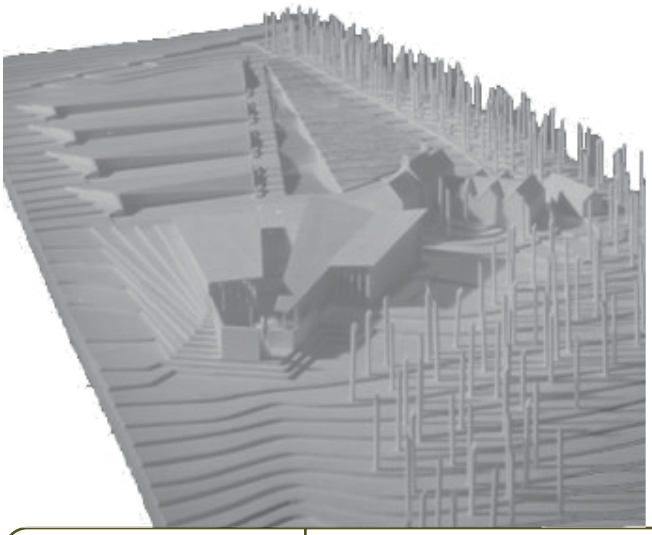
weiss/manfredi architects

2003

20,000 sf

$7 million

cost: $350 sf



b. typological research

museum of the earth

In addition to studying the site configuration for this complex, I was able to see how research information could be presented to the general public. To display the research findings and the 4.6 billion year history of the planet, a 7,000 sf exhibit hall was created and within this area there are displays of many kinds and discovery stations, where visitors can interact and learn.

conclusion:

The Museum of the Earth was a contribution to my case study series due to its nature background. This museum illustrates how a building can use natural elements as designing guidelines, also this building has an exhibit space based around the natural elements.

c. historical context

Fire has been a naturally occurring phenomenon since the start of time. The use of fire has been part of ancient societies; these societies understood the benefits of regular fire as a way to cleanse the land. The Australian Aborigine are a prime example, they used the "firestick" to start fires for land management purposes. Prior to the settlement of North America by European settlers, many of the Native American tribes used fire to hunt and cleanse the land. The Native Americans would relocate in harmony with the natural force of fire. Once the Europeans settled the land, they did not embrace natural fire; as it usually meant destruction to their permanent housing structures and crops. They developed the idea of fire suppression, which is trying to be reversed in modern society. Unfortunately, single entities could not control these large fires that were occurring across the nation, which were usually not caused by nature but by ignorance among people occupying the forests. In the late 1800's, the US Forest Service was formalized and created a national approach to wildland protection, once again it was based on fire suppression. From this point forward, society has seen fire as an "evil" that needed to eliminated, as much as possible. This idea of "evil" fire is still present in today's culture, but that might be starting to shift. The many Yellowstone fires of 1988 and the benchmark fire season of 2000, has started to shift public perspective of fire and the public is now starting to embrace the idea of fire as a positive occurrence.

Technology and strategy for the use and control of fire are changing at a rapid pace in today's society. The fire research institute would provide a state of the art facility for advancing the field of wildfire research. Not only will it provide a space for the advancement of wildfire knowledge, it will also function as a space to educate the public. The public will be able to come to the building for seminars, hands on experiences and displays; through this interaction people may begin to shift their understanding of fire and its importance. The wildfire research institute will be one of the few wildfire research centers in the United States, and from what I have gathered; it will be the only one that is specifically designed for this type of research.

d. goals for the thesis project

Goals

1. The design will be an exciting culmination of fire research. It will be one of the premiere wildfire research facilities in the world, through its research, the facility will provide strategy innovations that will be applied across the United States.

2. The project will educate the public about fire management. It will demonstrate and promote new research techniques by having seminars and interactive displays.

3. Being a research facility based on natural phenomenon, the building will use low energy systems and passive design strategies.

4. As a personal goal, I will create a presentation utilizing superior graphic techniques that far exceeds any previous work accomplished by myself.

d. goals for the thesis project

Schedule
2005-2006

January

10 Site Analysis
Schematic Design

30 Revise Schematic Design
Structure

February

06 Design Development
Systems Integration

20 Design Details

March

06 Midterm Reviews

13 Revise and Finalize

27 Model
Finalized Design
Begin Presentation Process

April

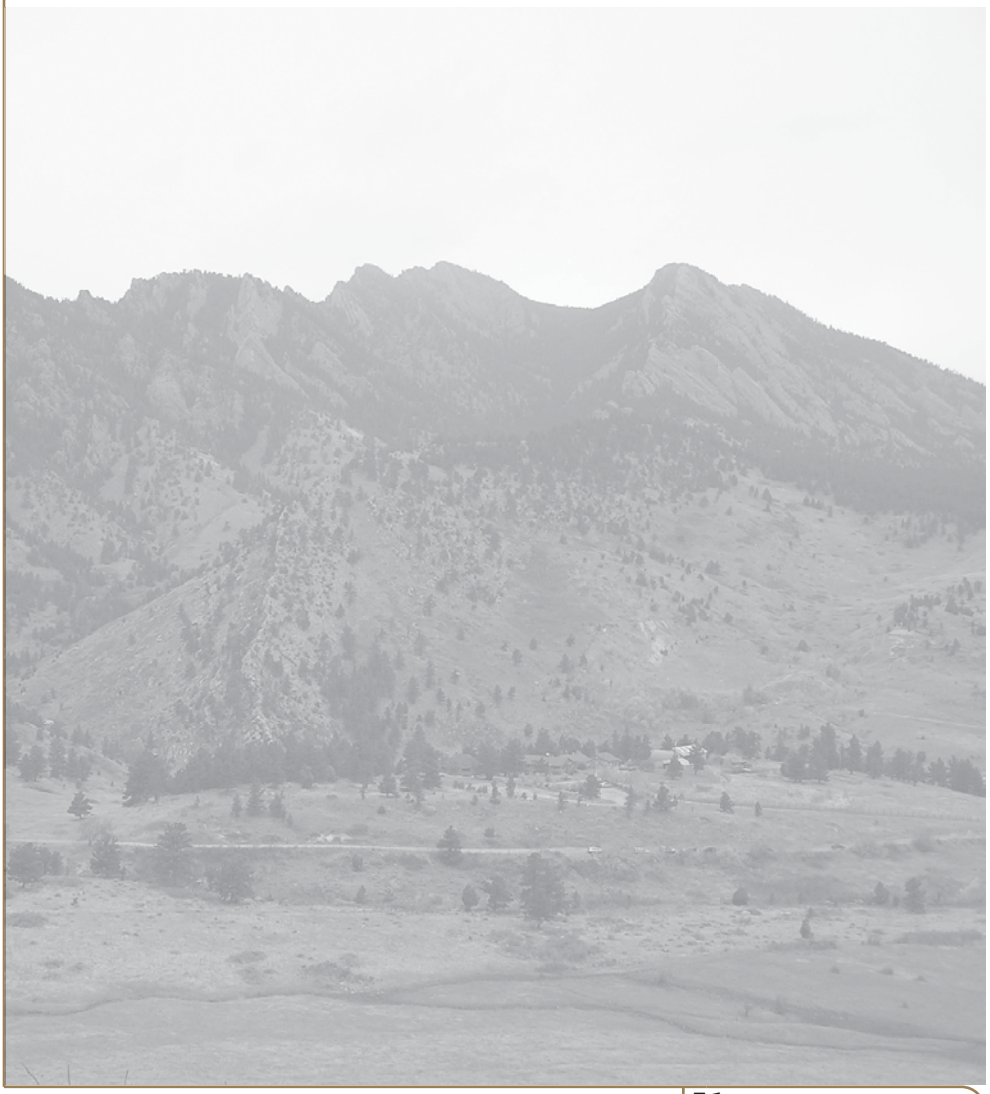
24 Thesis Projects Due

27 Thesis Reviews Start

May

11 Final Thesis Documents Due

2. site analysis



2. site analysis

summary

The thesis site is located to the south east of Eldorado Springs, CO, a small community. The city of Boulder is located five miles to the north-north east, and can be seen from my site. The site itself is a flat, open plateau covered with prairie grasses with an evergreen tree scattered over the site. The site is over looking prairie land to the north and west. To the south, the site is surrounded by evergreen trees and to the west the Rocky Mountains start. To the west, in the mountains, there is Eldorado Canyon State Park and the Eldorado Mountain itself; this area is known for its rock climbing. The State of Colorado emphasizes the protection of nature so everyone can use the great outdoors and this evident as there are multiple biking and hiking trials that lead you through the mountains. Currently, there are no trails that cross my site, but there are multiple trials that meander around the site itself.

Climatically the site is very accommodating; the average yearly temperature for this area is 51.8 . During the winter, the average low is 22 and the summer has an average high of 85 . Neither the winter nor the summers are extremely hot or cold, allowing for outside activities year round. Being that the site that is located out in the wilderness, there was a concern about the winds being harsh and uncontrolled. After researching the wind conditions, I found that the winds are not a large factor that I had once imagined. Typically the winds are out of the south or south west

summary

with an average wind speed of seven miles per hour. The summer months tend to have a slightly higher wind speed than the winter, but only by two miles per hour. The site will be affected by mountain winds, which means that during the day the air warms up and travels up the mountain valleys creating an updraft. Then in the evening when the air cools down, it travels back down the valleys creating a down draft.

Being that the site is elevated, there are numerous views from this location. From this location, one will be able to overlook three different ecological systems; prairie, forested land and the mountains. I will take advantage of these views with my design. Later in this section, this information will represented graphically so one can see how this information is incorporated into the site.

2. site analysis

qualitative aspects

As I was flying into Denver, there they were. At first only ghostly masses, but as the plane drew closer to Denver, the objects started to reveal themselves as the Rocky Mountains. As the plane touched ground, the setting sun radiated over the tips of the mountains casting a vibrant mixture of orange and blue into the sky, the mountains had become silhouettes in this majestic sun set. The next mourning I had set out to visit the site, my mind and body were full as anticipation as I started my journey. Heading slightly southwest, more west than south, the car moved around a long, subtle curve in the road and the mountains started to reveal themselves. At first only ahead of me, then a little to the left, a little more to the right and then to the left again, and there it was, my site off to the left. The site is a plateau that extrudes above the lower, flatter land to the east, but had a Rocky Mountain background to the west.

2. site analysis

qualitative aspects

As I started out on the trail that would lead me to the top of the plateau, I noticed to my right a patch of forest that had been subject to fire in the past few years and to my left a small valley that was in between me and the summit of my hike. As I made my way to the summit, I crossed a small babbling brook and hiked past a herd of deer. When I had finally reached the top the view was amazing, you could see Boulder and flat prairie land to the Northeast, the Rocky Mountains to the West and forested land to the south. The day that I had visited the site was not the most desirable; it was a rainy overcast dreary day. Because of the weather I was able to see clouds form as air moved over the tops of the mountains, I could feel the wind as it moved across the site and I was able to see how fast weather can change. The site itself is relatively flat, the ground is covered with prairie vegetation and there is an occasional yucca plant mixed in. There are no visible signs of significant people usage, only the occasional hiking path that the area is known for. Due to the sites location and current condition, it will provide a solid base for the understanding and researching of fire behavior. From this location a person can see and visit different land conditions and fuel types, giving the researchers a wide range of flexibility and convenience when studying different fire conditions.

2. site analysis

quantitative aspects- site photographs

The following images were taken October 30, 2005 when I was in Boulder, CO. These pictures are brief overview of my site. The first picture is taken from the north end of my site, looking north. In the horizon line you can barely make out Boulder, which is about 5 miles away. Also from this picture you can see the main road for this area. This view shows the transition from the prairie to the mountains.

This picture is taken from the east side of the site looking east. You can see one of the few residential houses in the area.

In this picture you are looking south from the southern point of the site. Here you can see the mountains in backgrounds and the transition of the plant material from a prairie grass mix to a predominately wooded composition.

2. site analysis

quantitative aspects- site photographs

This is the last view looking away from the site. Here you are on the western edge of the site looking west. This view shows the predominate mountain landform. In the center of the picture, you can see where a fire had burned through the area, you can also see one of the many walking trails that weave through the mountains. In the first four pictures, you can see the transition of land forms that surround this site.

This is the first view looking over the site. Currently you are at the north end of the site looking south. This picture illustrates the flatness of the site as well as the ecological composition of the site.

In this image you are on the east side of the site looking to the mountains to the west. Once again you can see how flat the site is and the sparsity of trees on the plateau.

2. site analysis

quantitative aspects- site photographs

This image is taken from an adjacent plateau to the north east. This picture illustrates the context in which the site is located in. From this angle you can easily see the mountains in the background.

Here you are to the north of the site on another plateau. In this image you can see that the mountains are not directly behind the site.

This last image is taken from ground level, or the level the first time a person will see the site. From this level you see it is tough to get a good view of the backside of the site, which I will have to remember when I start designing. It is apparent that this site will be visible from multiple locations, possibly even Boulder.

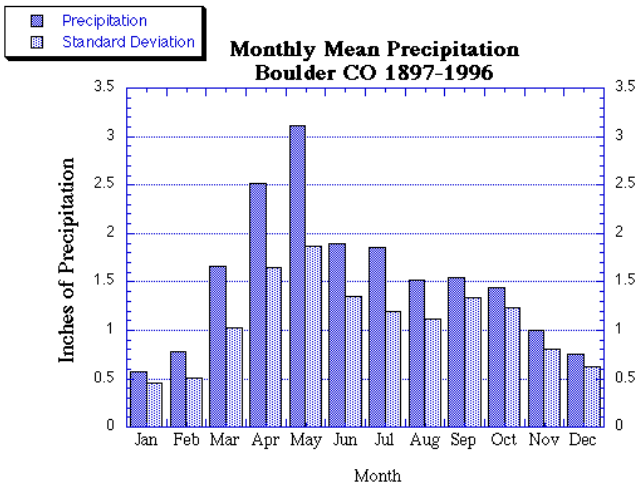
2. site analysis

quantitative aspects- climate data

Station:(050848) BOULDER
From Year=1948 To Year=2005

	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	45.4	20.5	32.9	73	20/2005	-22	12/1963	43.5	53	21.9	***	0.0	5.2	26.6	2.2
February	48.3	23.5	35.9	79	08/1954	-24	05/1989	47.6	54	24.1	***	0.0	2.8	23.0	0.9
March	54.0	28.0	41.0	80	20/1997	-6	02/2002	48.7	86	30.8	***	0.0	1.7	21.3	0.3
April	62.7	35.7	49.2	88	21/1989	-3	02/1975	56.7	81	42.8	***	0.0	0.2	10.7	0.0
May	71.8	44.5	58.2	95	28/2000	22	02/1954	64.3	58	50.9	***	0.4	0.0	1.2	0.0
June	81.8	52.9	67.3	104	23/1954	30	02/1951	74.9	56	62.2	67	6.5	0.0	0.0	0.0
July	87.5	58.6	73.1	104	11/1954	42	05/1972	78.3	54	68.3	92	13.3	0.0	0.0	0.0
August	85.6	57.3	71.5	101	08/1969	40	28/2004	75.0	48	66.3	92	8.9	0.0	0.0	0.0
September	77.7	48.9	63.3	100	02/1983	15	30/1985	69.8	48	55.9	65	2.5	0.0	0.8	0.0
October	67.1	39.1	53.1	90	01/1953	5	31/1991	61.9	50	41.8	69	0.0	0.2	6.7	0.0
November	53.3	28.5	40.9	79	04/1952	-8	25/1993	53.1	49	31.1	85	0.0	1.9	19.4	0.2
December	47.1	23.0	35.1	76	17/1980	-24	22/1990	44.1	57	20.7	83	0.0	3.3	25.7	1.0
Annual	65.2	38.4	51.8	104	19540623	-24	19890205	56.0	54	49.6	85	31.6	15.2	135.5	4.7
Winter	46.9	22.3	34.6	79	19540208	-24	19890205	40.9	54	28.7	84	0.0	11.3	75.3	4.1
Spring	62.8	36.1	49.4	95	20000528	-6	20020302	52.7	66	45.1	83	0.4	1.9	33.2	0.3
Summer	85.0	56.3	70.6	104	19540623	30	19510602	74.9	54	65.8	92	28.7	0.0	0.0	0.0
Fall	66.0	38.8	52.4	100	19830902	-8	19931125	57.8	53	47.1	85	2.5	2.1	26.9	0.2

stern Regional Climate Center, wrcc@dri.edu



Boulder has a temperate climate with a yearly average of 81 inches of snow. The temperature can range from 104 degrees F to -24 degrees F,with a yearly mean average of 51.8 degrees F. The Rocky Mountains produce their own air movements, in the mourning the air moves up the mountain slopes then in the afternoon the air moves back down the slopes.

The prevailing winds for Boulder are out of the south or the south west with an average of 6 mph over the course of a year. This is true for all of the seasons in Boulder. During the summer months the winds are only slightly stronger than the winter months.

There is an abundance of sunny days in Boulder, over 300 for the year, that is more than San Diego and Miami.

Boulder has an extensive system of outdoor activities; hiking, skiing, rock climbing, etc. and they are all dependent on the climate of region.

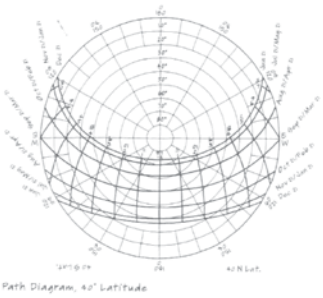
2. site analysis

quantitative aspects- climate data

summer solstice 68.78

equinox 47.55

winter solstice 25.07

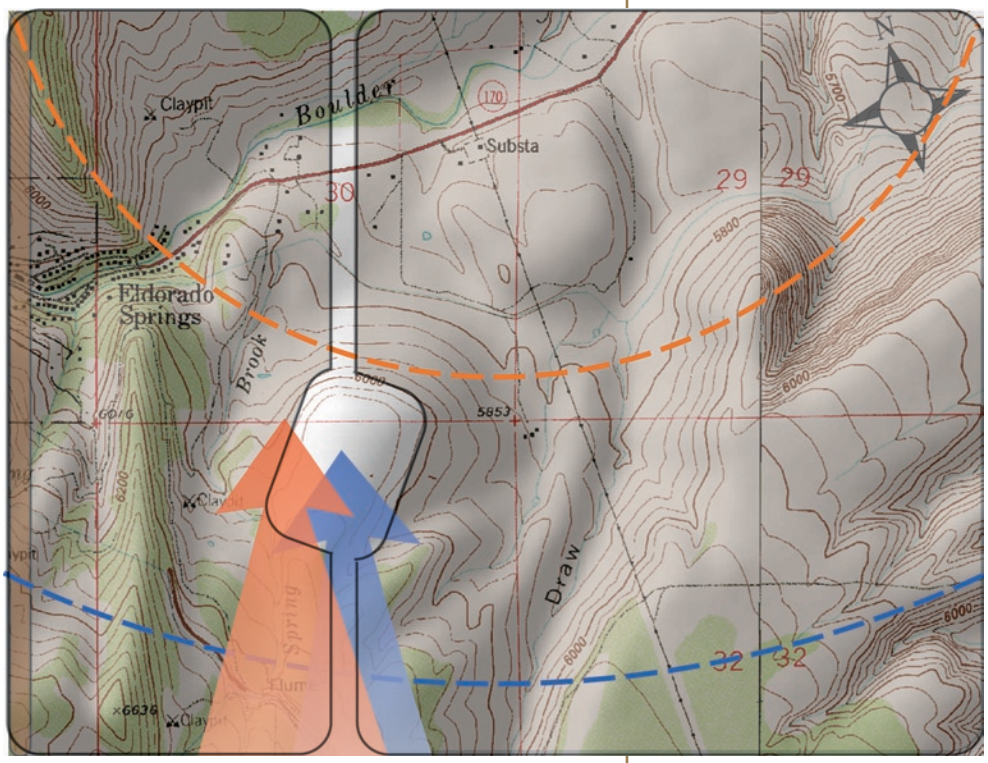


summer winds

winter winds

summer sun path

winter sun path



trails

water shed

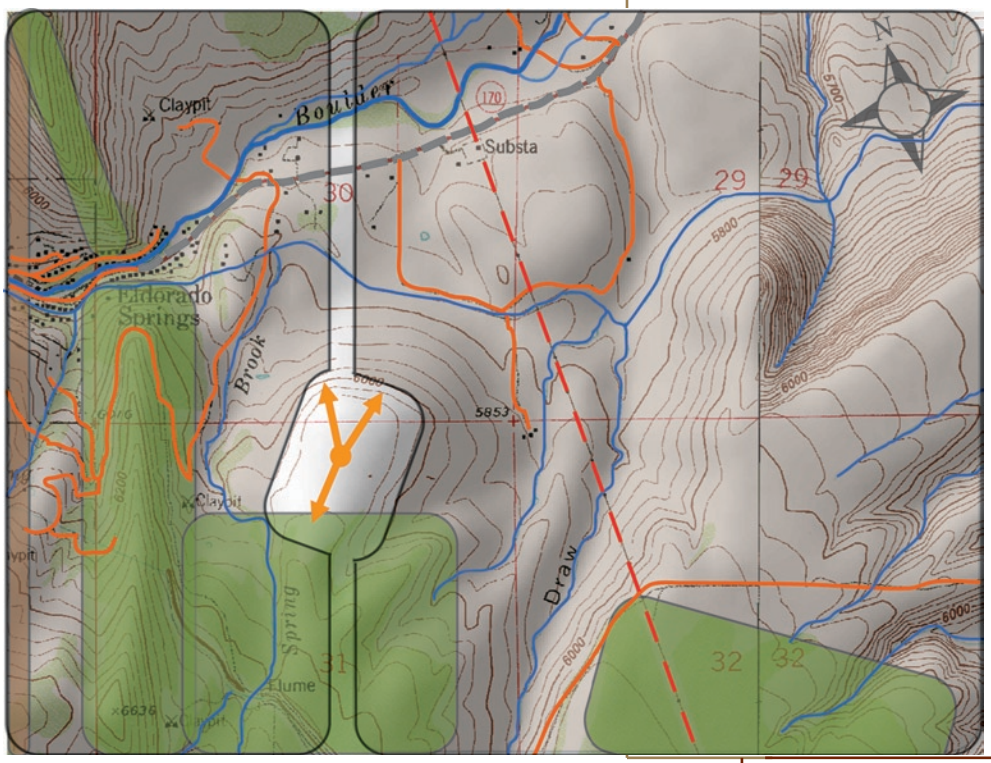
forest

mountain ridge

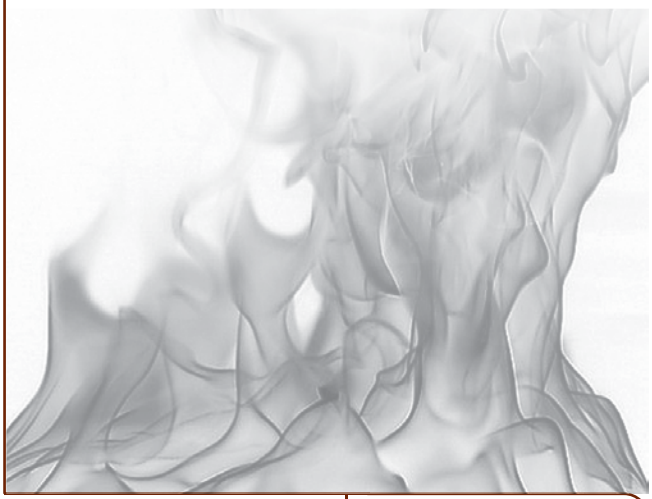
power line

existing road

views



3. program spaces



Synopsis Spatial Requirements

Qty	Space	SF	Total
	research labs		
2	group labs	3,000	6,000
2	large labs	4,000	8,000
4	government	1,200	4,800
3	faculty	1,200	3,600
3	graduate	500	1,500
1	growth space	6,000	6,000
1	wind tunnel a	8,300	8,300
1	wind tunnel b	5,400	5,400
1	burn chamber	4,000	4,000
	office		
2	supervisor	500	1,000
30	government	140	4,200
12	faculty	140	1,680
3	graduate	500	1,500
	support		18,000
	information		
1	library	3,000	3,000
1	archive	1,500	1,500
2	conference	400	800
5	computer lab	500	2,500
	public		
1	exhibition	3,000	3,000
1	auditorium	3,000	3,000
1	reception	1,000	1,000
	support		
1	kitchen	2,400	2,400
15	storage	1,000	15,000
	sub total		92,180
	mechanical	20%	18,500
	circulation	15%	14,000
	TOTAL		
	PRELIMINARY BUDGET		
	total SF		124,680 sf
	average cost case studies		$300 sf
	estimated cost		37,404,000

GROWTH CHAMBER

activity description	a large isolated lab containing equipment and lights that rec-reate the natural di-urnal and weather cycles of nature.
net area	6,000 SF
identical spaces	1
total area	6,000 SF
users	all researchers associated with the facility
number of occupants	12 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, work stations, plant shelfs

WIND TUNNEL A

activity description	contained space allowing the study of wind and fire on materi-als and models
net area	8,300 sf
identical spaces	1
total area	8,300 sf
users	all researchers associated with the facility
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	exterior tunnel controls

WIND TUNNEL B

activity description	contained space allowing the study of wind and fire on materials and models
net area	5,400 SF
identical spaces	1
total area	5,400 SF
users	all researchers associated with the facility
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	exterior tunnel controls

BURN CHAMBER

activity description	large scale fire research, recreate natural situations and allow for controlled study of fire
net area	4,000 sf
identical spaces	1
total area	4,00o sf
users	all researchers associated with the facility
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	large energy meters, extensive exhaust system

GOVERNMENT RESEARCH LABORATORY

activity description	labs where full time government employees can do research, specific lab functions will be determined by the research being conducted
net area	1,200 SF
identical spaces	8
total area	9,600 sf
users	full time government researchers
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, tables, work stations, desks,

GOVERNMENT RESEARCHER OFFICES

activity description	place for researchers to review research findings, an individual sanctuary away from the lab
net area	140 sf
identical spaces	30
total area	4,200 sf
users	full time government researchers
number of occupants	1 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, desks, cabinets, task lights

GOVERNMENT SUPERVISOR OFFICE

activity description	place for research management, coordination, oversee the research proceedings
net area	500 SF
identical spaces	2
total area	1,000 sf
users	department supervisors
number of occupants	1 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, desks, cabinets, task lighting

FACULTY RESEARCH LABORATORIES

activity description	place for research, space dependent of the research
net area	1,200 SF
identical spaces	3
total area	3,600 sf
users	faculty researchers
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, tables, work stations, desks,

GRADUATE RESEARCH LABORATORIES

activity description	place for research, faculty/graduate interaction, group/individual studies
net area	500 sf
identical spaces	3
total area	1,500 sf
users	graduate students
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, tables, work stations, desks,

FACULTY OFFICES

activity description	individual sanctuary away from lab, faculty/graduate interaction, analyze research findings, review graduates research
net area	140 SF
identical spaces	12
total area	1,680 sf
users	faculty researchers
number of occupants	1 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, desks, cabinets, task lighting

GRADUATE STUDENT OFFICES

activity description	place to formulate ideas based on research, group interaction, faculty/graduate interactions
net area	500 sf
identical spaces	3
total area	1,500 sf
users	graduate students
number of occupants	4 per space
hours of use	daytime, available 24 hrs
furnishings	chairs, desks, cabinets, task lighting

LIBRARY

activity description	place for study, research, contains journals, books and periodicals about the natural environment
net area	3,000 SF
identical spaces	1
total area	3,000 sf
users	faculty researchers, graduate students, full time researchers
number of occupants	50
hours of use	daytime
furnishings	book cases, tables, task lights, computers, desks, shelving

ARCHIVES

activity description	a storage facility for previous research endeavours, object storage
net area	1,500 sf
identical spaces	1
total area	1,500 sf
users	faculty researchers, graduate students, full time researchers
number of occupants	25
hours of use	daytime
furnishings	shelving, work tables

CONFERENCE ROOM

activity description	an interactive space between the researchers, faculty, graduates, other professionals. video conference capabilities
net area	400 SF
identical spaces	2
total area	800 sf
users	faculty researchers, graduate students, full time researchers, other professionals, guests
number of occupants	20
hours of use	daytime
furnishings	conference table, chairs, video conference equipment, cabinets

COMPUTER LABS

activity description	run computer simulations, analyze field research findings such as fire temperature. Possible command center for large wildfires
net area	500 sf
identical spaces	5
total area	2,500 sf
users	faculty researchers, graduate students, full time researchers, other professionals
number of occupants	15
hours of use	daytime
furnishings	computers, tables, chairs, multimedia equipment, virtual technology

PRESENTATION AUDITORIUM

activity description	presentations, lectures, information sharing
net area	3,000 SF
identical spaces	1
total area	3,000 sf
users	faculty researchers, graduate students, full time researchers, other professionals, public
number of occupants	150
hours of use	daytime
furnishings	chairs, presentation equipment,

EXHIBITION SPACE

activity description	exhibit fire related equipment, interactive displays, education for the general public
net area	3,000 SF
identical spaces	1
total area	3,000 sf
users	general public, tourists, staff
number of occupants	150
hours of use	daytime
furnishings	shelving, display cases, interactive displays, tables, chairs

RECEPTION AREA

activity description	entry space, gathering space before auditorium, circulation, public interaction
net area	1,000 SF
identical spaces	1
total area	1,000 sf
users	public, tourists, staff
number of occupants	35
hours of use	daytime
furnishings	chairs, reception desks, coffee tables

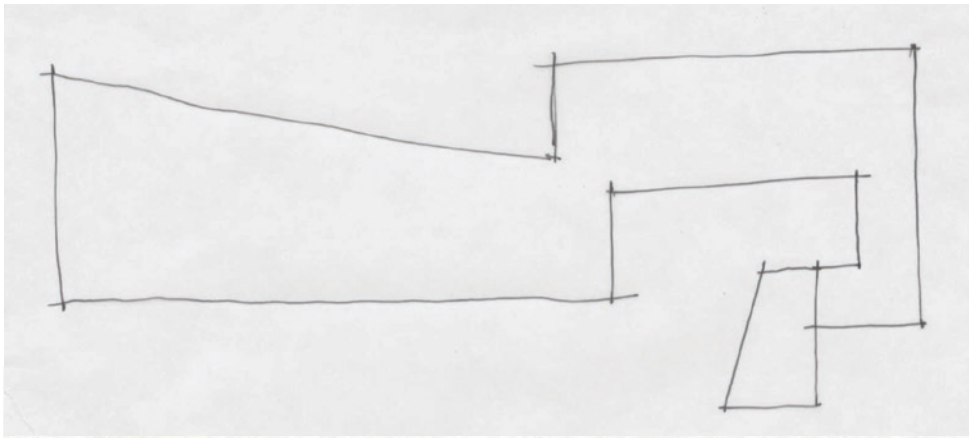
DINING/KITCHEN	
activity description	provides food for staff, researchers and public on special occasions
net area	2,400 SF
identical spaces	1
total area	2,400 sf
users	faculty researchers, graduate students, full time researchers, public on days of events
number of occupants	4
hours of use	daytime
furnishings	tables, chairs, cabinets, kitchen equipment

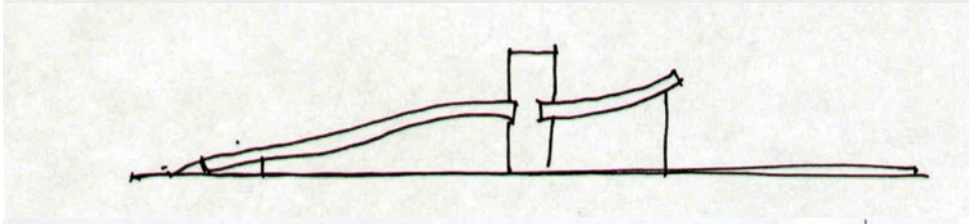
STORAGE	
activity description	place to store extra equipment, office supples, research material
net area	300 SF
identical spaces	10
total area	3,000 sf
users	faculty researchers, graduate students, full time researchers
number of occupants	4
hours of use	daytime
furnishings	shelving

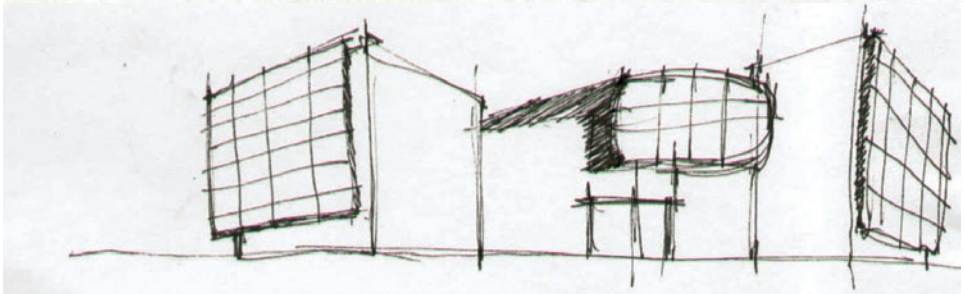
4. design process

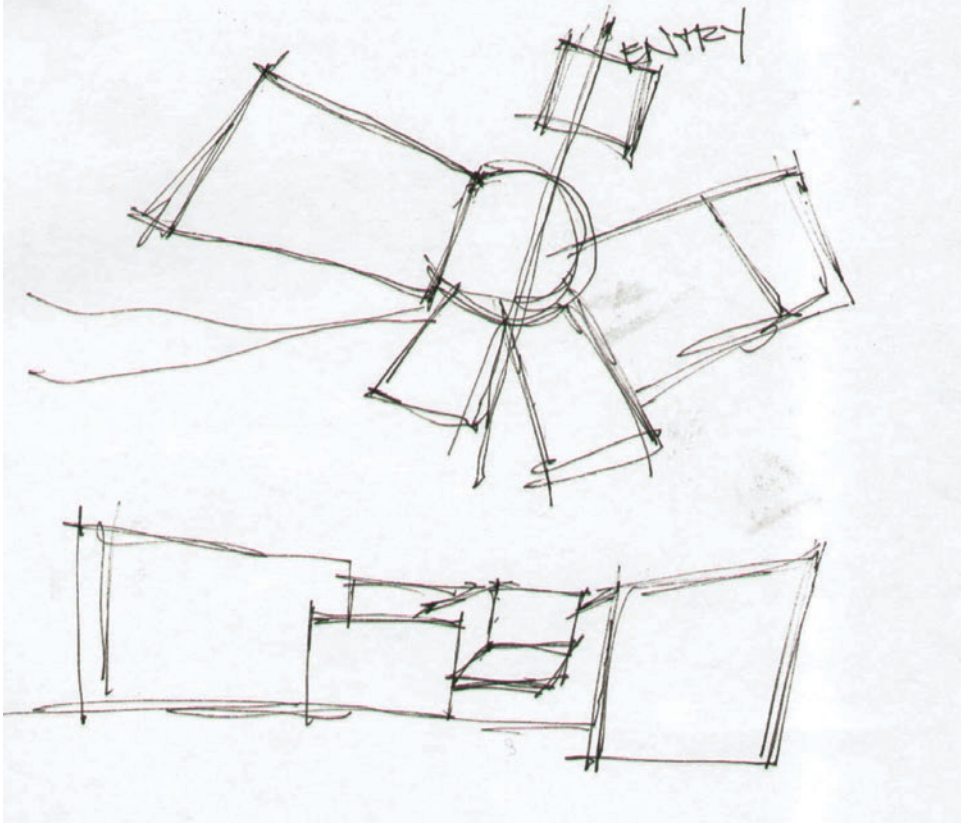
4. design process

concept sketches



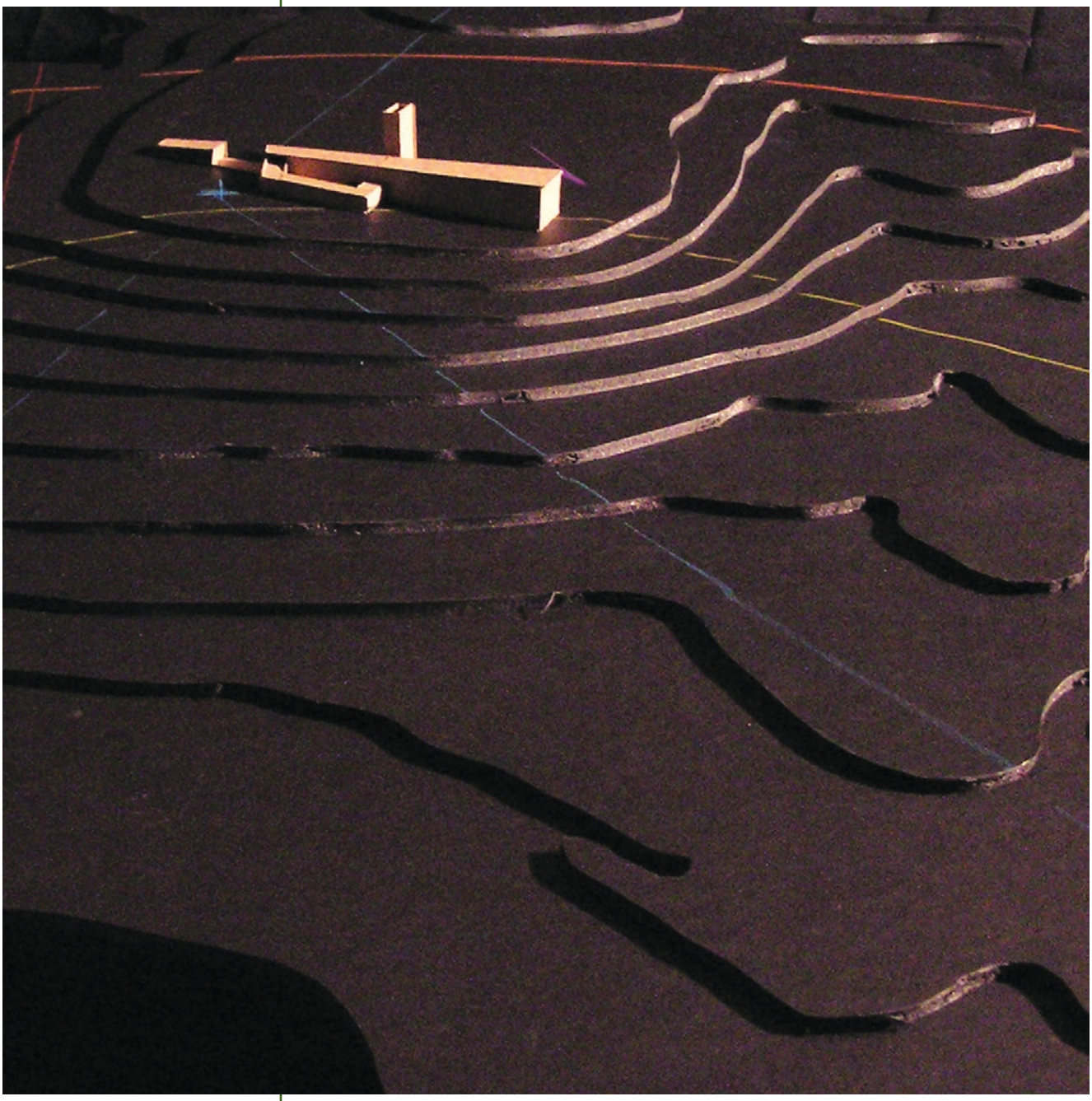






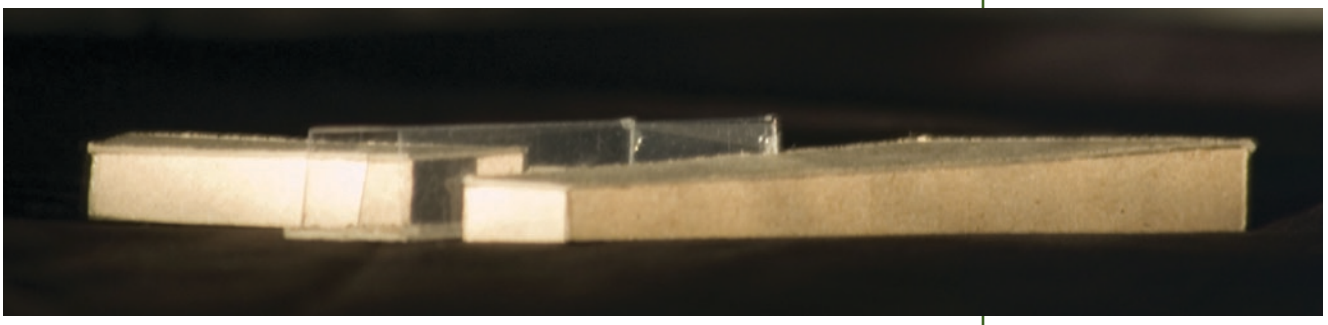
4. design process

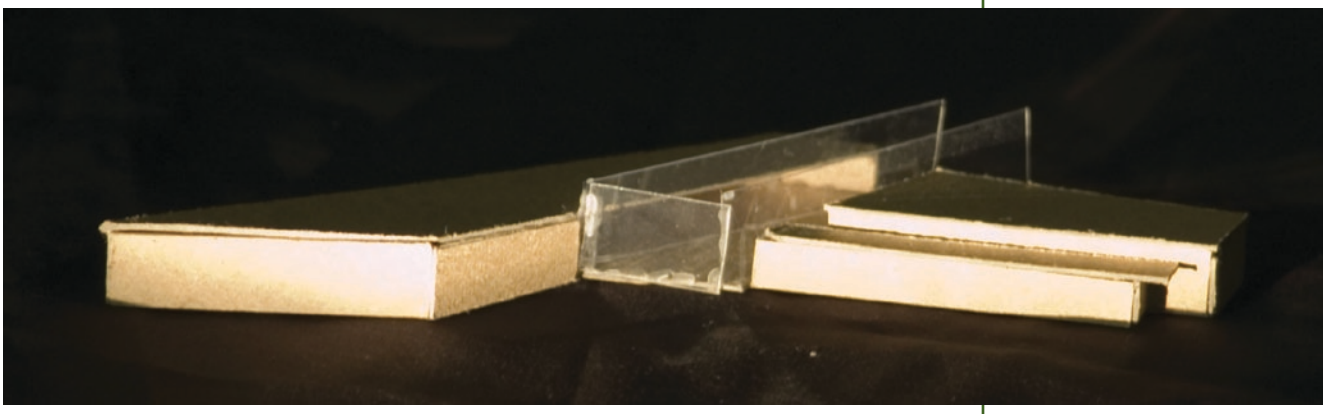
study models

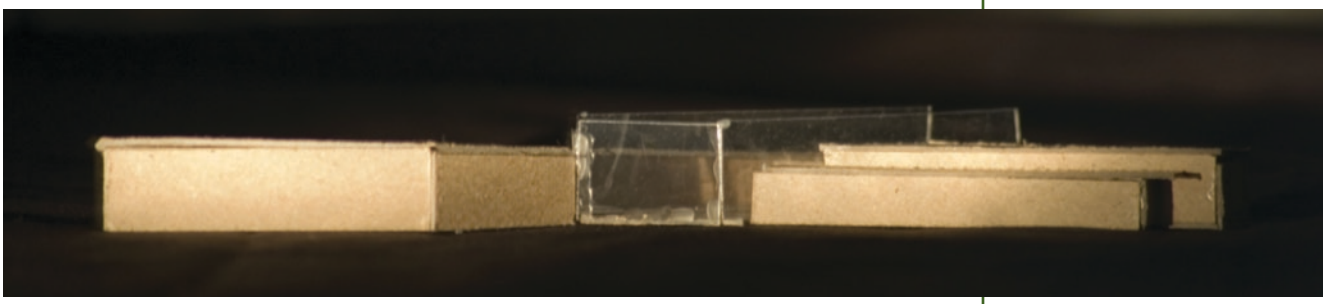


4. design process

study models

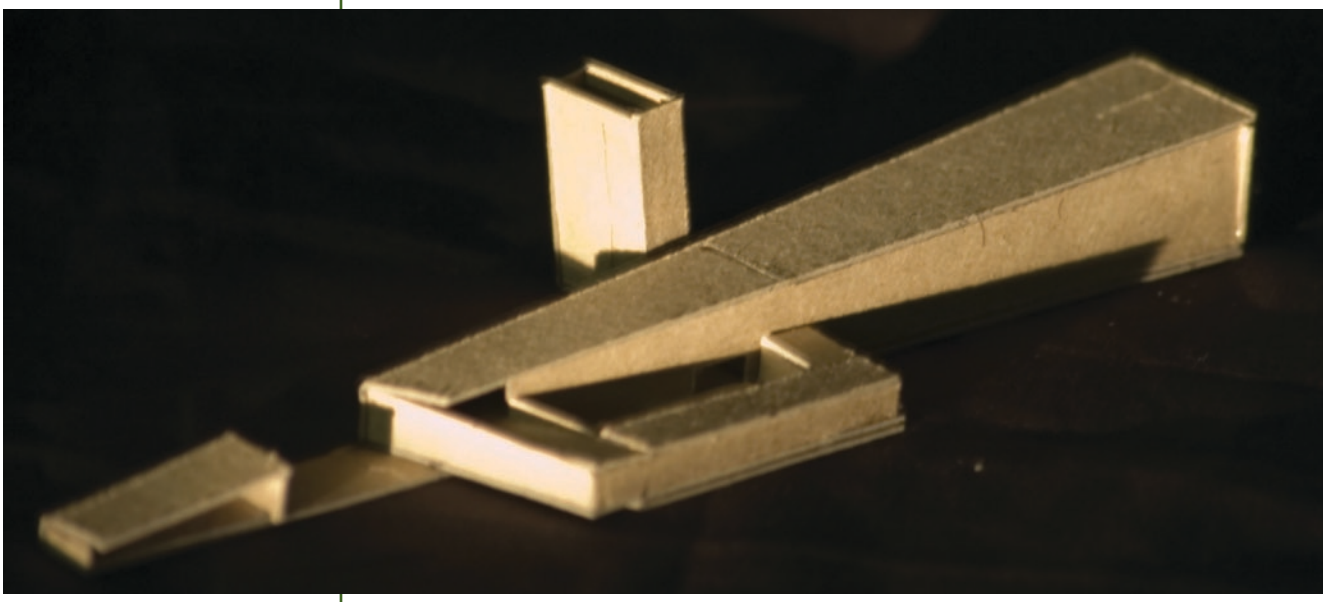


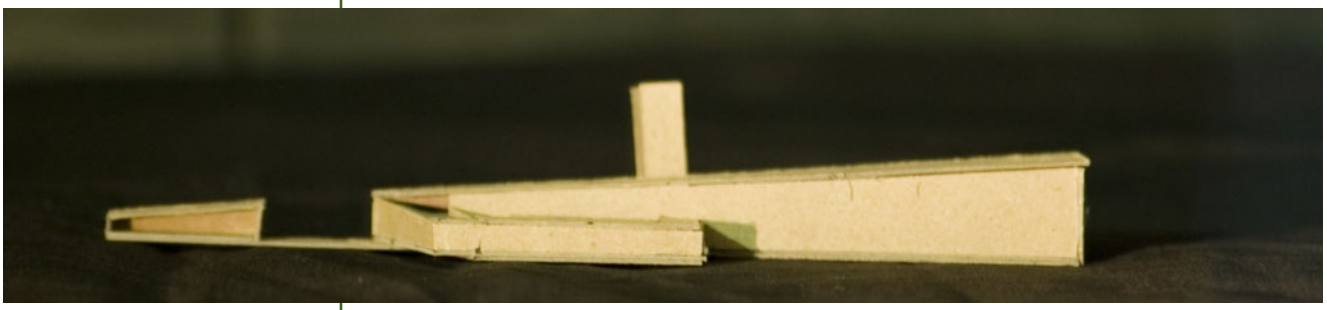


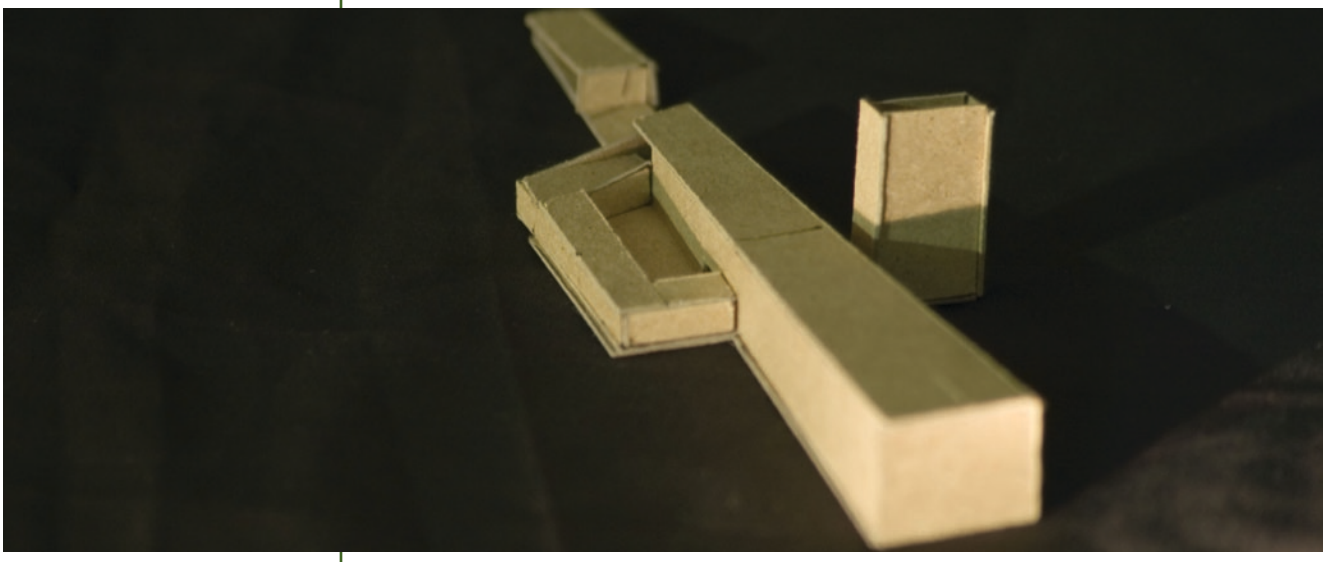


4. design process

study models

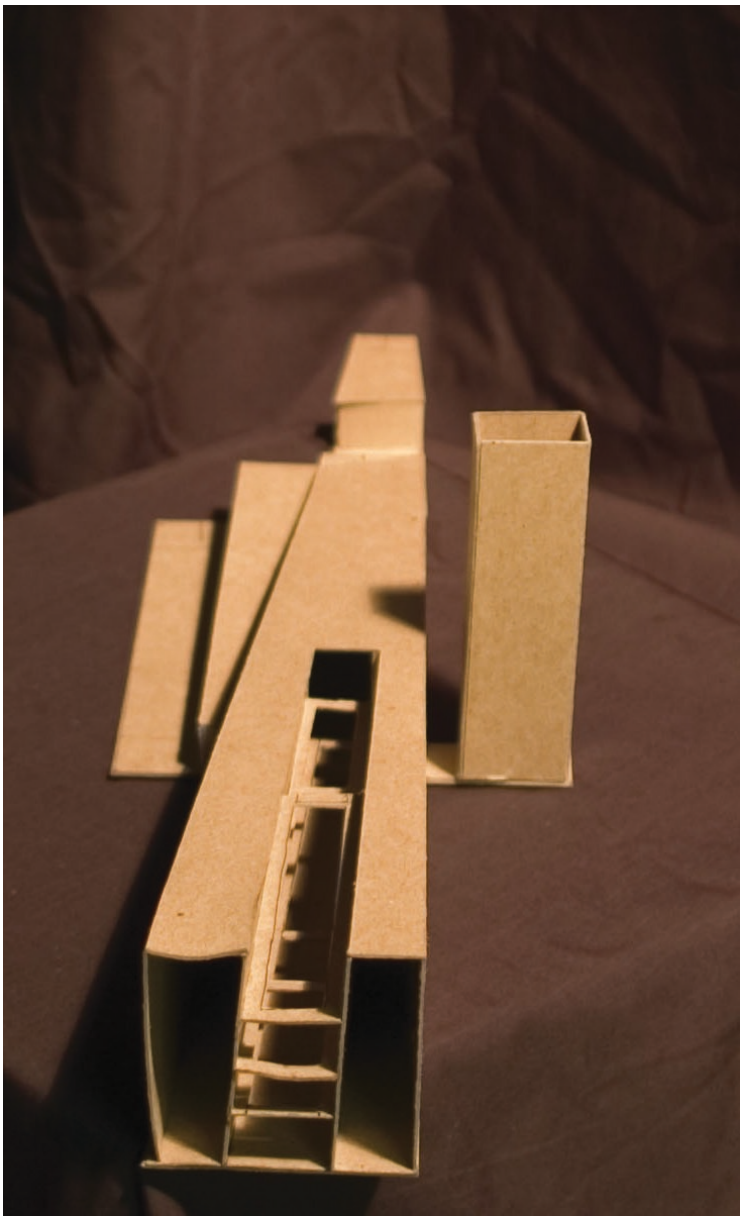


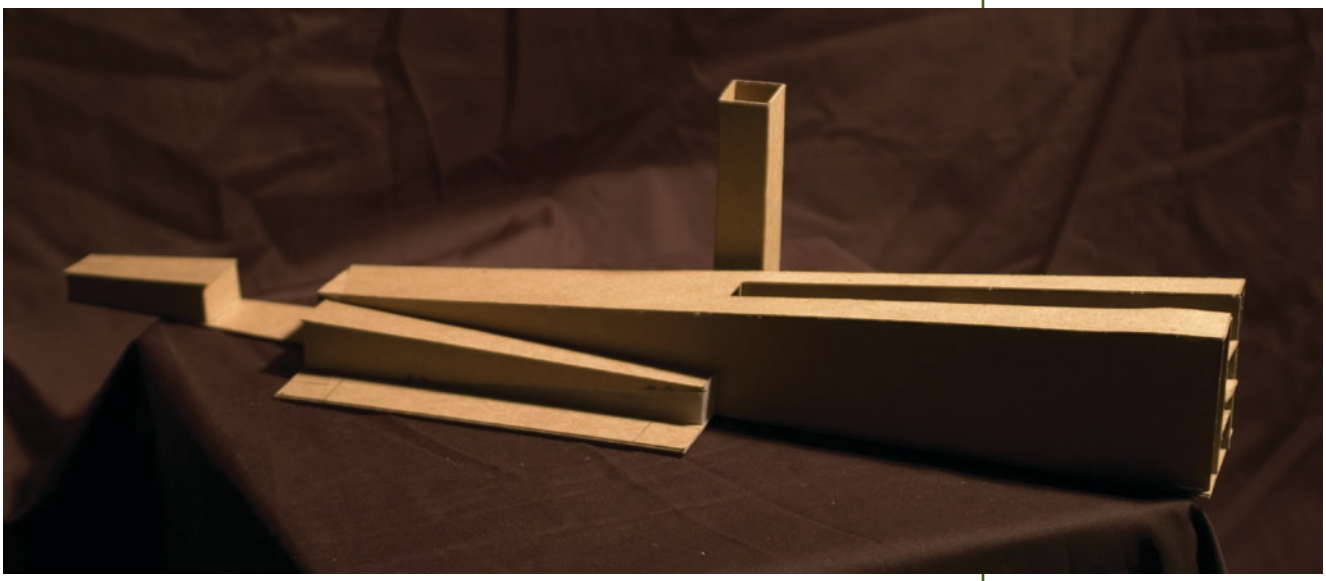




4. design process

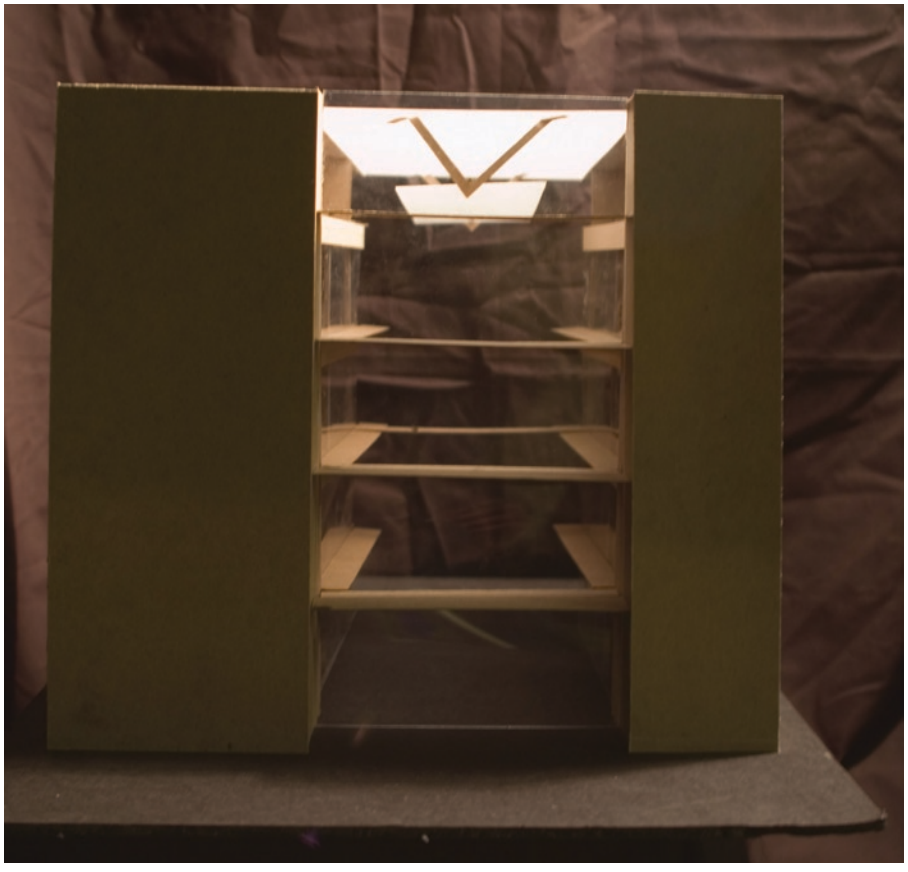
study models





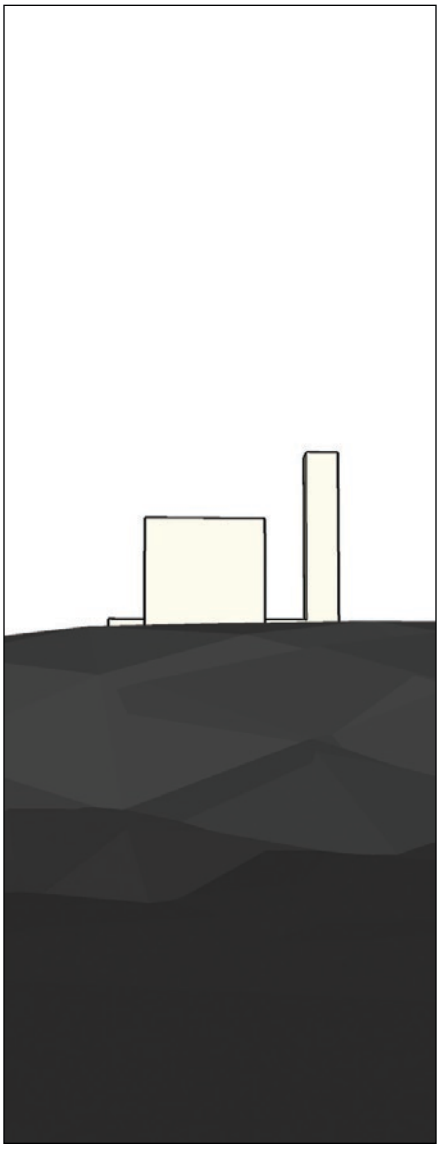
4. design process

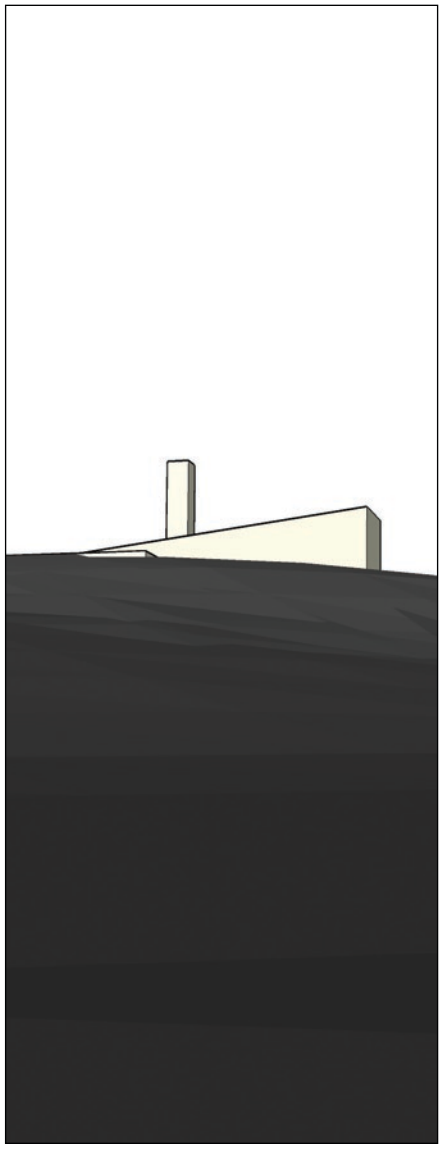
study models

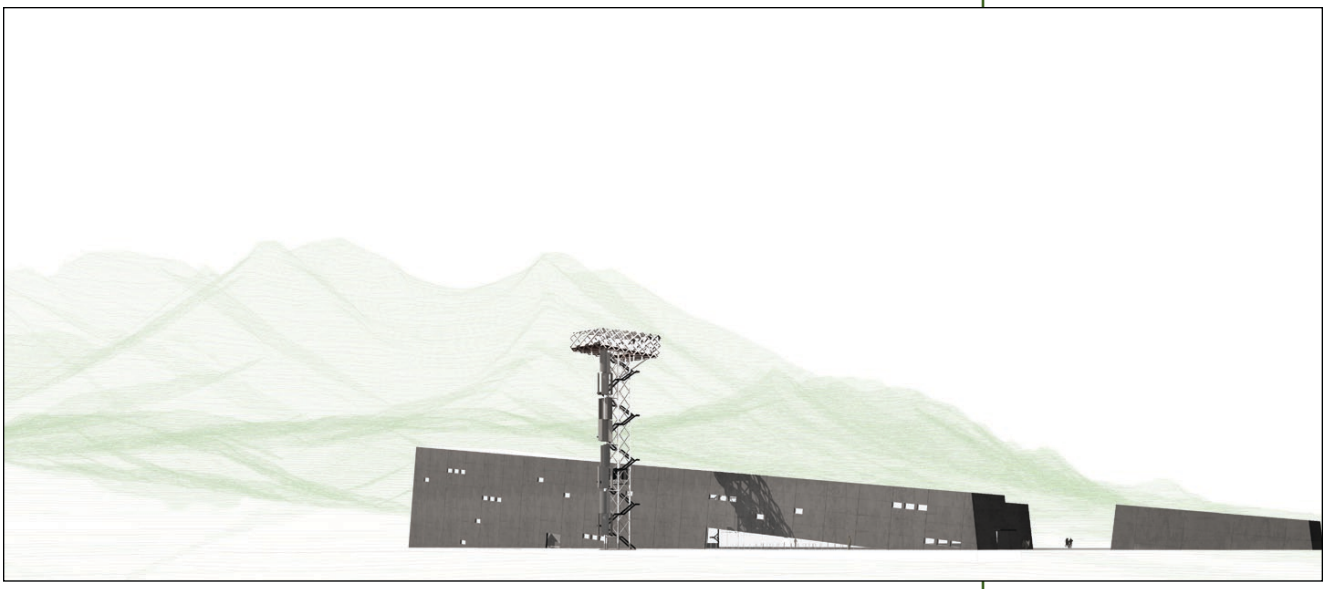


4. design process

study models

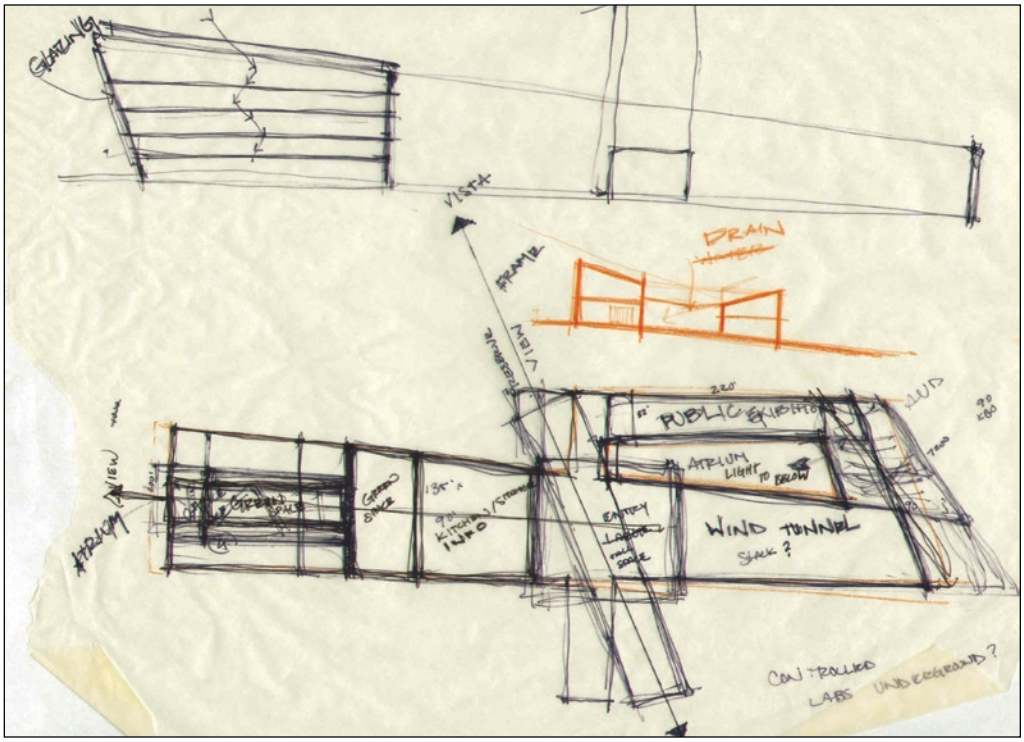


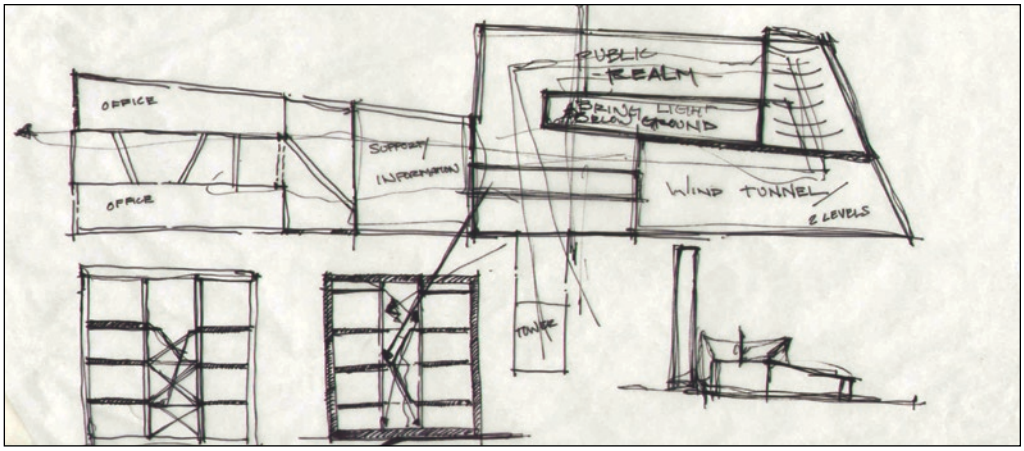


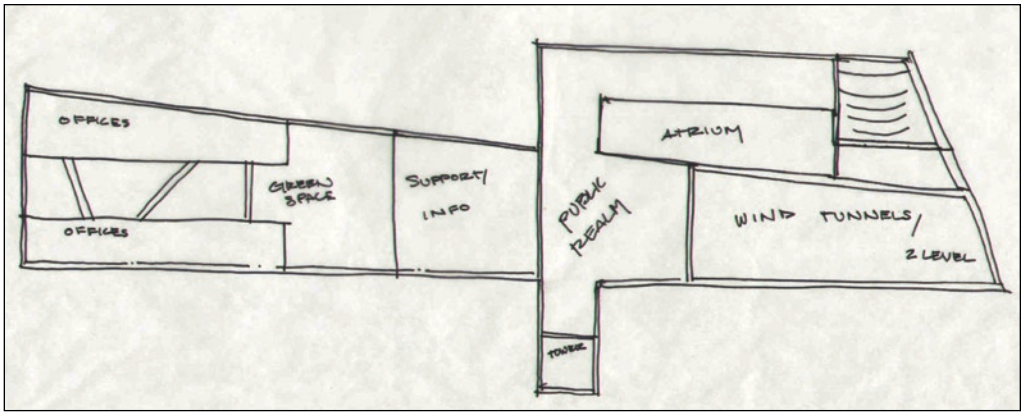


4. design process

design development

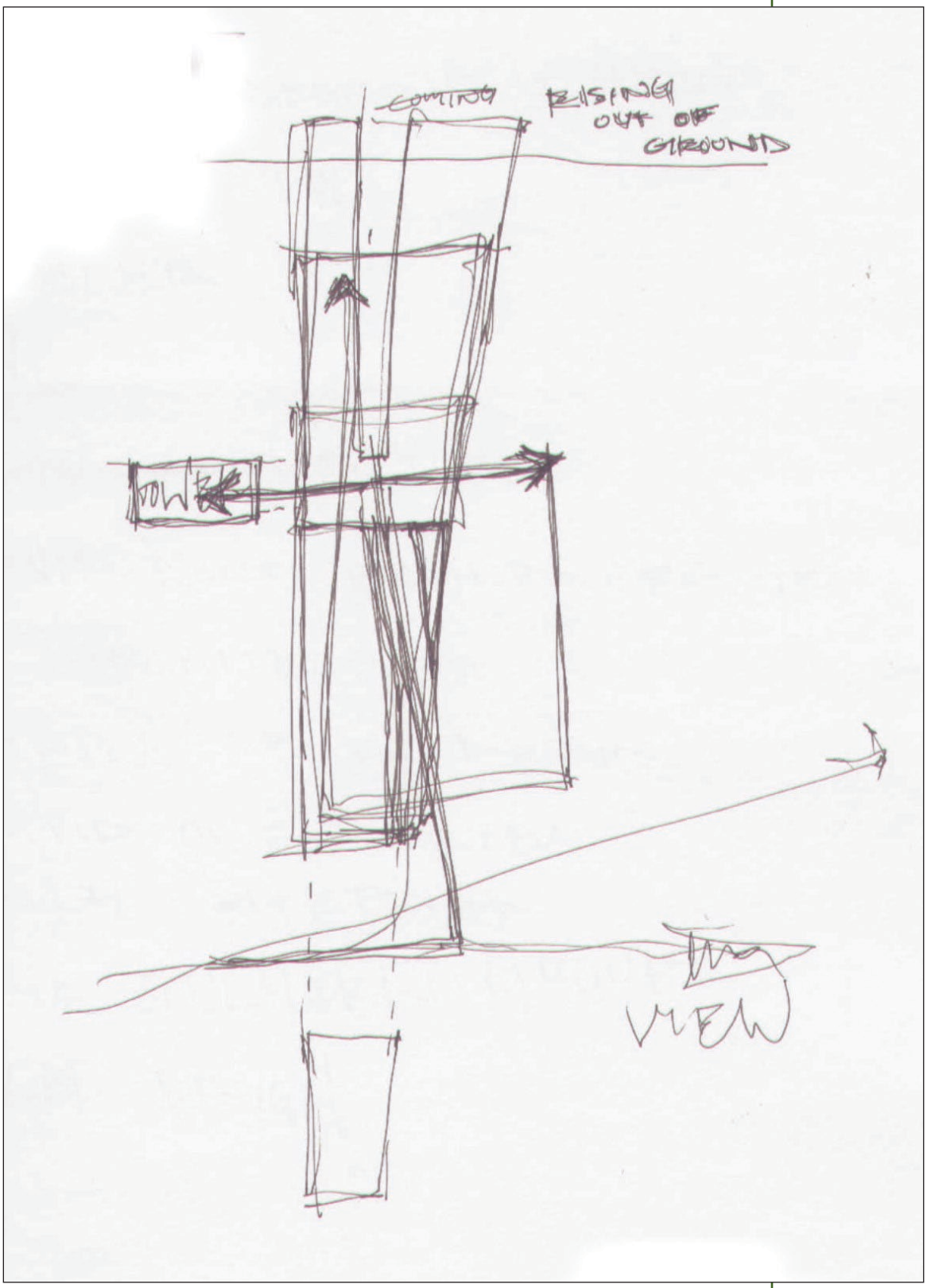


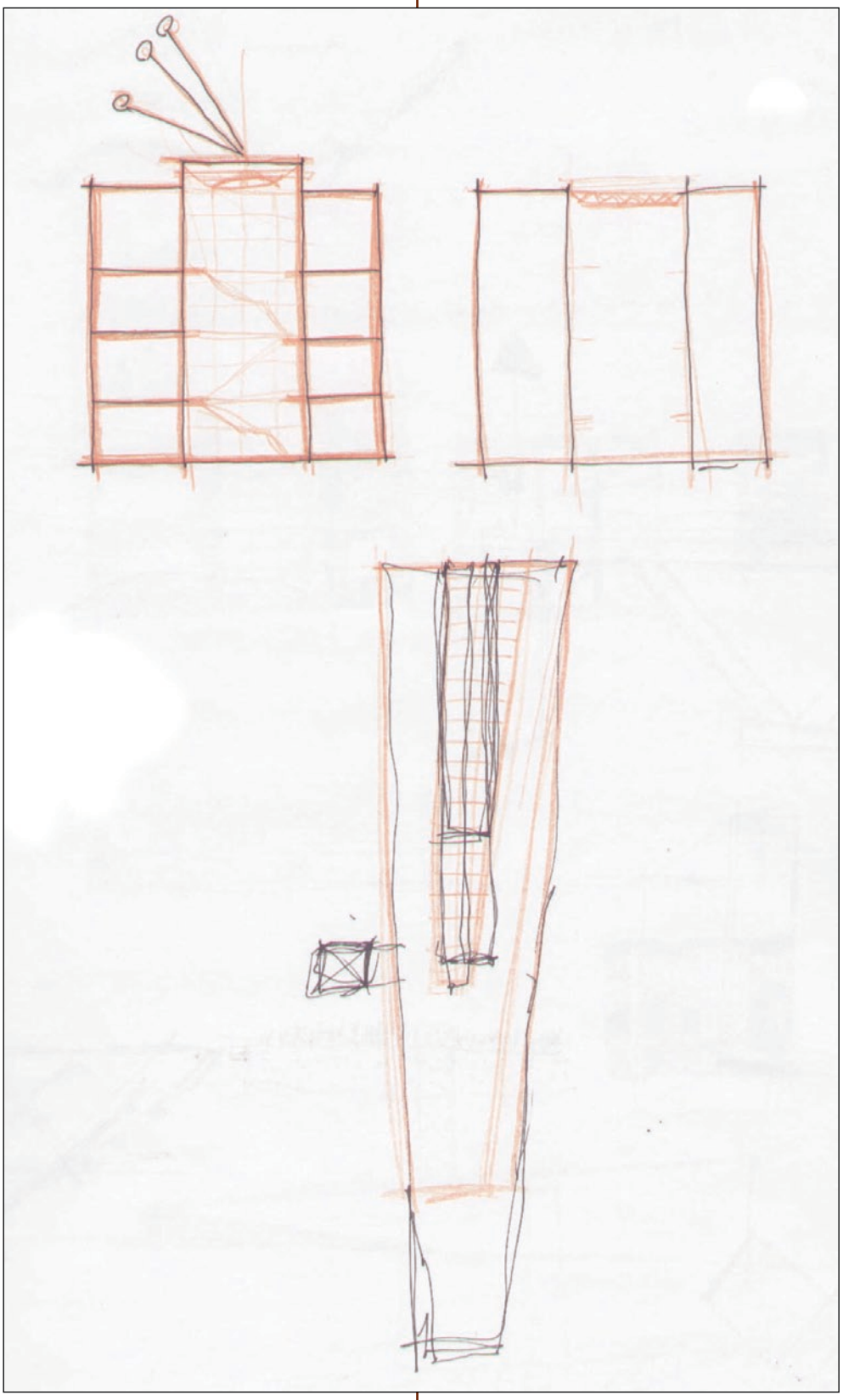




4. design process

design development





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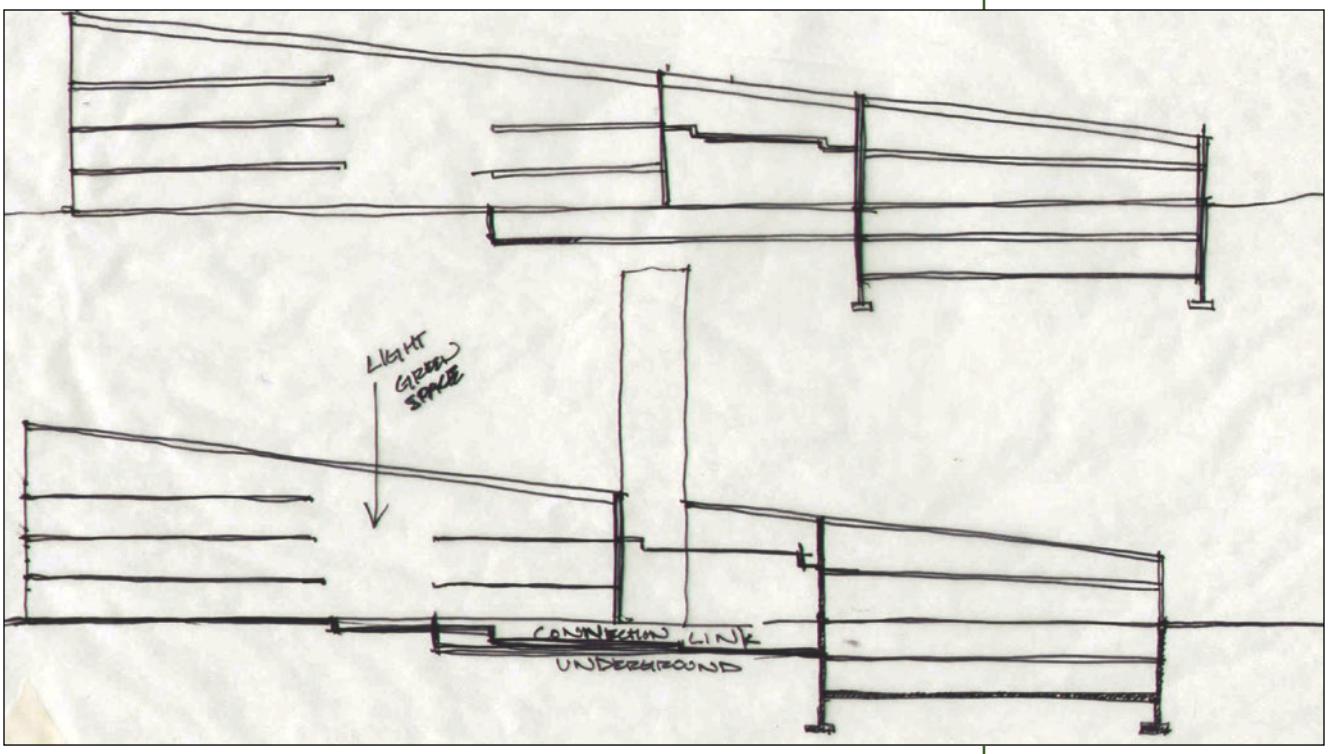

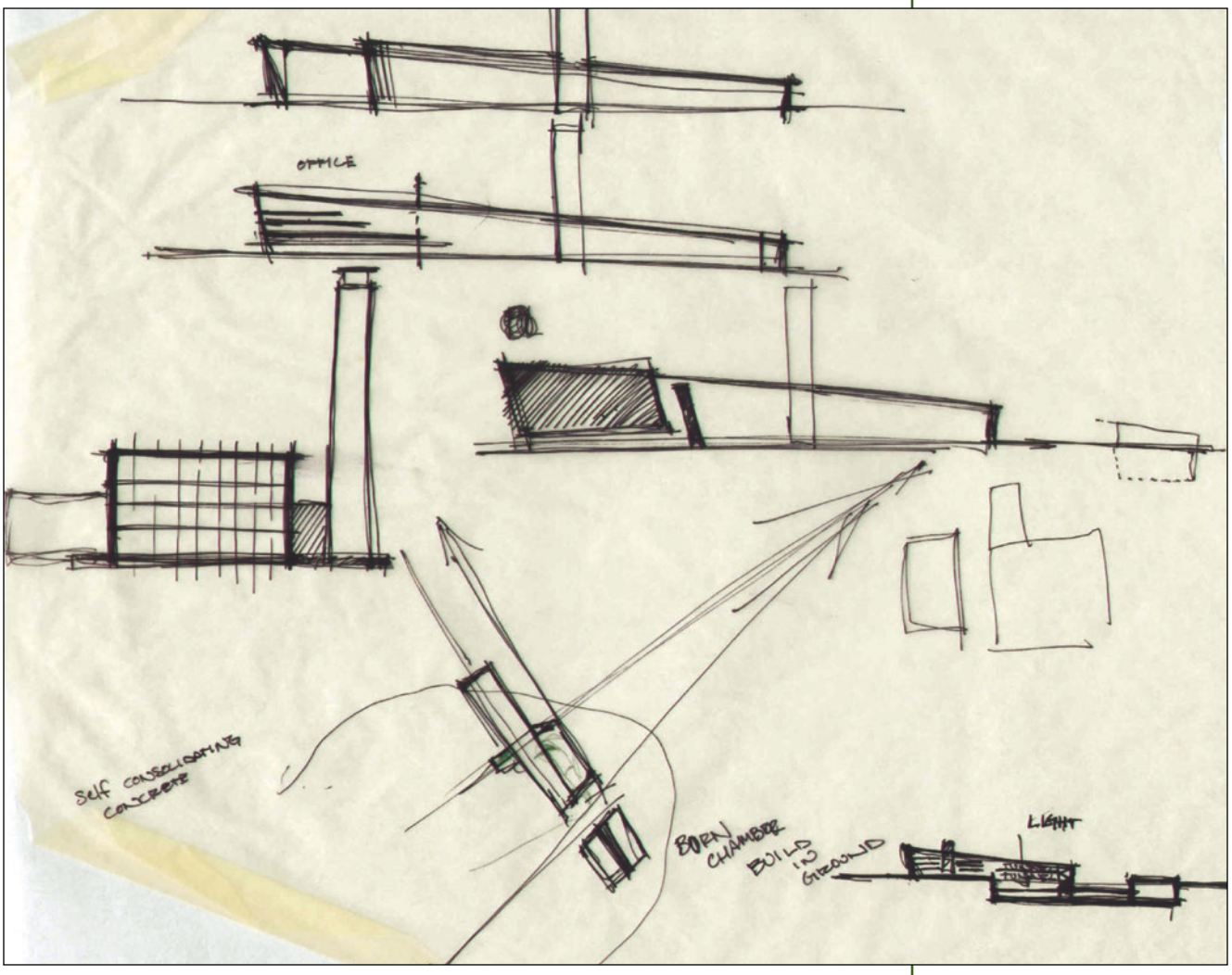

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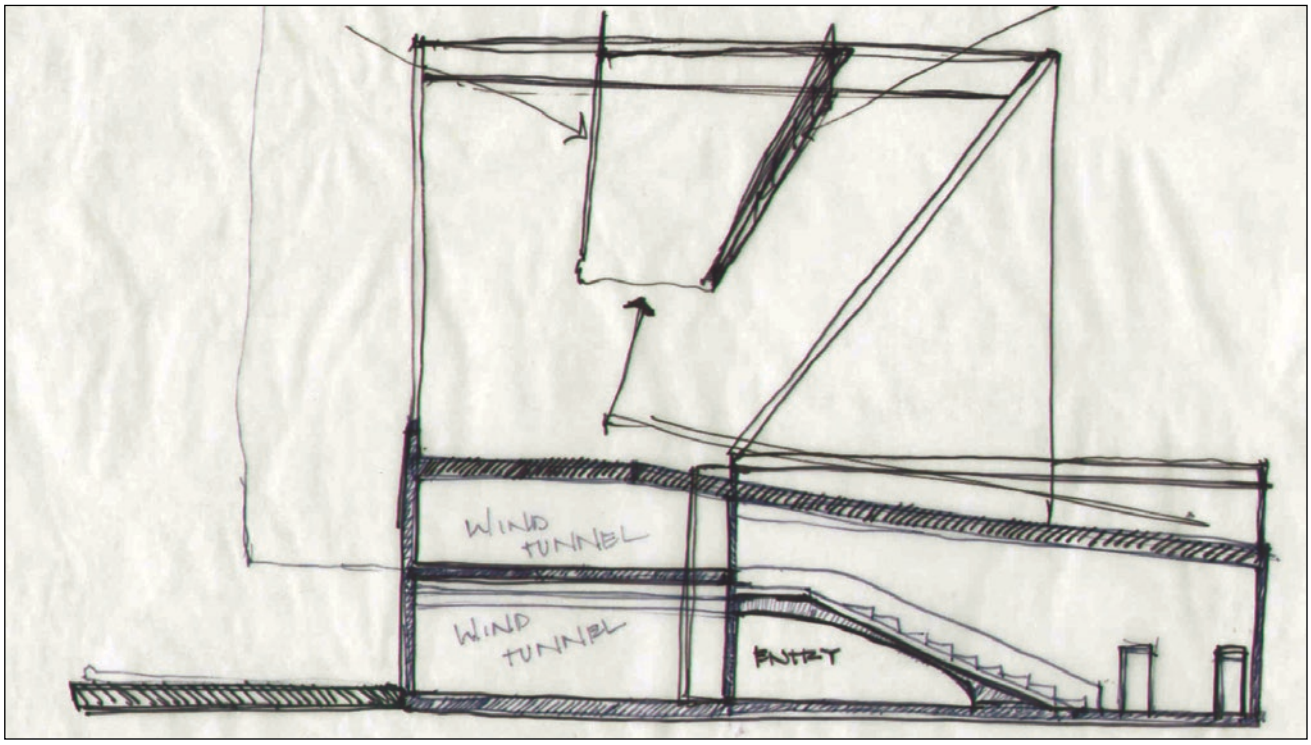

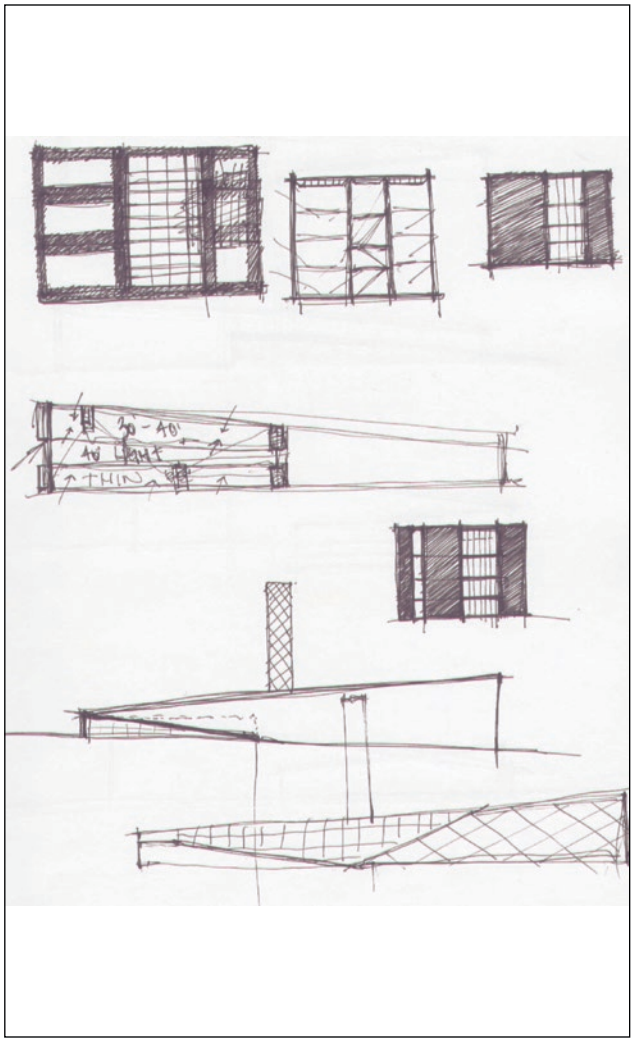

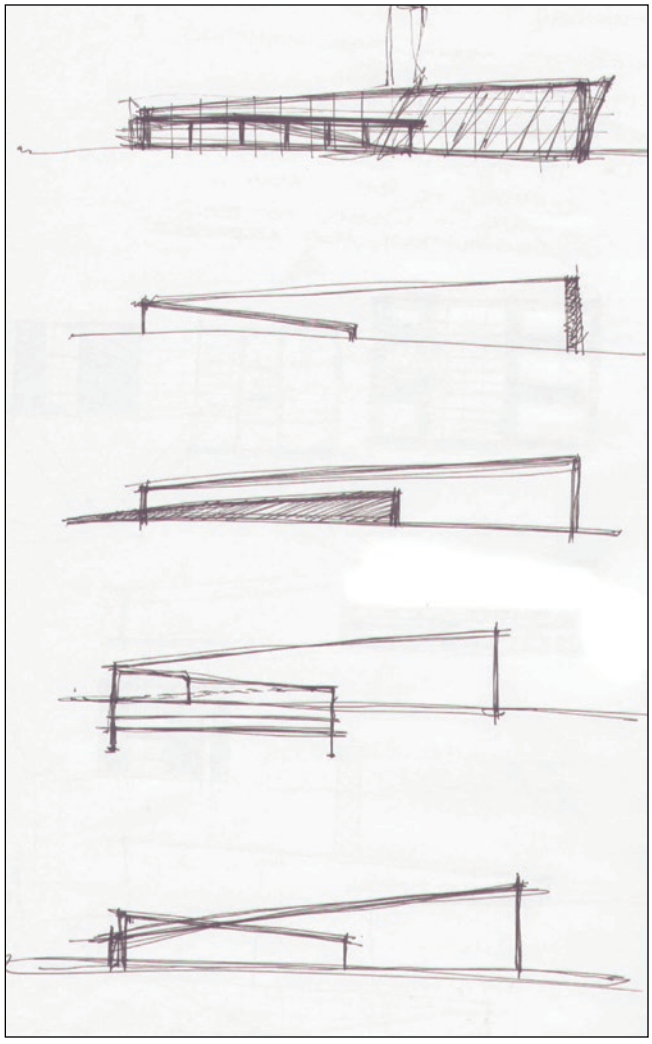

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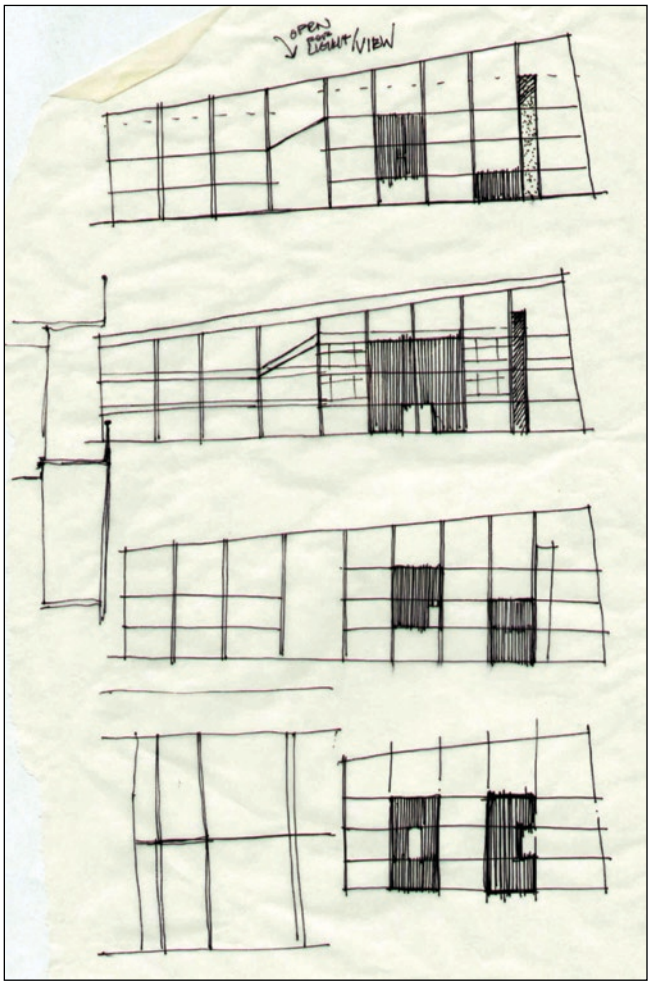

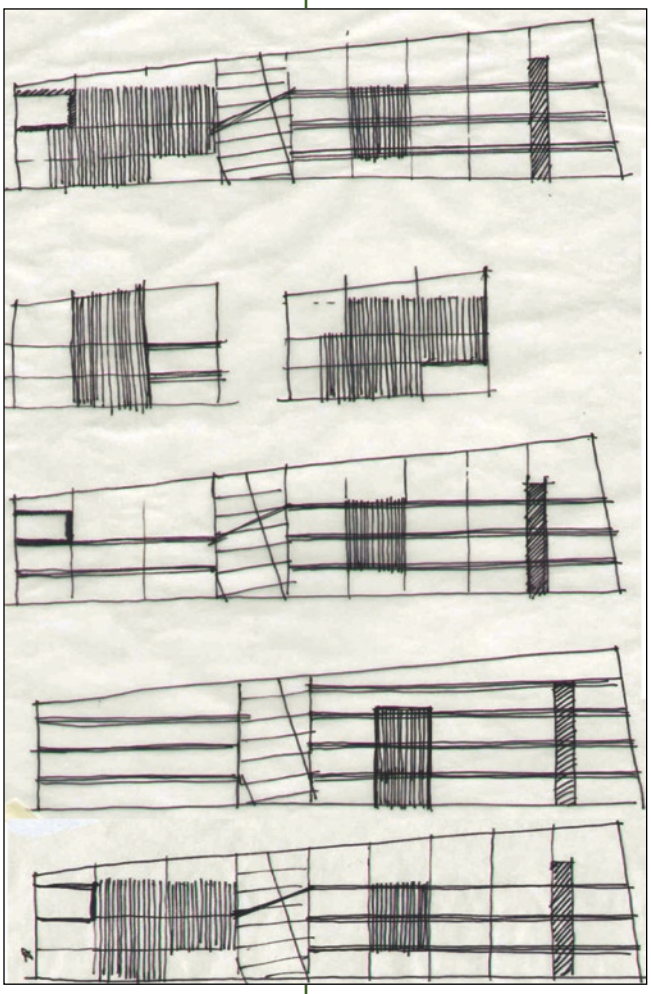

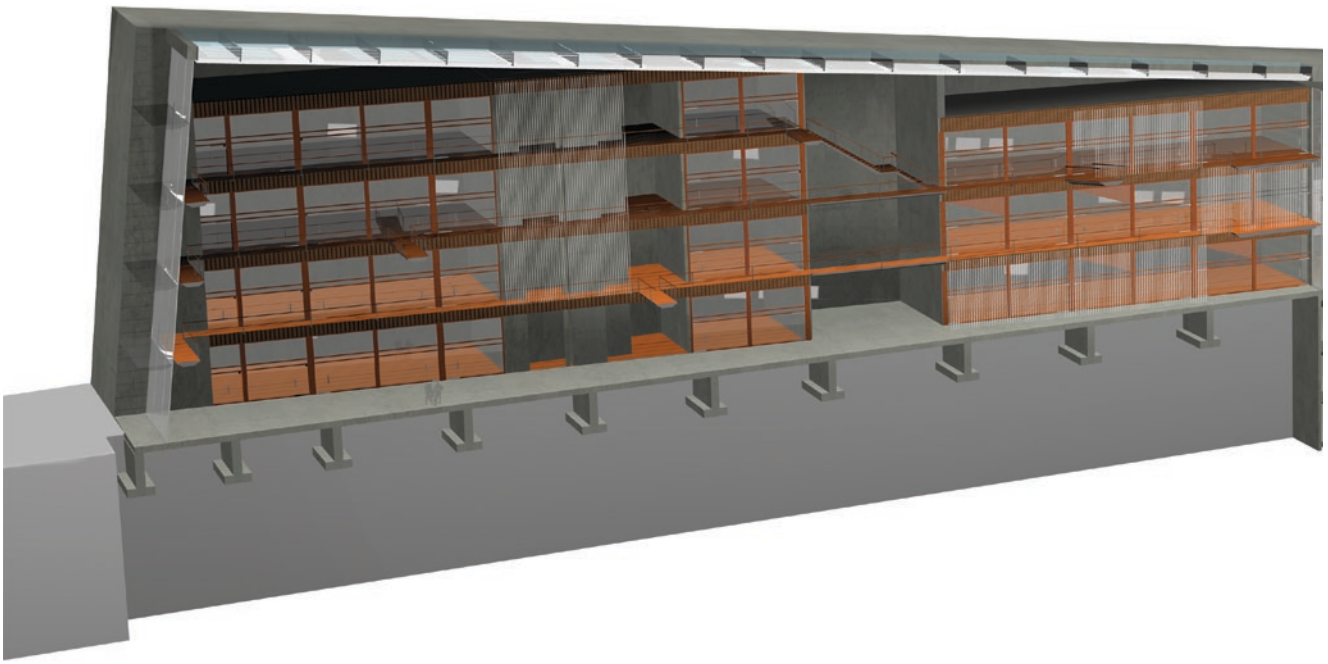

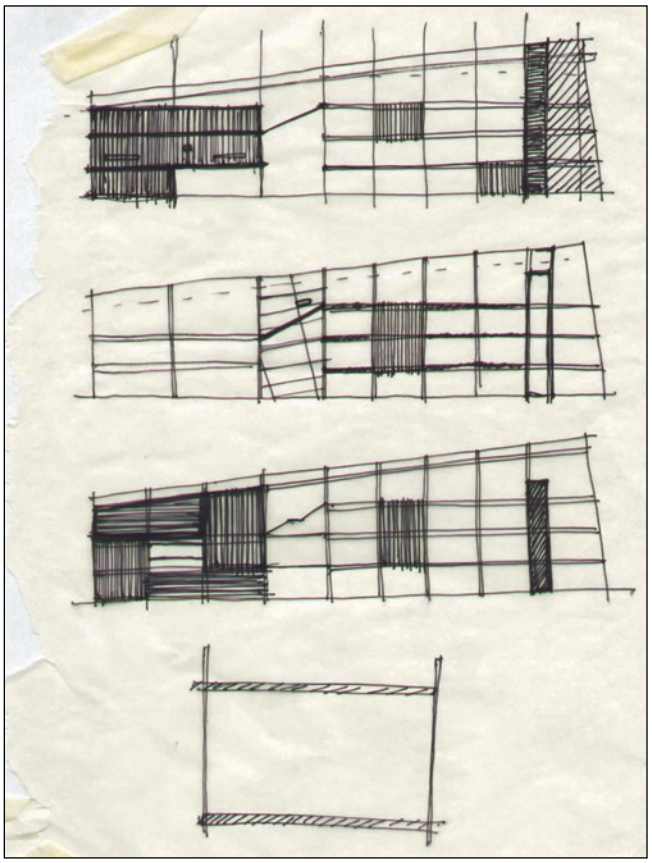

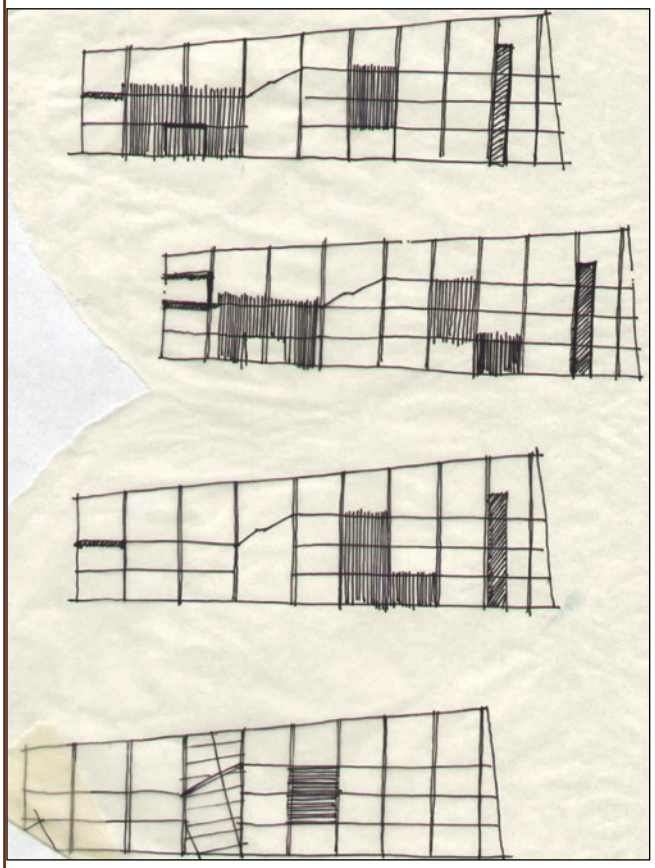

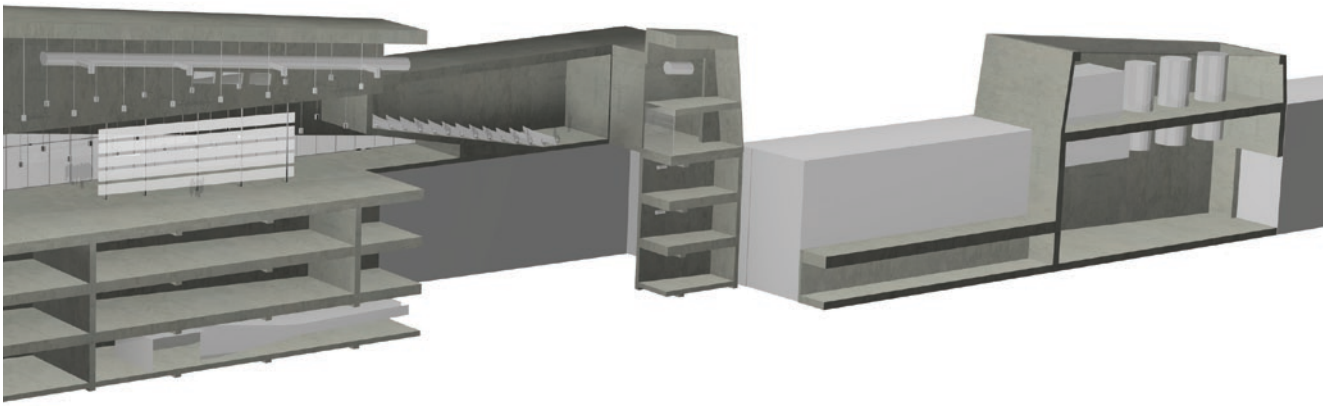

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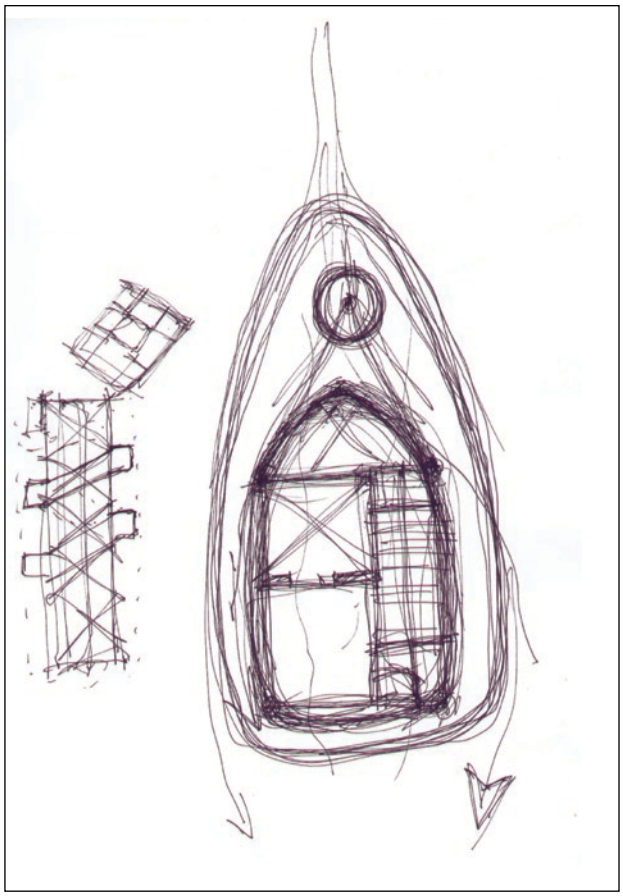

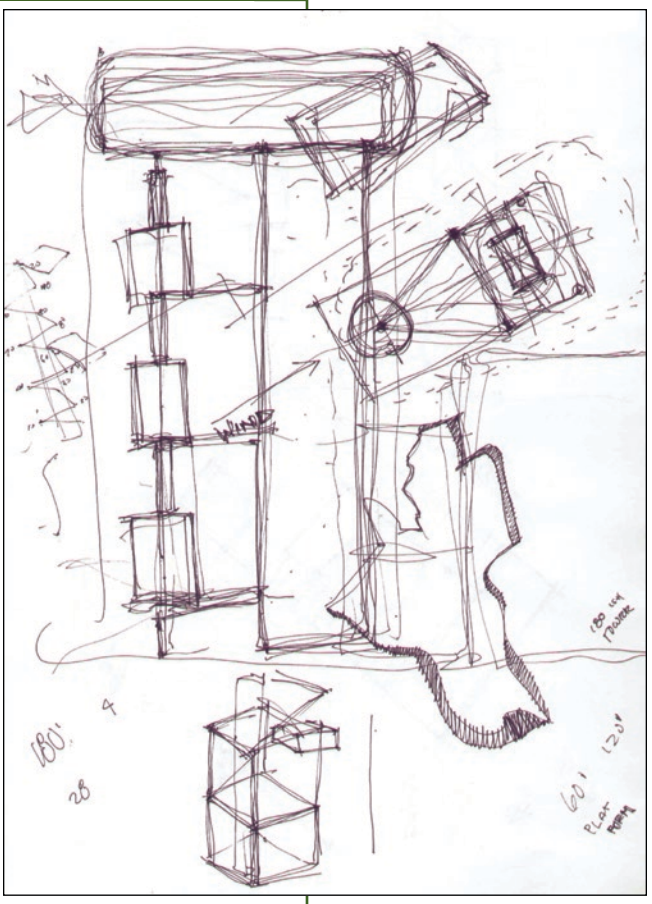

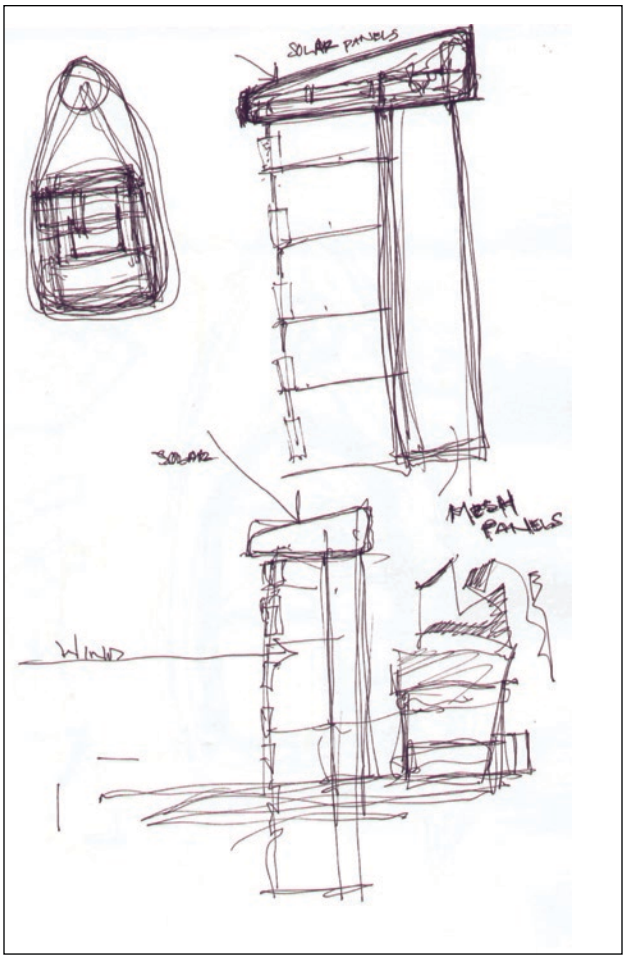

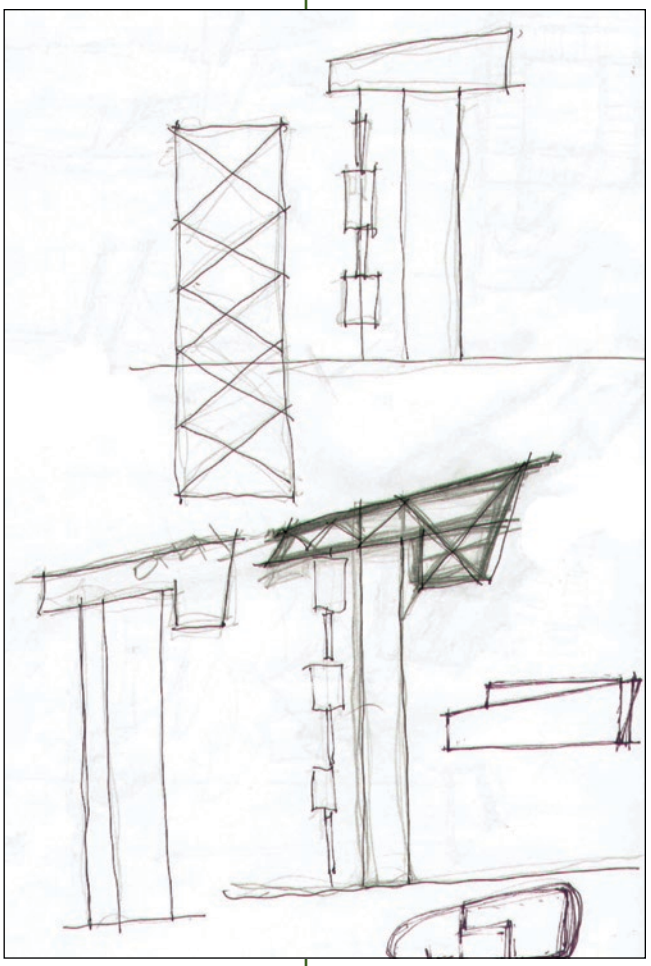

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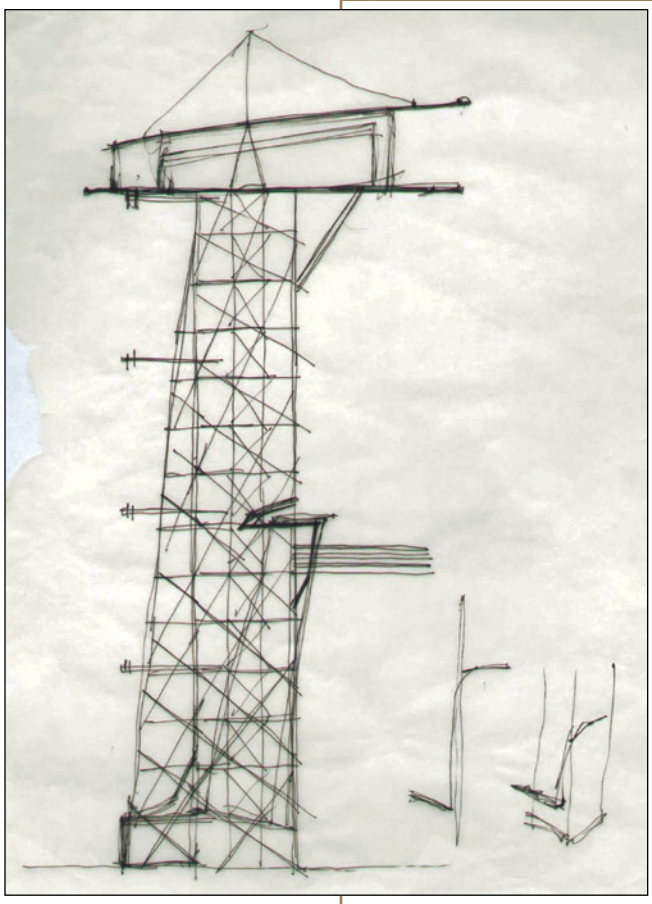

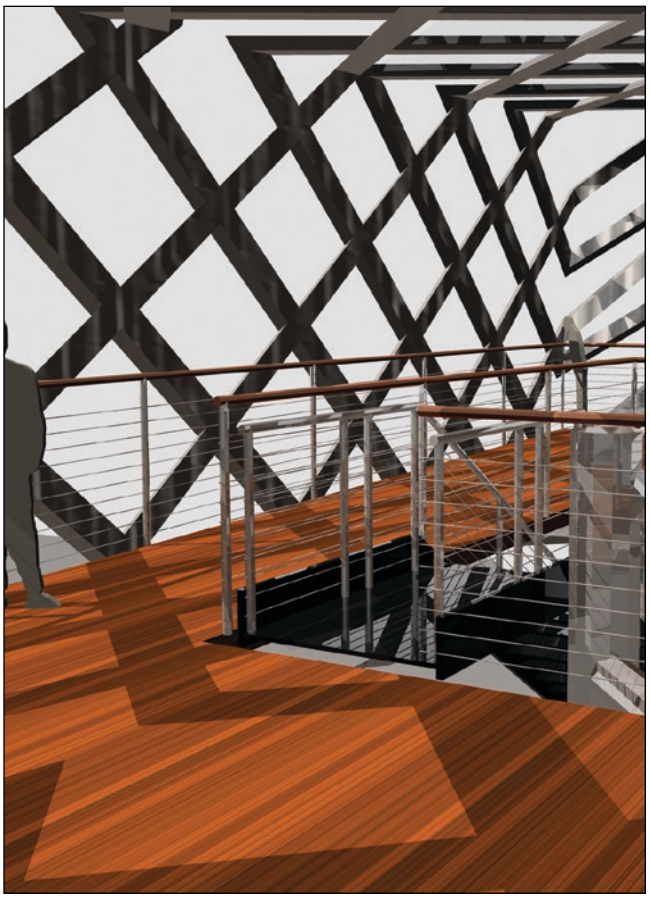

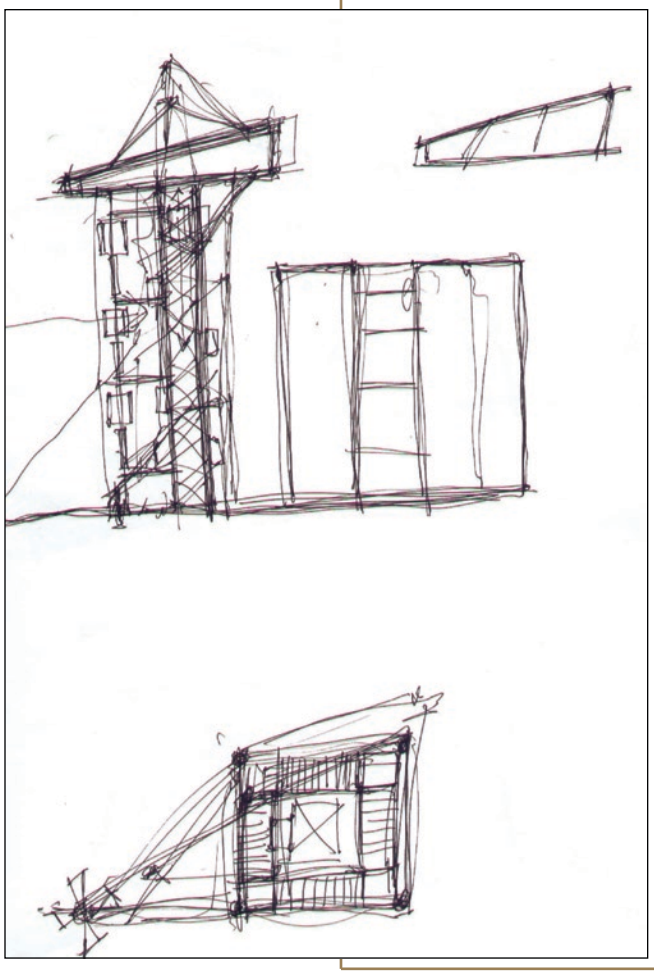

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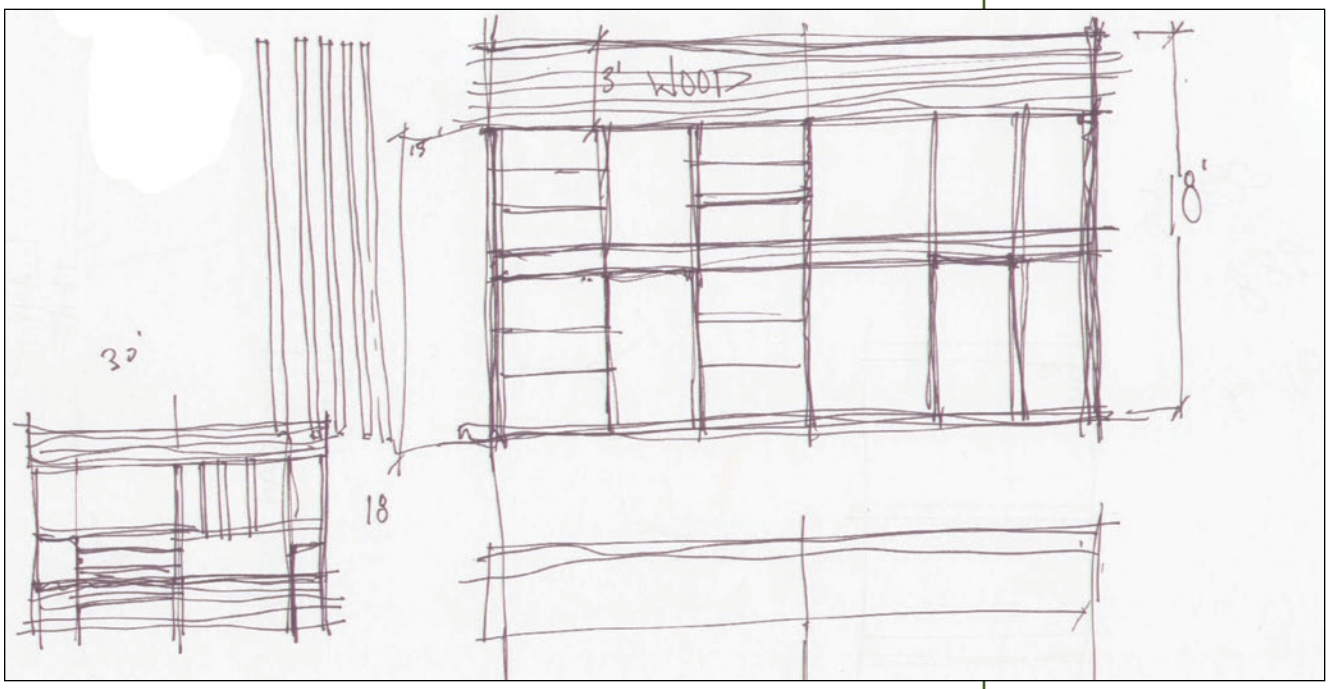

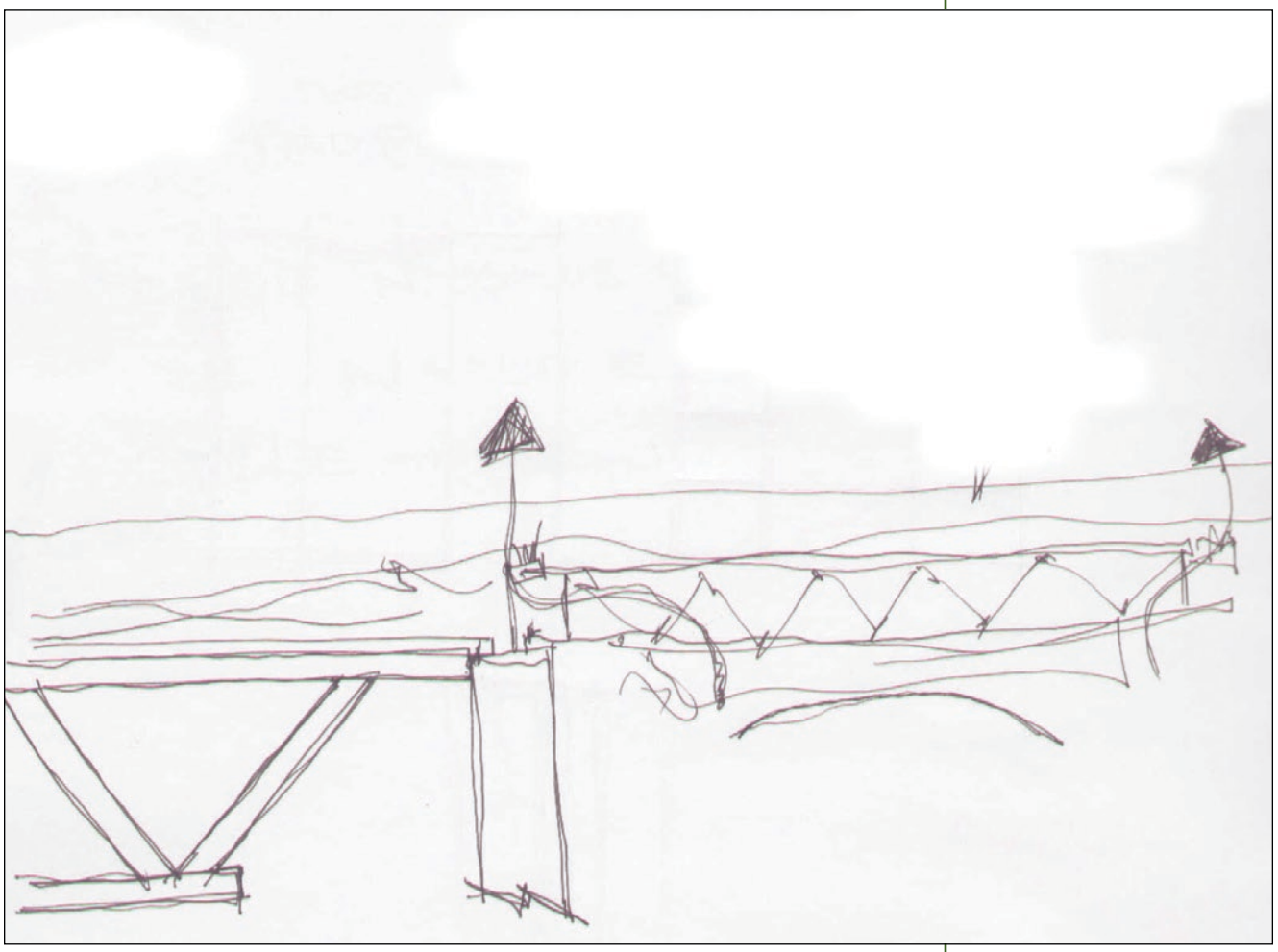

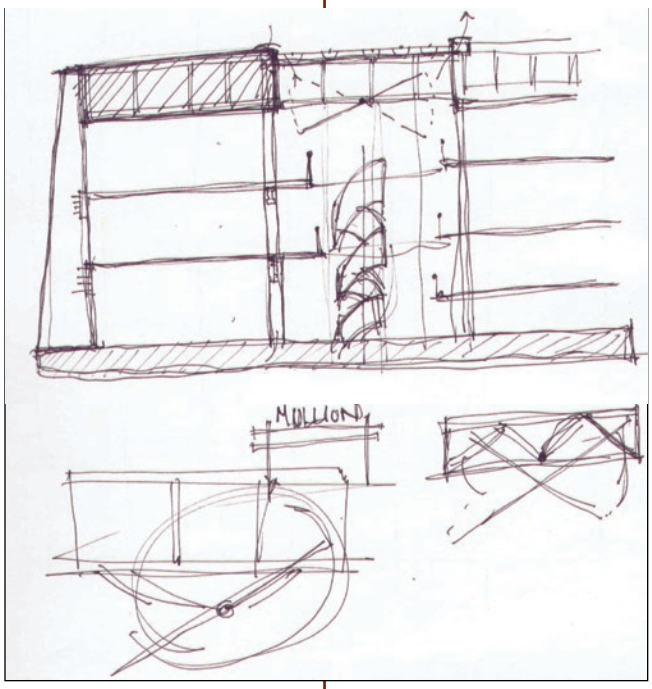
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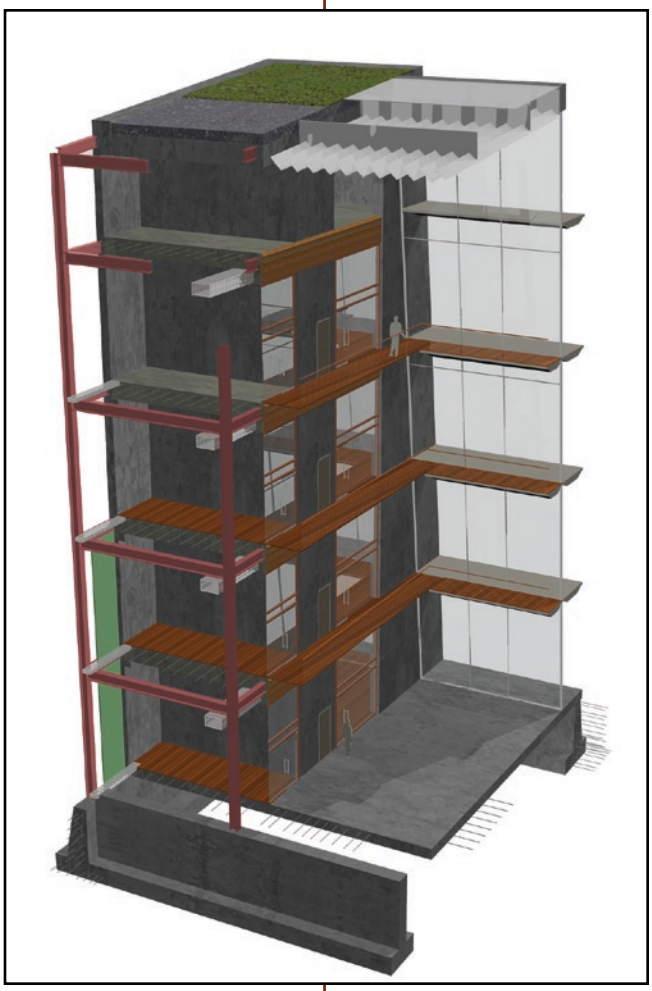

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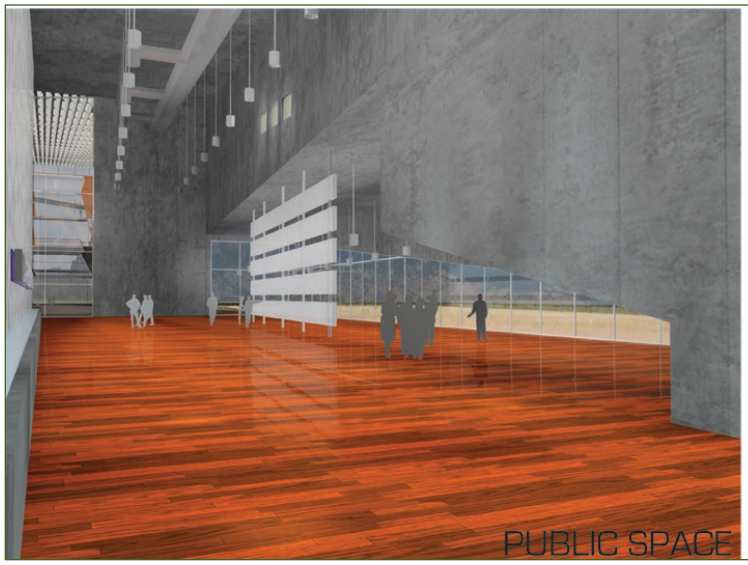
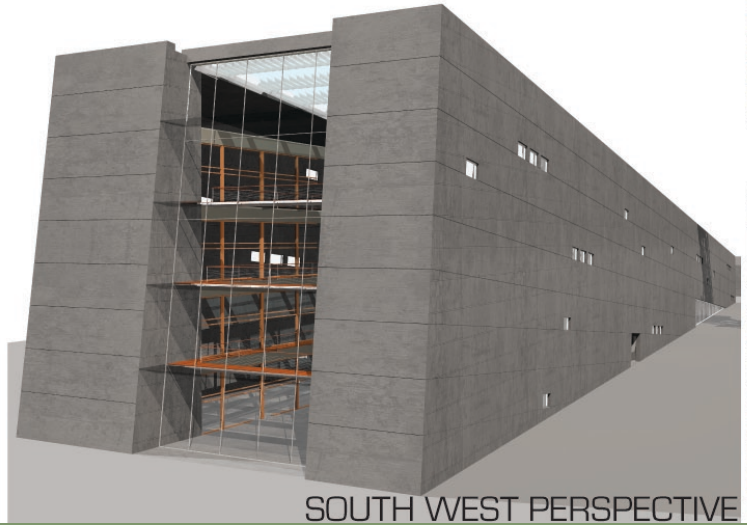
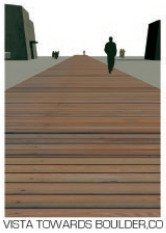


PUBLIC SPACE

WATER WALL



SOUTH WEST PERSPECTIVE

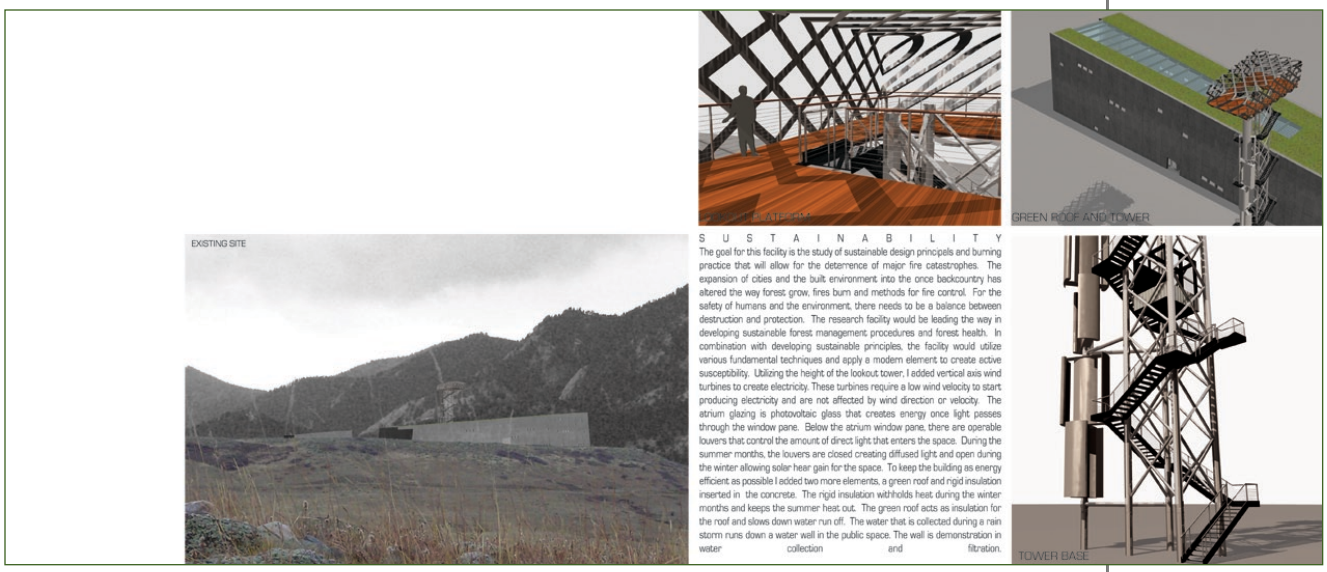


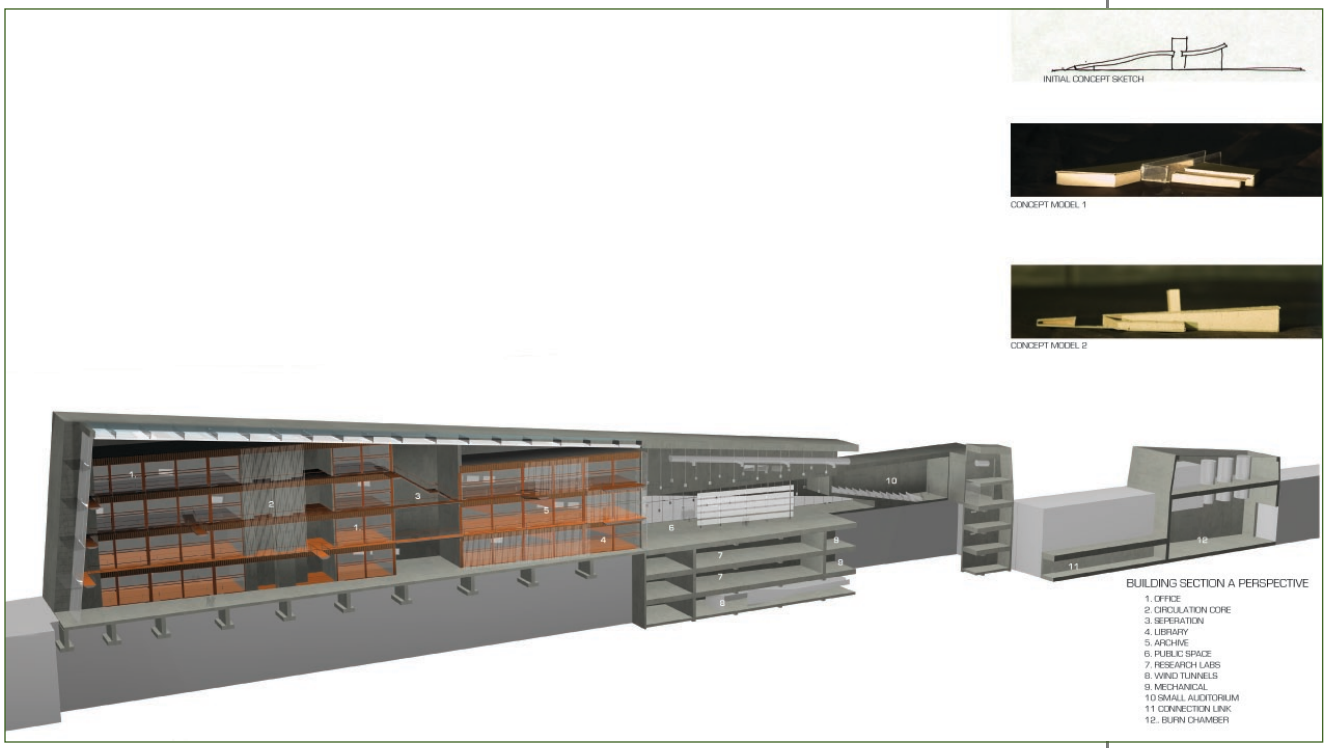
VISTA TOWARDS BOULDER,CO

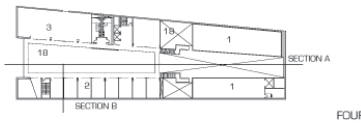
VIEW FROM LOOKOUT TOWER

4. design process

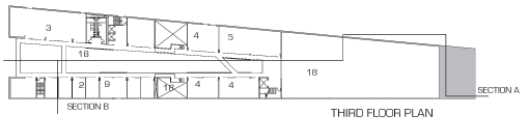
final board design



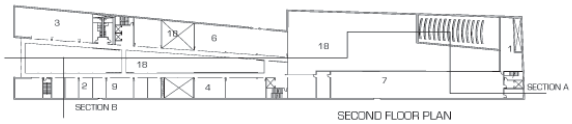




FOURTH FLOOR PLAN
1"=40'



THIRD FLOOR PLAN
1"=40'



SECOND FLOOR PLAN
1"=40'

FORMED BY CONTEXT SCULPTED BY FUNCTION

Large scale masses rising to the sky around the site heavily influence the design of the building. To place the building within the site I used the same idea, raising the building out of the ground in correlation with the mountain range. I also pushed the back end of the building into the ground, accentuating the idea of the building rising out of the ground. Burying the back end of the building was very functional as well, the ground has a very stable temperature throughout the year, making it easier for the research labs to be environmentally controlled. This was also a perfect solution for the burn chamber, public underground and pull it away form the main part of the building reducing the risk of fire spreading on site and to other parts of the building.

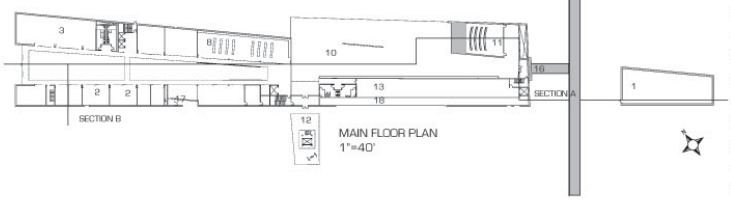
Wild land fire Research

The facility will utilize both laboratory and field experiments to do the studies. These experiments include actual fires, chemical studies of fuels and fuel structure, computer analysis and many studies revolving around the effects of fire flora and fauna.

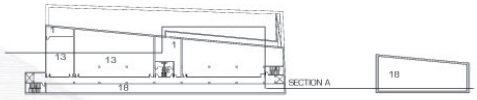
The creation of spaces and form was based on my experiences as a wild land fire fighter. I took my knowledge of the fighting techniques and applied little nuances to the building. I used the idea of 'fire lines' as a design direction for this project. When you look at the exterior of the building you should notice small horizontal reveals, these reveals are like 'scratch' lines that are created by fire fighters when they first appear on site trying to contain the fire. The windows are like 'hand' lines. The hand lines are usually created by twenty person crews, and are much like the hand lines the windows are more noticeable. The creating of different lines was also carried through to the interior. The vertical pieces that you see in the section and the perspective are for visual privacy or light control. These would include the conference rooms, library and computer labs. I then used horizontal wood members to define space around the interior office spaces, such as the railing systems. For the 'blaze' effect, I pulled the spaces functions apart, leaving a large open common area.

S T R U C T U R E

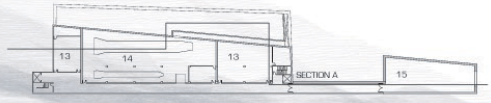
When considering the construction method of this project it had a few criteria that needed to be addressed. First, the building needed to withstand the high temperatures of fire, both internally and externally. I also needed the structure to be flexible enough to allow for large openings in the building facade. Choosing a concrete/steel composite structure, I was able to frame the window openings with the steel structure and then protect the building from fire with the concrete exterior. The same system was used on the interior, the floor slabs and beams are thinner, due to the structural qualities of steel.



MAIN FLOOR PLAN
1"=40'



BELOW GRADE
LEVEL 1 & 2
1"=40'



BELOW GRADE
LEVEL 3
1"=40'

FLOOR PLAN

1. MECHANICAL ROOM
2. RESEARCHER OFFICES
3. SUPPORT STAFF
4. COMPUTER LABS
5. STORAGE
6. ARCHIVE
7. GROWTH CHAMBER
8. LIBRARY
9. CONFERENCE ROOM
10. EXIBITION/PUBLIC SPACE
11. SMALL AUDITORIUM
12. WIND TURBINE/LOOKOUT TOWER
13. RESEARCH LABS
14. WIND TUNNEL
15. BURN CHAMBER
16. MAIN PUBLIC ENTRANCE
17. EMPLOYEE ENTRANCE
18. OPEN TO BELOW

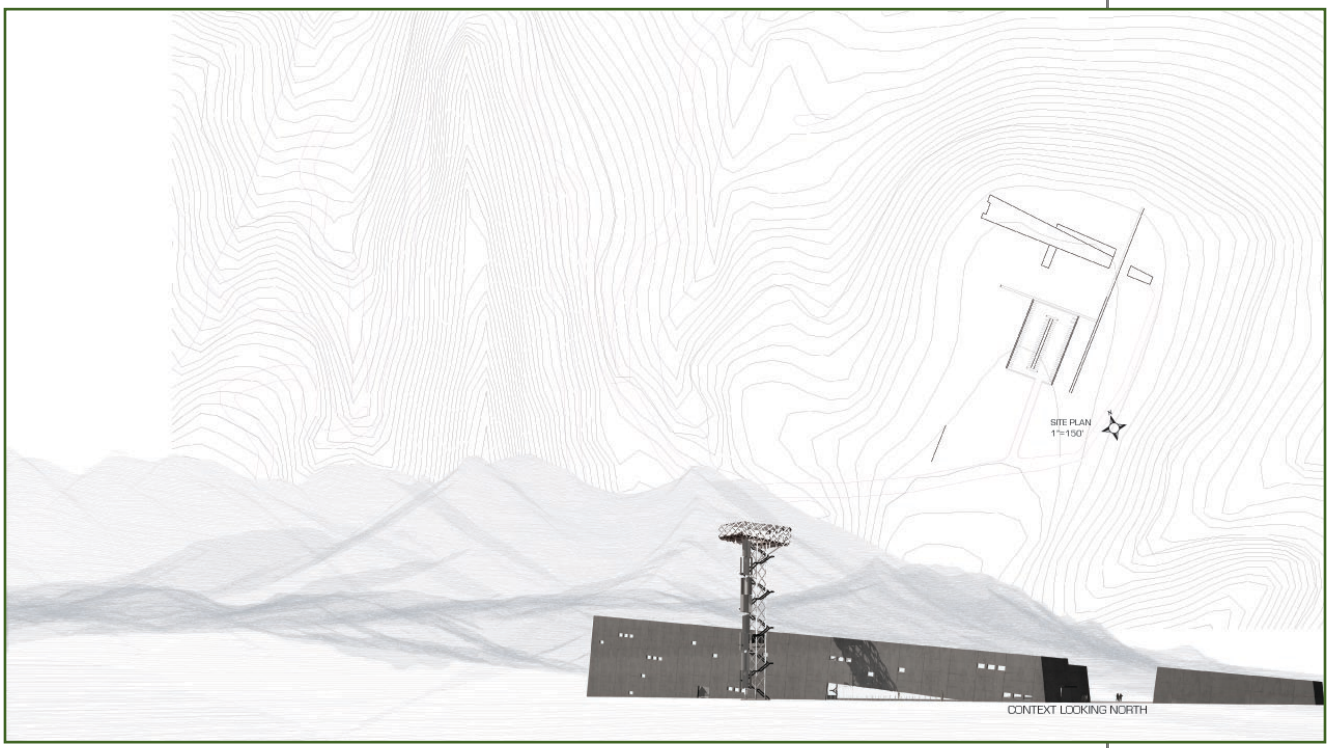
SITE

The project is located just south of Boulder, CO. The site is nestled on the foothills of the Rocky Mountains. The state of Colorado has a substantial fire season every year, which makes it a great place for fire research.

To be a successful research facility for the future, the research spaces needed to be as flexible as possible. The field of research is constantly changing requiring flexibility and independence. I addressed this issue by creating multiple mechanical spaces. Each research lab space has its own mechanical space attached to it. By allocating individual mechanical spaces, each lab can be performing different research and be able to change the type of research without affecting other labs in the building.

4. design process

final board design



5. program appendix

Interview Via E-mail

Bret W. Butler, Ph.D.
USDA Rocky Mountain Research Station
Fire Sciences Laboratory, Fire Behavior Project

1. Approximately how many researchers are on staff? Is there a minimum number of support staff needed for the researchers, like research aids?

Scientists: approximately 20
Support staff: 60

2. Approximately, what is the building square footage in which the studies are being performed?

Laboratory space:8,000
Storage Space: 15,000
Office Space: 20,000

3. How does one study fire and what kinds of activities are included in the research?

Through both laboratory and field experiments. Experiments include actual fires, chemical studies of fuels and fuel structure, computer analyses, and because this is wildland fire, many studies revolve around the effects of fire on flora and fauna.

4. What kinds of spaces are required for the research?
i.e. Controlled labs, Group labs, Individual labs

Large spaces with capability to control temperature, humidity and wind over the entire range of physically possible conditions found in nature. Groups labs for larger scale studies and individual labs on the order of 1000-2000 square feet for more specific studies. We are unique in that our facility includes a large environmentally controlled chamber for fire experiments and two large wind tunnel in which we can control air temp, humidity and wind speed for fire experiments. The working cross sections are 10'x10'/80' and 3'x3'x60' We would like a larger burn chamber on the order of 40'x100' long by 30' tall. We also would like additional space with capability to control temp humidity and growth lights that could be used to simulate natural diurnal cycles and growing conditions.

5. Are there any suggestions that would help create a better research environment?
i.e. Spatial relationships, Number of spaces, Break rooms

We have limited office space which has been addressed through use of modular buildings.

6. Is there any information that you may feel relevant that will help me understand the fire research facility?

You should look carefully at the www.firelab.org website to understand range of studies.

5. program appendix

Thesis Abstract

The project typology is a university institute for the study of prairie, woodland and forest fires located in Western Colorado. The thesis will examine the need for natural fire and the need to control fire in populated areas.

Statement of Intent

Project typology:

A university institute for the study of prairie, wood land and forest fires located in Western Colorado.

Theoretical Premise:

The thesis will examine the tension between the need for natural fires and the need to control fires in populated areas. Design metaphors, analogies and or tectonics will be developed from the examination.

The Project Justification:

Our ability to sustain ourselves in the future means coming to terms with natural forces such as wildfire. The project addresses one of these forces.

Project Narrative

Humans' epidemic desire to control what we inhabit has lead to years of domineering thought in how we design and use our environment. Our lust for power and control has given humanity a false sense of superiority to natural forces, a sense in which we dictate the boundaries of natural elements without regards to consequences. Our design shortcomings have been battered as of late with the devastation inflicted by Hurricanes' Katrina and Rita throughout the Gulf Coast Region. The tragedies are a reverberating reminder that we as humans/designers need to facilitate a healthy balance with nature and its overwhelming powers.

My interest in coming to terms with nature will be investigated through the destructive force of fire. As people push further into the wilderness for habitation, there has been a transformation in the natural environment and how fire affects these spaces. Our ability to sustain ourselves in the future means coming to terms with natural forces today. To facilitate such an investigation, a university institute will be the catalyst for the research. The university institute is a typology that is synonymous with learning and expanding of knowledge, a building complex that accommodates new ideas and an overall better understanding of the subject at hand.

5. appendix: proposal

User/Client Description

The premise of the thesis indicates a user group that focuses on understanding and formulating philosophies based on fire. The main client for this project will be the University of Colorado at Boulder. Members associated with the university that will use this building include graduate level students and the faculty who also do research when not working with the graduate students. I believe that there also might be the need to have a full time research staff associated with this building. Upon further research, the user group might expand and include the general public, which will dictate the need for public and private space.

Major Project Elements

Research Space

The research component of the Fire Research Institute will be the largest component of the building. This component will include research labs, computer simulation spaces, and experimentation facilities, which includes the thousands of acres of forests in the state of Colorado.

Information Spaces

This component of the research institute will include researcher offices, graduate spaces, libraries and archives of research information. These are spaces for individuals to go to after they have performed their research, a sanctuary to allow these individuals to reflect and escape the rigors of their research.

Interpretative Center

At this present time there is the possibility of adding an interpretative center for the general public. This space would include museum/exhibition space and an auditorium. The museum space would allow the general public to interact and better understand the study of fire, while the auditorium would be space for the researchers to give presentations and educate the public. Upon doing further research I will be able to determine if I will incorporate these spaces into the design.

5. appendix: proposal

Site: Macro to Micro

For this thesis project, I have not determined a specific site which to proceed from. The site has been narrowed to Boulder, Colorado for various reasons, including the proximity to a major university, site relationship to the study at hand and the existing research models for study.

I can only be general with aspects related to topography and landmarks. The site will likely be nestled in the foothills or on a plateau of the Rocky Mountains. The site will need to be a space which is open but yet sheltered by trees from the elements. I feel that the site will need to have an un-obstructed view of the surrounding area for research reasons. The site, at this point in the research, will not be located on the University of Colorado's campus. The lack a specific site hinders me from providing information regarding demographics, history and the economic base of the site.

Project Emphasis

The study of sustainable design and burning practices that allow for the deterrence of major fire catastrophes. The expansion of cities and the built environment into the once back country of this country has altered the way forests grow, fires burn and the methods for fire control. Through the thesis project I will look at our ability to come to terms with the forces of fire. For the safety of humans and the environment there needs to be a balance between destruction and protection. It is unhealthy for forests not to burn but, the current state of the woodlands does not allow for the uncontrolled burns that once occurred. An uncontrolled burn would be catastrophic to the environment as well as the structures located in these areas.

5. appendix: proposal

Plan For Proceeding

Definition of a research direction:

The thesis research and analysis will be by a mixed method, quantitative and qualitative approach. The approach employed will be one of a concurrent transformative strategy that will be guided by the theoretical premise. With the strategy at hand, both quantitative and qualitative data will be gathered concurrently. Priority will be assigned by the requirements of the theoretical premise. The integration of the data will occur at several stages in the process of the research and will depend on the requirements of the examination of the theoretical premise. The methods of research will include computer simulations, controlled burns, historical forest density, laboratory investigation, fire fighting principles and urban sprawl. Analyzing, interpreting and reporting of results will occur throughout the research process.

The collection of quantitative data will include but not limited to statistical and scientific data. Statistical data is to be gathered and analyzed locally or obtained through an archival search. Scientific data is the measurement obtained through instrumentation and or experimentation, either gathered directly or through an archival search.

Qualitative data will be gathered from direct observation, lo-

Plan For Proceeding

cal survey, an archival search and direct interviews.

Design Methodology:

The process of design will be explained in two manners, a graphical analysis fashion and a language based manner. The graphical analysis will include the following; an interaction matrix, interaction net, Venn diagramming, morphological charting and others means which all can be explored with the aid of software. Language based design can be broken down into three components; philosophical logic through adduction and deduction, phenomenology examination of objects or events as they appear in experience and dialectical argument.

Documentation of the Design Process:

The design process will document the progression of ideas in a digital manner including photography, scanned images and digital drawings. Along with the digital documentation, documentation will occur with the use of sketchbooks.

Schedule of Work:

Working on the thesis will require establishing a weekly schedule for the design process. The schedule should include critical milestones, such as data analysis report dates, as well as the meeting times with the advisor. This schedule should be written as well as being graphic. The following

5. appendix: proposal

Plan For Proceeding

schedule would be an example of a schedule documenting the critical milestones of the design process.

Preliminary Proposal due	OCT 13, 2005
Final Proposal due	OCT 27, 2005
Site Visit	OCT 28-31, 05
Program due	DEC 08, 2005
Mid Term Reviews	MAR 6-10, 06
Thesis due	APR 24, 2006

Previous Studio Experience

2nd Year Fall	
Professor Hatlen	Space Relationships, Site context studies
	TEA^2: Fargo, ND
	Prairie Images, an Architecture Studio
2nd Year Spring	
Professor Yergens	Lofty Intentions: Fargo, ND
	Canadian Coptic Village: Winnipeg Canada
3rd Year Fall	
Professor Martens	Golf Club House: Mapleton, ND
	Probstfield Farmstead. A Living Learning Center:Moorhead, MN
3rd Year Spring	
Professor Jenkinson	Library and Art Center for Fargo: Fargo, ND
	Masonry Competition-Adoption Center and Animal Clinic: Fargo, ND
4th Year Fall	
Professor Kratky	Urban Design: St. Paul, MN
4th Year Spring	
Professor Faulkner	FLAD High Rise: San Francisco, CA
	Marvin Windows: Dakota Flooring Expansion for NDSU, Fargo, ND
5th Year	
Professor Martens	Fargo City Center Winter Garden: Fargo, ND

5. program appendix

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