Engaging Existing Conditions with New Conditions

A Farm Equipment Museum Amidst an Abandoned Dairy Farm

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Abstract

When designing architecture, an architect must always decide how best to engage the existing conditions to most effectively initiate the newly introduced conditions. Whether remodeling an older facility or building something entirely new, there will always be some existing condition, either on site or somewhere surrounding, that will have an influence on the newly introduced condition. The way a new construction engages its existing conditions is probably one of the most important aspects of architecture. When introducing a new condition into an existing condition, there are two questions to ask. Does it make sense to force the new condition to comply with the same form, scale, and materiality as the existing condition? Does it make sense to allow the new condition to bear a form, scale, and materiality of its own that differs from the existing condition?

So does it make sense to force the new condition to comply with the same form, scale, and materiality as the existing condition? Well, if the new condition performs a different function than the existing condition, then it would be pertinent for the new condition to have an expression that is conducive to that particular function. This conducive expression will undoubtedly differ from the existing condition. Hence, in this instance, it would not make sense to force the new condition to comply with the same form, scale, or materiality as the existing condition. However, it would make sense for the new condition to have some sort of relationship to the existing condition, since the existing condition has already established a sense of place that the new condition should aspire to be a part of.

If it does not make sense for the new condition to comply with the same form, scale, and materiality as the existing condition, then does it make sense for the new condition to bear a form, scale, and materiality of its own that differs from the existing condition? Well, it would if the new condition established a new function; then it would require an identity of its own that reflects that differing function. As long as the new form, scale, or materiality in some way relates to the existing condition, then it would make sense for the new condition to bear an expression that differs from the existing condition.

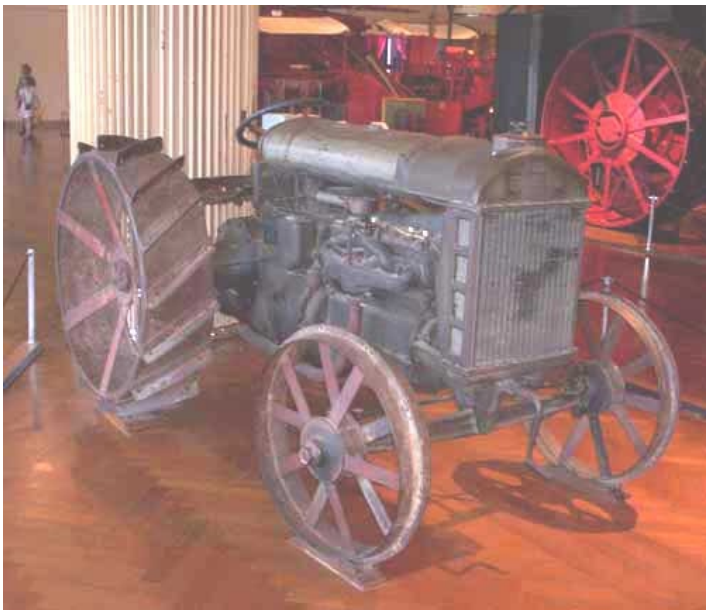
Circumstance

Since this thesis project is in the rural/agricultural settlements theme, and since it is desired to successfully engage an existing condition and integrate that existing condition with a new condition, then it is desired to work with a site that is located in a rural environment and that has an existing condition with significance worth engaging. For example, a site with significant natural, historical, or architectural existing conditions would be worth engaging.

A successful engagement with the existing conditions would provide a place for activities that bring attention to the significance of the existing conditions. For example, preserving, honoring, and highlighting the significant natural, historical, or architectural existing conditions are activities that the new condition can do to successfully engage them.

Thesis

Farm equipment has historical, scientific, and cultural significance in that their advancements has decreased the time, effort, and manpower necessary in the production of agricultural products, while simultaneously increasing the quality and quantity of those products. Hence, less than one-percent of the American population now provides the necessary products, allowing the rest of the people to devote their time and effort to other important tasks. Because of their historical, scientific, and cultural significance, farm equipment deserves to be exhibited in a museum in order to educate visitors of their significance.



This is the first Ford tractor which was the first mass produced tractor. The tractor exponentially revolutionized the agricultural industry.

An appropriate site for the farm equipment museum is an abandoned dairy farm near Saline, Michigan on Textile Road. The farm contains three barns from various time periods with various construction types, a house with many additions, and a garage. The buildings are surrounded by a meadow and all have their longer sides facing north and south. Adjacent to the site, to the north, east and west, are grain fields. To the south, across the street is a marsh. This site is appropriate because the rural context surrounding the abandoned farm is transforming into a suburban context, with farms and fields being demolished and replaced with subdivisions and parking lots. A farm equipment museum on the site will preserve the site's rural context and honor Saline's agricultural past amidst Saline's suburban present.

View of the existing barns and garage

Since the site is a former dairy farm, and since space is limited, which prevents the museum from exhibiting every piece of pertinent farm equipment, then it is appropriate that the museum focus on the equipment that pertains to the processes of dairy farming. The processes that pertain to dairy farming in Michigan are sowing, cultivating, harvesting, and processing corn and hay for feed; and milking the cows. Also, the museum will be limited to equipment from the time period in which the dairy farm was operational, which was from 1840 to 2006.[1] Hence, the equipment exhibited will highlight the major advancements in the farm equipment of each process pertaining to dairy farming from the years 1840 to 2006.

In order to effectively exhibit dairy farm equipment in a manner that preserves and respects the site's rural agricultural heritage, the museum must not destroy the natural existing surroundings of the site or be designed with similar forms or materials of the existing buildings. Instead, the museum should respect the scale and proportion of the existing buildings, and be constructed of different materials. Since the museum is a new building on the site with a different purpose than the old existing buildings, it should be expressed differently from the existing buildings. An example of a new construction within an existing framework built with a purpose differing from that of the existing framework's can be illustrated by the new Kresge Foundation Headquarters.

The Kresge Foundation Headquarters is an early twenty-first century office building built on a mid-nineteenth century farm. The headquarters preserved and reused the existing barn, house, and outbuildings on the farm and integrated them with a new twenty thousand square foot office building. The new office building utilized metal and glass materials and construction that contrasted with the wood construction of the barn and outbuildings and the stone construction of the house. The architect Joe Valerio respected the scale and proportion of the existing structures, which were rectangular and orthogonal and stood upright upon the terrain, by designing the office building to be long and broken up into rectangular forms similar to the existing buildings and dug into the ground. The headquarters also preserved the site's natural surroundings by allowing for the lawn to remain native Michigan grasses and by utilizing sustainable design practices, such as green roofs, geothermal heating and cooling, and recycled materials.[2]

1. "Plat Maps." pittsfieldhistory.org. 2005. 17 December 2007. <http://pittsfieldhistory.org/index.php?section=history&content=platmaps>

2. "Elegant Office Building Achieves Right Balance." jsonline.com. 2006. 18 December 2007. <http://www.jsonline.com/story/index.aspx?id=411028>

Just as the Kresge Foundation Headquarters is made up of rectangular forms that are at a similar scale to the existing buildings on its site, the museum will consist of multiple structures that are at the same scale as the existing barns. However, unlike the Kresge Foundation Headquarters, the museum will not connect directly to the existing barns because doing so would be disruptive to the barns. Instead, the museum's structures will be constructed separately from the existing barns and be arranged among them. All of the existing buildings are oriented on the east-west axis, but the new structures of the museum will be oriented on the north-south axis. This is to conform with the existing orthogonal grid layout of the streets established by the Northwest Ordinance and to differentiate the new construction from the existing construction. Since the house lacks the historical and cultural significance of the barns and garage, and because of its dilapidated condition, the house will be demolished. Instead of being constructed primarily from wood materials, as the barns have; the museum will be constructed primarily from concrete and steel. The concrete and steel construction of the museum will contrast with the wood construction of the barns. Because the museum's structures will be of the same scale and be arranged among the existing barns, the museum's structures will be integrated with the existing barns. But, because the museum's structures are oriented differently and are constructed of different materials, they will also contrast with the existing barns. By both integrating with and contrasting from the existing conditions of the site, the new museum's structures will form an ideal relationship with the existing barns.

To further respect the historical and cultural significance of the barns on the site, the museum will be made up of forms that are similarly proportioned to the barns. If the museum were proportioned differently than the barns, then the museum would be too unrelated to the existing buildings on the site and they would clash since their materials are different. If the museum and the existing buildings clash, then the focus would be shifted away from the existing structures, and the historical and cultural significance of the site would be ignored. Ignorance of the site is the exact opposite of the intent of the museum and is to be avoided. Therefore, extravagant, multifaceted, or irregular shapes will not form the spaces of the museum, but instead, simple, purposeful, orthogonal forms that are similar to those of the barns will make up the spaces of the museum.

In order to conserve the environment of the site, the existing meadow consisting of native grasses that surrounds the existing barns is to remain and be disturbed as little as possible. The pathways that will be mowed into the meadow to provide access between the barns and the fields for pedestrians and machinery will be kept to a minimum. For instance, the new structures will be arranged in such a way so that only two wider pathways mowed into the meadow for machinery and vehicular access is needed.

Besides being of a similar form and proportion of the three barns in order for the historical and cultural significance of the barns to be acknowledged, the museum also will effectively exhibit the farm equipment by showing how the advancements in farm equipment have influenced the history of agriculture in Michigan. The museum will also show how the circumstances and traditions in farming culture from throughout history have influenced how and when a particular piece of farm equipmenthas been utilized. For example, an exhibit will show how an advancement in a particular piece of farm equipment has influenced the way in which the farmer completed a particular task; how that change in task changed the quality of the final product and how efficiently that product was produced; how that change in quality and quantity of the final product changed the economics of the agricultural industry; and how that change in the agricultural industry changed the quality of life of the farmer and of the general population. In turn, another exhibit will show how the customs practiced by the farmers of a time period and the economics of the agricultural industry of that time period influenced the way in which a particular farm implement was manufactured; what materials it was manufactured from; and how that particular farm implement was adopted by farmers. By showing how the overall circumstances of the time period influenced a particular piece of farm equipment and how that particular piece of farm equipment then changed the overall circumstances of that time period, the exhibits of the museum will be effective.

Just as the museum's attention to scale and use of contrasting materials respects the historical and cultural significance of the existing conditions of the site and its surroundings, the materials and scale of the museum's exposed structural members will acknowledge the historical and cultural significance of the farm equipment. This acknowledgment of the historical and cultural significance of the farm equipment will provide a higher awareness of the exhibits to the visitor by the museum to further the effectiveness of the exhibits. Also, the layout of the structural members will create a system that will serve as the basis for organizing the overall layout of the exhibits. Also, the structure of the exhibits will be integrated with the structure of the museum.

The scale of the structural members will form a space that is suitable in size to allow for the passage of the tractors with the attached farm implements during farming demonstrations. However, the size of the exhibition spaces will be small enough in order to not be overwhelming to the human visitors. The structure itself will be constructed primarily from pre-cast concrete and be a beam and column system supporting pre-cast concrete floor slabs. The concrete structural system will contrast with the mostly metal and wood materials of the farm implements. When constructed at this scale and with these materials, the focus will be on the farm equipment exhibits and not on the museum's structure itself.

The organization of the exhibition spaces by the structural system will divide the spaces into different sections. The center aisle will delineate where the pieces of farm equipment will be parked for exhibition. The side aisles will delineate the passageway from which the tractor and towed piece of farm equipment will travel into and out of the museum during farming demonstrations, and they will designate the main routes for the visitors to travel to and from the exhibits. Secondary structural members will delineate the spaces between the exhibits. Also, any structure needed for exhibiting any smaller pieces of equipment, text, photos, and displays accompanying the farm equipment will be integrated with the structure of the museum.

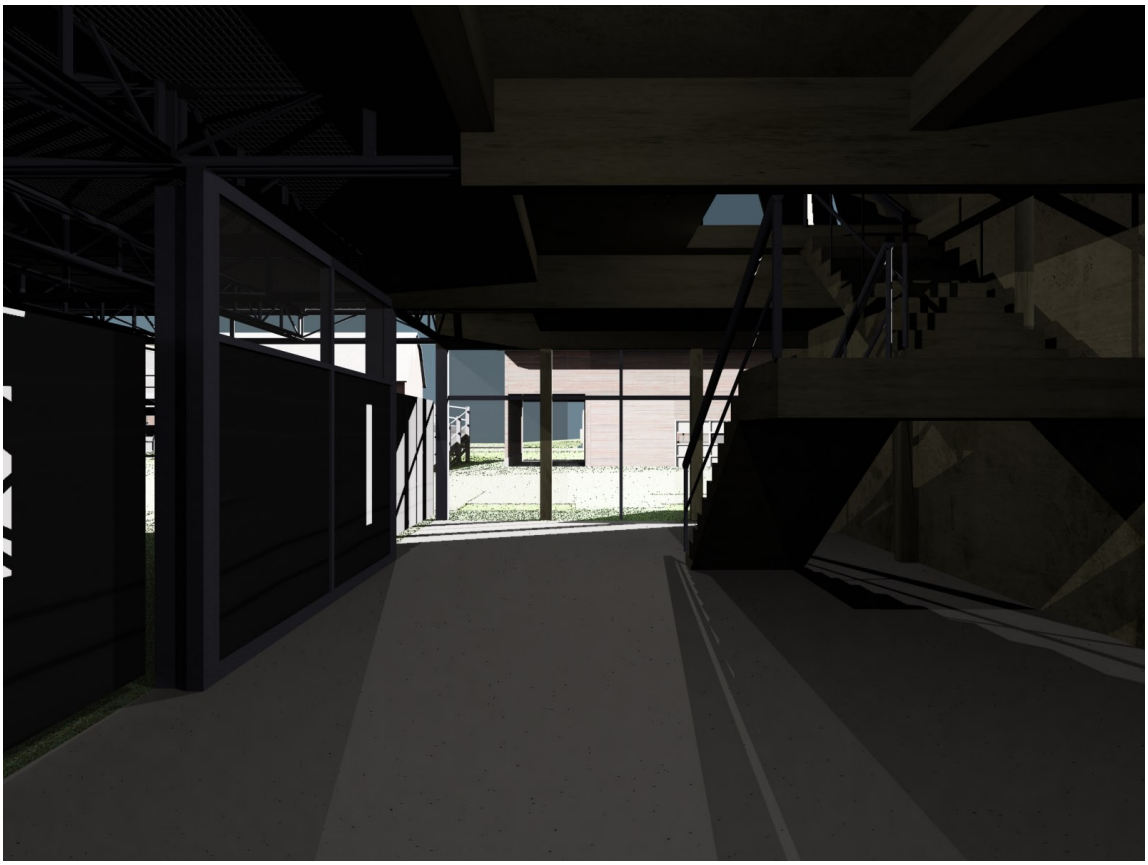
When documenting the site, which included photographing and measuring the structure and other details of the barns, it was discovered that the shingles of the roof of the existing barns had worn out and had not been replaced, which led to the roof sheathing to deteriorate. Also, there existed some areas where the walls were overly weathered. The decayed patches in the roof and the walls had let in a dramatic quality of light. This dramatic quality of light is best described as a kaleidescope, a random assortment of spots of bright light cast throughout the space. It was deemed necessary to recreate and refine this quality in such a way that the light enhances the visitor's experience of the museum's spaces. Light can enhance the visitors' experience of the museum by providing a context that improves the visitor's ability to understand the information presented by the exhibits. For example, the Mercedes Benz Museum in Stuttgart, Germany utilized light in the exhibits of its general collection of automobiles in such a way as to simulate a daylight atmosphere similar to that outside, where one would expect to find such vehicles.[3] Also, the fenestration of the museum lets in the Stuttgart landscape, which is where the first Daimler, Mercedes, and Benz, cars were made and is the headquarters for Daimler AG, to the interior which provides a backdrop for the exhibits. For the special exhibits, the lighting was controlled and used to reinforce the architect's and exhibition designer's concept.[3]

3. Ulrike Brandi Licht. Lighting Design: Principles, Implementation, Case Studies. Munich: Institut fuer Internationale Architektur-Dokumentation, 2006.

Like the Mercedes Benz Museum, the farm equipment museum will utilize lighting to convey the atmosphere present in a dilapidated barn, which simultaneously provides the context of a barn and the field in which farm implements operate. This is because the outdoor space is literally brought into the inside of the barn. The museum's form and materials will in no way resemble a dilapidated barn, but the fenestration and the ensuing daylight that will penetrate it will be similar to the lighting found in a dilapidated barn. To further enhance the visitor's experience of the museum, the utilization of light will highlight details of the farm equipment exhibits. Also, the spaces within the museum will be delineated with differing qualities of light.

In highlighting the details of the exhibits, the museum will utilize daylighting to focus concentrated beams of light onto important details of a specific exhibit during the day and spotlighting during the night. These concentrated beams of light will be an additional tool to further clarify the information that is being given by the exhibit.

In further delineating the spaces, such as the exhibit spaces from the circulation spaces, different windows and glazing will provide a different quality of light for each space. For example, the circulation spaces will be brighter and more diffuse, while the exhibit spaces will be dimmer with more concentrated beams.



Precedent Analysis

The Kresge Foundation Headquarters in Troy, Michigan was built in 2006 after it had outgrown its old facility which was on the current site. The 20,000 square-foot office building was designed by Joe Valerio of the Chicago based firm Valerio Dewalt Train Associates to achieve three objectives. They were to preserve and reuse the existing farm structures, some as old as 150 years; integrate the new building seamlessly with the old; and demonstrate sustainable building strategies by qualifying for a high LEED rating.

The existing farm structures on the foundation's site include a stone farmhouse from the 1850's, a century-old wood barn, various out-buildings, and two windmills. To preserve and reuse these existing farm structures, the architects and foundation planners decided to connect the new building to the farmhouse and the century-old barn. The farmhouse is now a reception area and meeting space, and the barn has been converted into staff services, including a kitchen, with mechanical equipment for the whole complex hidden in the barn's newly dug basement.[4]

4. "Elegant Office Building Achieves Right Balance." jsonline.com. 2006. 18 December 2007. <http://www.jsonline.com/story/index.aspx?id=411028>

To integrate the new building seamlessly with the old, the architect decided not to make the new building similar in form and materials to the existing structures, but to instead juxtapose the existing old structures with something very new.[5] To successfully integrate a very new structure with a very old structure, the new structure must respect the scale of the existing structure. The new office building respects the scale of the existing buildings by being long, low, and dug into a gentile slope. This contrasts with the existing buildings which stand tall and upright upon the land. Joe Valerio stated that the barn likens to "an ocean liner, sailing across the prairie."[5] The new construction contrasts with the old existing buildings by utilizing metal and glass instead of stone and wood. The facade of the new office building is an arrangement of super-insulated, recycled aluminum plates that were pitted and acid treated. This somewhat random arrangement of light reflecting panels creates a subtle geometric patchwork that animates the surface of the new building and breaks up its mass.[5] Because the new building is restrained and well proportioned, it allows for the existing buildings of the past to be honored and re-appreciated.

To demonstrate sustainable building strategies, the foundation headquarters integrates many sustainable building systems with the architecture. It does this primarily by recycling materials, reducing energy consumption, and conserving water. Twenty-seven percent of the foundation headquarters is made of recycled materials. Seventy-six percent of the building materials came from within 500 miles of the site to reduce transportation costs and oil consumption.[6] The facade panels are of recycled aluminum, the window shades are made from recycled plastic fabric, even the retaining walls are from recycled materials.[6] The retaining walls are made up of crushed stone, recycled paving materials, and blue granite that are held in place with galvanized metal mesh. The crushed stone is the rubble from the demolition of the foundation's previous office building.[6] If a material was not recycled, then it came from a readily renewable source. For instance, the wood flooring and desks were made from rapidly renewable wheat board finished with a veneer of FSC certified sustainably-harvested wood. Also, the walls were coated with milk paint which is made from milk protein, herbs, and minerals without volatile organic compounds.[6]

5. "Elegant Office Building Achieves Right Balance." jsonline.com. 2006. 18 December 2007. <http://www.jsonline.com/story/index.aspx?id=411028>

6. The Kresge Foundation. The Kresge Foundation Headquarters: A Case Study in Building Green. Troy, MI: The Kresge Foundation, 2006.

To reduce energy consumption, the headquarters utilizes a geothermal system, made up of forty geothermal wells extended four-hundred feet below grade, for heating and cooling. This requires no natural gas and produces no carbon dioxide. The floor of the office building is raised to allow greater control and efficiency of the delivery of the heating and cooling. Since the building is embedded into the ground, the temperature is maintained at about 55 degrees, which reduces the heating and cooling needs. Also the walls and roof are insulated at double the required level, and parts of the roof are further insulated where a green roof is in place. Finally, the building is oriented with its long sides facing north and south with proper window shading to take full advantage of the winter sun and keep out the summer sun to further reduce energy needs for heating and cooling.[7]

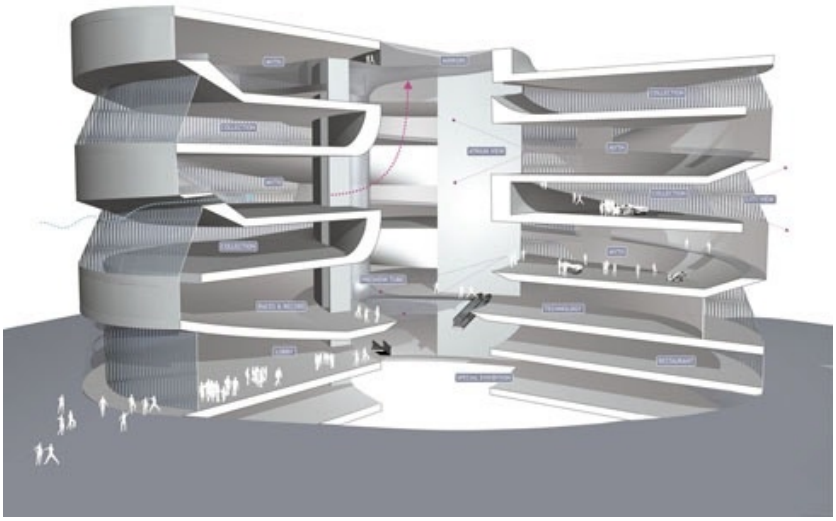
To conserve water, the headquarters has pervious pavers for the parking lot to reduce rainwater runoff. Rainwater runoff is further reduced by the green roofs. A wetland with two small ponds on the south side of the site filter pollutants from the storm water and contain cisterns that collect rainwater for supplemental use on the green roofs. Furthermore, native vegetation in the landscaping and green roofs are better adapted to the environment and require little irrigation.[7] Because all of these green sustainable systems were thought of early on in the design process, the systems are effectively integrated within the design of the building and the site.

Because the Kresge Foundation Headquarters has many similarities with the site of the proposed farm equipment museum, and because the new office building succeeds at integrating itself with the existing buildings, it is a very good precedent to study. It is the intentions of the farm equipment museum to integrate new buildings that function as a meeting/gathering space, and exhibit spaces with the old existing barns on the site in Saline, Michigan. Also, because of the pressing need to reduce energy consumption and pollutants in the environment, it is necessary for the farm equipment museum to achieve an equal or better level of sustainability as the Kresge Foundation Headquarters.

7. The Kresge Foundation. The Kresge Foundation Headquarters: A Case Study in Building Green. Troy, MI: The Kresge Foundation, 2006.

The Mercedes Benz museum in Stuttgart, Germany designed by the Dutch architecture firm UN Studio opened to the public on May 20, 2006. It showcases 1500 exhibits that effectively illustrate the 120 year history of the company. The 35,000 square meter building contains the car museum, shops, restaurant, offices, and an auditorium. Visitors enter the museum through a central atrium and are whisked to the top floor in futuristic elevators. From there, they descend through nine levels of display galleries via either of two interconnecting helixes. The galleries are uninterrupted by support columns and the flow between them is uninterrupted by doors or corridors. The museum contains two types of galleries. The first type consists of open spaces that contain the general collection of automobiles, and the second type consists of closed-off spaces that contain special exhibitions.[8]

What is significant about this museum is its utilization of light. The museum utilizes a daylighting system that provides the vast amount of necessary lighting. Very few artificial lights are needed for the one-hundred-eighty-thousand square-foot facility. The general exhibit spaces displays vehicles in a daylight atmosphere similar to that outside, where one would expect to find them. The facade lets filtered daylight into the building and exposes the Stuttgart landscape to the inside, which recedes into a backdrop for the exhibits. The ceiling in the general exhibit space is smooth and bright with integrated lighting elements to give off direct light. The closed-off spaces that contain special exhibits, in contrast to the general collection space, are designed to receive little daylight so that artificial light can be used to reinforce the architect's and exhibition designer's concept.[9]



8. "Virtual Tour: Mercedes-Benz Museum." motortrend.com. 2007. 07 January 2008. <http://www.motortrend.com/features/consumer/112_0607_mercedes_benz_musuem_tour>

9. Ulrike Brandi Licht. Lighting Design: Principles, Implementation, Case Studies. Munich: Institut fuer Internationale Architektur-Dokumentation, 2006.

The Kimbell Art Museum in Fort Worth, Texas designed by Louis I. Kahn and completed in 1972 is an exceptional example of how the use of light and spacial qualities work in tandem with the functional and programmatic issues raised by exhibiting artwork. In fact, it worked so well that the curator of the museum stated that the Kimbell Art Museum is "what every museum man has been looking for ever since museums came into existence."[10]The museum is a simple composition of parallel concrete vaults with porticoes that are continuations of the building's vaulting. These porches define the structural vocabulary of the whole museum. That vocabulary is simply cycloidal concrete shell vaults, post-tensioned and spanning 100' by 22' between four two-foot square columns. The bottom edge of the shell supports the flat concrete roof slab between the individual vaults and is in turn stiffened by it. The entire roof of the museum is then covered by lead sheets.

The spatial qualities work well with the exhibits. For example, the interiors are finely scaled to complement the individual works of art and do not overwhelm them. There is a dignified rhythm of the spaces that enhances the procession of the visitors. Technology is utilized to control an idea and is not an extravagance in its own right. Also, there is a refined treatment of the materials from the silver-gray concrete, panels of travertine, and stainless steel reflectors at the peak of each vault.

10. Brawne, Michael. Kimbell Art Museum. London: Phaidon Press Ltd., 1992.

Just as it was for the Mercedes-Benz Museum after it, lighting was a major concern for Louis Kahn when designing the Kimbell Art Museum. The Texas sunlight is very intense and so is a major factor to cope with in terms of heat production, visual effect on exterior design, psychological effect looking out from the building's interior, difficulties of potentially high surface reflectance of natural light off of art objects, glare effects when looking at art against natural light sources, and the intensity of light upon art objects in which time causes fading.[10] To deal with these issues, light would come from above but would be reflected and diffused by the form of the vault as well as by baffles. Part of the reflector immediately below the slit is opaque to block the direct sun and increase reflections while the sides of the reflector has open perforations and appears diaphanous. The reflector is supported by curved brackets which at their ends hold a lighting track for adjustable lights.[10] Side light is controlled in the courtyards by plantings and vegetation. The different means of modifying light from above and the side creates different conditions and thus light varies from space to space making each space special.

Light is not only filtered, diffused, and controlled by the architecture, but light also explains the architecture. Fore instance, the ends of the vaults have a stiffening edge which follows the cycloidal outline. Between it and the travertine clad gable non-load bearing wall, there is a glazed gap. The outline of the gable wall became an arch so that the opening varies in width, widening from the top to the bottom. This makes the geometry of the vault visibly clear. The relationship to materials and light are also important. The reflective quality of pale concrete and travertine is essential to the luminosity of the interior. The positioning of water next to the open vault on the west side produces reflected light on the underside of the shell, and the sandblasting of the stainless steel with pecan nut shells provided a metal without highlights.

10. Brawne, Michael. Kimbell Art Museum. London: Phaidon Press Ltd., 1992.

Additional Research

The first step in implementing the farm equipment museum is to restore the three existing barns to their original condition. To do so requires an understanding of how nineteenth century heavy timber framing buildings were constructed. This involves different types of wood joinery, manually operated tools, and manual wood shaping.

There were many different types of joinery methods that were used depending on what was being connected. For instance, there are a number of different tying joints which join wall posts either below the plate or at the plate. There are also a number of sill and floor joints which tie the posts at the foundations. Wall and brace joints connect the wall sub-structure. Roof joinery connect the rafters to the plate, and scarf joints join two pieces of timber member together.

The most common method for tying joints, wall and brace joints, and floor and roof joints is the mortise and tenon. One member that is to be connected has a pocket hollowed out of it, which is the mortise. The other member has a an end shaped to fit snuggly into the pocket, which is the tenon. The two are then held in place by a peg that runs through each member. This connection is apparent in the two older barns that are of heavy timber construction. The most common rafter-to-plate connection is the birdsmouth, which is just an angled notch in the board. Scarf joints are most commonly a halved scarf, which is removing half of each member's section and pinning them together. Both the birdsmouth and the halved scarf are prevalent in the older heavy timber constructed barns.

Mortise and tenon

Birdsmouth

Halved Scarf

Site Analysis

The site is east of Saline, Michigan near Ann Arbor on an abandoned small-scale dairy farm. The original owners, the Cody family, acquired the site in the early 1840's.[11] Buffalo Bill Cody visited his relatives here when his traveling wild west show performed in Ann Arbor in the late 1880's.[12] A general dairy farm's operations consist of milking the cows, planting and cultivating feed crops, harvesting feed crops, and processing and storing feed crops. A general dairy barn will shelter the cows plus provide feed and equipment storage. This site contains three barns, a house, and a detached garage. The buildings on the site are surrounded by a meadow of about 3.5 acres, and they are all interconnected by pathways that have been mowed into the meadow. Directly adjacent to the site from the north, east, and west, are cornfields totaling about 42 acres. Textile Road forms the southern border and across the street is a wetland of about fifteen acres, which is itself surrounded by cornfields. Just beyond the cornfields are newly developed subdivisions and an encroaching suburban fabric.

One barn is 26' wide, 90' long, and 33' tall, and it is primarily constructed from hewed heavy timber with 2X dimensional lumber for floor and roof joists. It was probably built around the turn of the 20th century. The first floor of this barn was originally designed for threshing. It is 22'-2" from the floor to the peak. The lower floor contains a room for a few cows with adjacent rooms for hay storage. It has a dirt floor that slopes up from west to east. At the far western room, the ceiling height is 10', and at the far eastern room the height is 7'-10" tall.

11. "Plat Maps." pittsfieldhistory.org. 2005. 17 December 2007. <http://pittsfieldhistory.org/index.php?section=history&content=platmaps>

12. "Historic Textile Road in Pittsfield Township, Michigan." pittsfieldhistory.org. 2005. 17 December 2007. <http://pittsfieldhistory.org/index.php?section=sites&content=roads_textile>

The second barn is 21'-3" wide, 44' long, and 28'3" tall. It is constructed primarily of hewed heavy timber and logs with 2X dimensional lumber for roof joists. It is the oldest of the barns; probably built before the 1880's. It contains two floors. Its upper floor is for hay storage and has a 21' tall to the peak of the roof, while the first floor is 7'-1" to floor boards and houses the cows for milking. There is also a stainless steel milk container for storage.

The third barn is 30'-0" wide, 60' long, and 27'-8" tall. It is constructed almost entirely of 2x dimensional lumber. It is the newest of the barns. On the first level, the barn contains a covered driveway where the harvested hay is unloaded from the trailer, a garage-like space for equipment storage, and a room for a few cows. The equipment storage and animal shelter is 7-1/2' tall to the ceiling. The second level is for hay storage and is about 20' tall from the floor to the peak.

The house is all boarded up and contains many additions. The garage is the structure that is in the best shape. It has hardly any noticeable decay.

When documenting the site, which included photographing and measuring the structure and other details, it was discovered that the shingles of the roof had worn out and had not been replaced, which led the roof sheathing to deteriorate. Where the roof was deteriorated, rain was let in and rotted out the floor boards. Also, some walls have weathered severely.

Satellite view showing farm, surrounding fields, and marsh across the street.

Satellite view showing existing buildings amidst the meadow.

View of barns and garage from the road's edge.

View of the marsh from across the street.

Exterior views of the large barn to the north

A room on the first floor

A view of the second floor

Deteriorated roof construction

Column, beam, and floor joist detail

Exterior views of the older barn to the east

A room on the first floor

A view of the second floor

Mortise and tenon detail

Wall structure on second floor

Exterior views of the newer barn to the east

A view of the first floor

A view of the second floor

Roof construction of covered driveway

Wood siding under covered driveway

Program Summary

The goal of the program is to educate visitors of the cultural and historical significance of farm equipment and their impact on agriculture as a whole. Visitors who have experienced the exhibits of the implements, which illustrate how they operate and perform their desired tasks, when they were utilized, and how they impacted the agricultural industry, in the context of an abandoned dairy farm will gain a better understanding of the cultural and historical significance of farm equipment. Each task category, which includes producing feed for cows, milking the cows, and towing and powering the equipment, will occupy a structure that exhibits a chronological collection of its respective implements. These spaces will be integrated with the existing barns and will be connected by mowed pathways for the visitors to follow from the gathering space to gain a comprehensive understanding of the information on the farm equipment. The existing barns will be restored to their original conditions. The restored barns will give visitors an understanding of timber construction and the function of barns on a farm. Also, allowing the pieces of farm equipment to demonstrate their respective tasks outdoors on the grain fields to visitors will further enhance the visitors' experience of the museum. Finally, it is desired that the visitors gain an appreciation for the rural environment and its agricultural artifacts.

Program Quantitative Summary

Exterior Spaces:

Parking –		18 spaces
Large North Barn Exhibit -- -- -- -- --	2 floors –	4680 square feet
Older East Barn Exhibit -- -- -- -- -- --	2 floors –	1260 square feet
Newer East Barn Exhibit -- -- -- -- -- -	2 floors –	3240 square feet
Garage --		900 square feet
Grain Fields --		42 acres

Non-Exhibiting Museum Spaces:

Entry -- -	165 square feet
Gathering Space -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --	376 square feet
Restrooms --	154 square feet
Administrative/Curator Offices -- -- -- -- -- -- -- -- --	-185 square feet
Mechanical Room -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -	30 square feet

Exhibiting Museum Spaces:

Tilling Equipment Exhibit -- -- -- -- -- -- -- -- -- -- -- -	1620 square feet
Sowing/Cultivating Exhibit -- -- -- -- -- -- -- -- -- -- --	1620 square feet
Harvesting/Processing Exhibit -- -- -- -- -- -- -- -- --	4680 square feet
Milking Equipment Exhibit -- -- -- -- -- -- -- -- -- -- --	1260 square feet
Tractor Exhibit -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- -	4680 square feet

Space Detail Summaries

Space: Large North Barn

A. Purposes/Functions: To exhibit the spaces, structure, and agricultural tasks supported of the barn

B. Activities: Visitors walk through, observe, and experience the space.

C. Spatial Relationships: The visitor will experience the barn as it was when it was first built.

D. Qualitative Considerations: The visitor will experience the barn as it was when it was first built.

E. Equipment/Furnishings: Original farm equipment that still remains in the barn

F. Structural Systems: Original/restored heavy timber frame

G. Mechanical/Electrical Systems: None

H. Site/Exterior Environment Considerations: The original or restored relationships will occur.

Space: Older East Barn

A. Purposes/Functions: To exhibit the spaces, structure, and agricultural tasks supported of the barn

B. Activities: Visitors walk through, observe, and experience the space.

C. Spatial Relationships: The visitor will experience the barn as it was when it was first built.

D. Qualitative Considerations: The visitor will experience the barn as it was when it was first built.

E. Equipment/Furnishings: Original farm equipment that still remains in the barn

F. Structural Systems: Original/restored heavy timber frame

G. Mechanical/Electrical Systems: None

H. Site/Exterior Environment Considerations: The original or restored relationships will occur.

Space: Newer East Barn

A. Purposes/Functions: To exhibit the spaces, structure, and agricultural tasks supported of the barn

B. Activities: Visitors walk through, observe, and experience the space.

C. Spatial Relationships: The visitor will experience the barn as it was when it was first built.

D. Qualitative Considerations: The visitor will experience the barn as it was when it was first built.

E. Equipment/Furnishings: Original farm equipment that still remains in the barn

F. Structural Systems: Original/restored heavy timber frame

G. Mechanical/Electrical Systems: None

H. Site/Exterior Environment Considerations: The original or restored relationships will occur.

Space: Entry/Gathering Space

A. Purposes/Functions: To welcome the visitors to the museum

B. Activities: Groups of visitors will gather after paying admission, using the adjacent restrooms, etc. to enter the exhibit spaces together.

C. Spatial Relationships: Will be wide open with the barrier between inside and outside obscured.

D. Qualitative Considerations: Will be bright, airy, calming and inviting

E. Equipment/Furnishings: Benches

F. Structural Systems: No special requirements

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Doors and fenestration will provide access to the exterior and views of the meadow, barns, and fields.

Space: Reception Area and Offices

A. Purposes/Functions: To provide an environment that is conducive for personnel to administer the museum.

B. Activities: Administrative and curator duties

C. Spatial Relationships: These spaces should be open and not feel like cubicles.

D. Qualitative Considerations: Should be relatively light, diffuse, warm, and intimate

E. Equipment/Furnishings: Office equipment, desks, chairs, and cabinets.

F. Structural Systems: No special requirements

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Fenestration will open up to the exterior and provide scenic views.

Space: Tilling Equipment Exhibit

A. Purposes/Functions: To exhibit and provide information about the tilling equipment.

B. Activities: Visitors will walk through, observe, and acquire knowledge about the tilling equipment.

C. Spatial Relationships: Structural supports will organize the exhibits within the space.

D. Qualitative Considerations: This space will be energetic and stimulating.

E. Equipment/Furnishings: Tilling Equipment

F. Structural Systems: Floor beams must be strong enough to support the load of all the equipment and visitors.

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Fenestration will give views to the barns and the meadow.

Space: Sowing/Cultivating Equipment Exhibit

A. Purposes/Functions: To exhibit and inform about the sowing and cultivating equipment from throughout history.

B. Activities: Visitors will walk through, observe, and acquire knowledge about sowing and cultivating equipment.

C. Spatial Relationships: Structural supports will organize the exhibits within the space.

D. Qualitative Considerations: This space will be energetic and stimulating.

E. Equipment/Furnishings: Sowing and cultivating equipment

F. Structural Systems: Floor beams must be strong enough to support the load of all the equipment and visitors.

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Fenestration will give views to the barns and the meadow.

Space: Harvesting/Processing Equipment Exhibit

A. Purposes/Functions: To exhibit and inform about the harvesting and processing equipment from throughout history.

B. Activities: Visitors will walk through, observe, and gain knowledge about harvesting and processing equipment.

C. Spatial Relationships: Structural supports will organize the exhibits within the space.

D. Qualitative Considerations: This space will be energetic and stimulating.

E. Equipment/Furnishings: Harvesting and Processing Equipment

F. Structural Systems: Floor beams must be strong enough to support the load of all the equipment and visitors.

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Fenestration will give views to the barns and the meadow.

Space: Milking Equipment Exhibit

A. Purposes/Functions: To exhibit and inform about the milking equipment from throughout history.

B. Activities: Visitors will walk through, observe, and gain knowledge about milking equipment.

C. Spatial Relationships: Structural supports will organize the exhibits within the space.

D. Qualitative Considerations: This space will be energetic and stimulating.

E. Equipment/Furnishings: Milking Equipment

F. Structural Systems: Floor beams must be strong enough to support the load of all the equipment and visitors.

G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

H. Site/Exterior Environment Considerations: Fenestration will give views to the barns and the meadow.

Space: Tractor Exhibit

A. Purposes/Functions: To exhibit and inform about tractors from throughout history.

B. Activities: Visitors will walk through, observe, and gain knowledge about tractors.

C. Spatial Relationships: Structural supports will organize the exhibits within the space.

D. Qualitative Considerations: This space will be energetic and stimulating.

E. Equipment/Furnishings: Tractors and their parts and accessories.

F. Structural Systems: Floor beams must be strong enough to support the load of all the equipment and visitors.

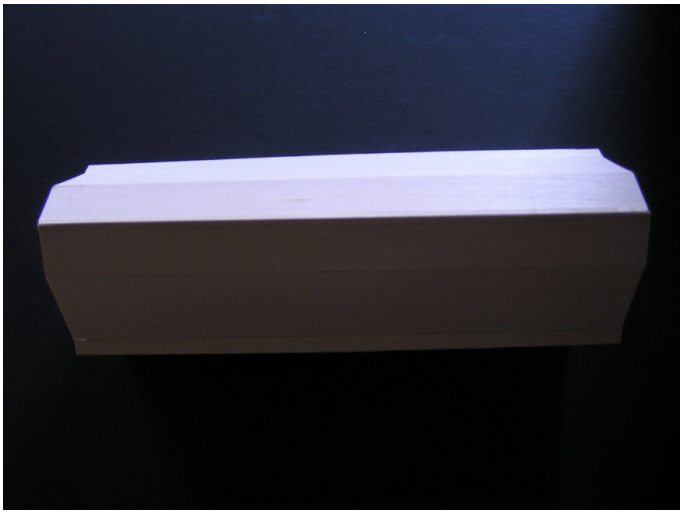
G. Mechanical/Electrical Systems: Must be environmentally sound and energy efficient.

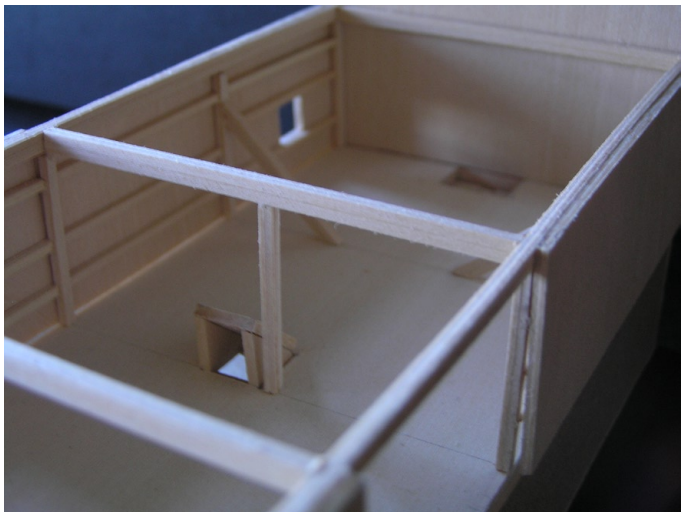
H. Site/Exterior Environment Considerations: Fenestration will give **views** to the barns and the meadow.

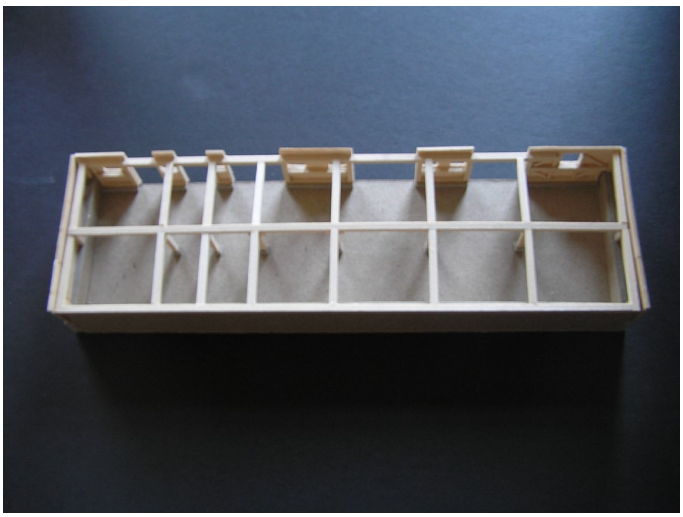
Schematic Design

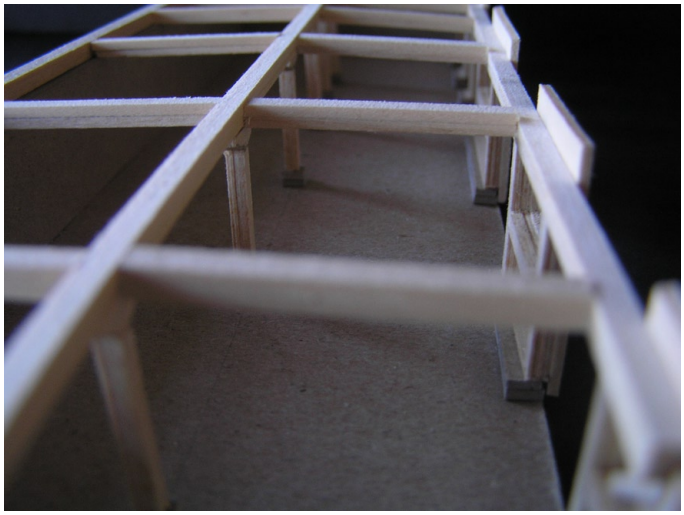
Initially, the overall plan for creating the farm equipment museum was to restore the existing barns and then convert them into exhibition spaces while designing an additional exhibition building for exhibiting tractors. This new exhibition building would be constructed out of glue-lam beams and columns. However, this overall plan was dropped in favor of adding new structures for exhibiting all of the farm equipment and constructing these exhibition structures out of concrete and steel. This was done because it was decided that the barns should be exhibits in themselves, and a glue-lam structure would too closely resemble the heavy timber framing of the existing barns.

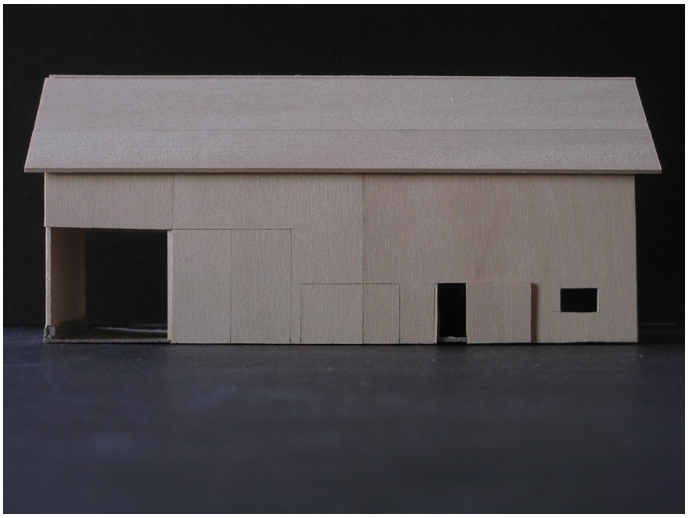
Model of existing large barn to the north



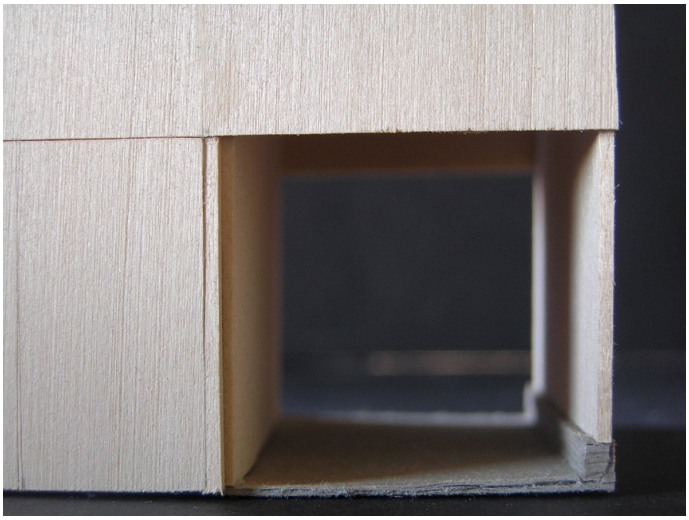


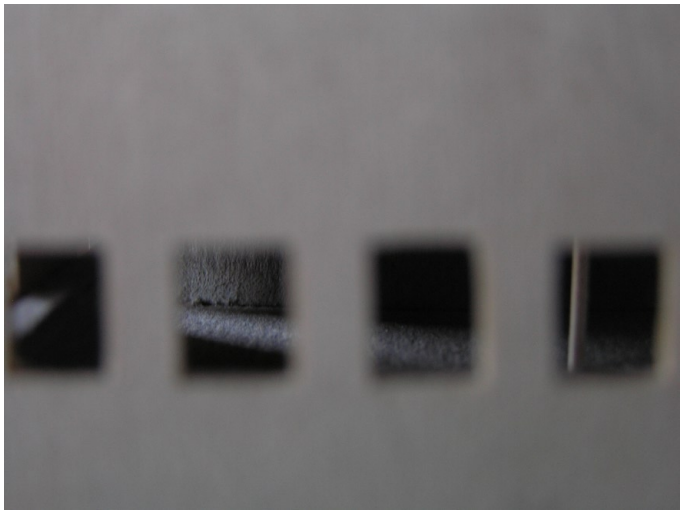


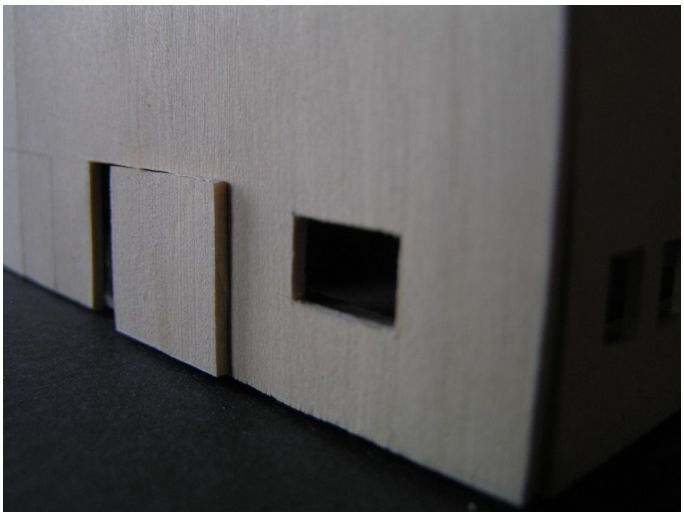


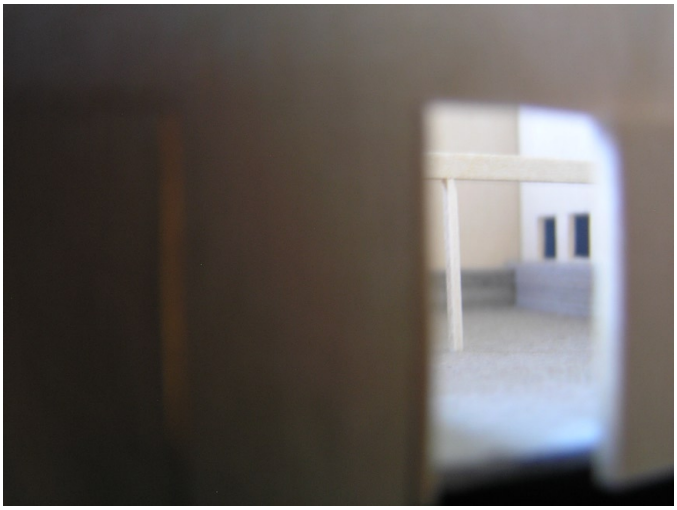


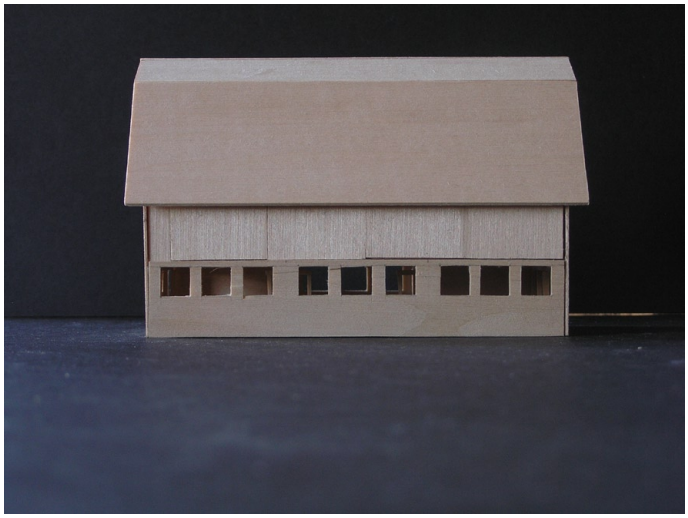
Model of existing newer barn to the east



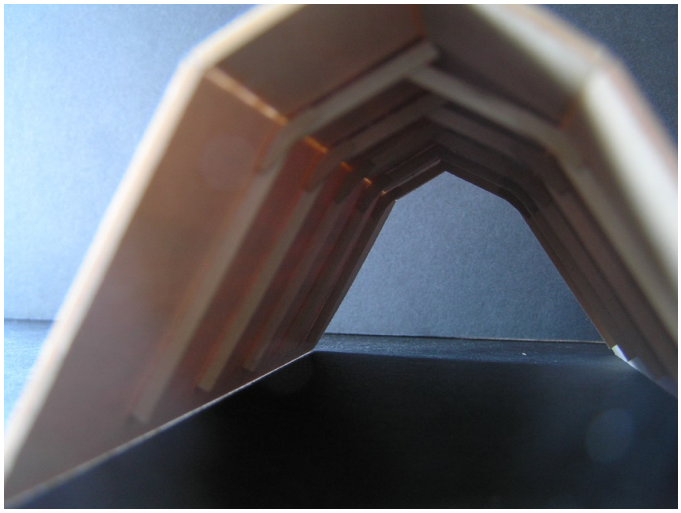


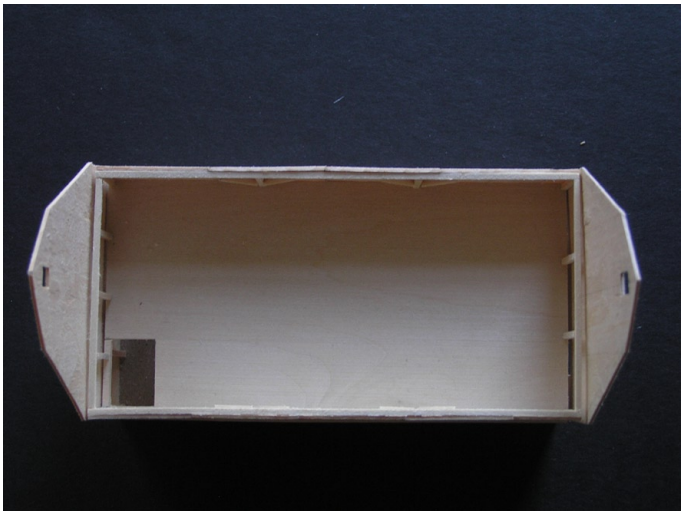


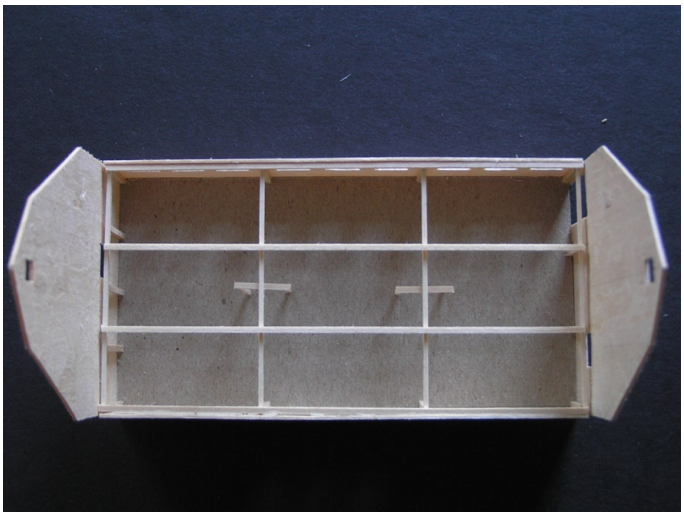


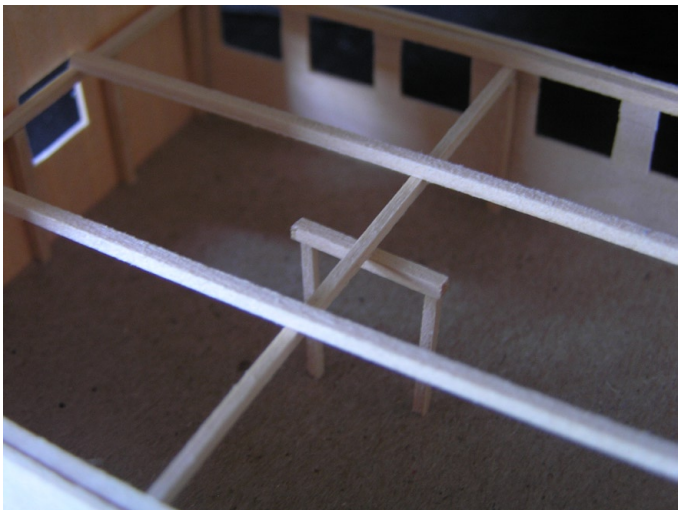


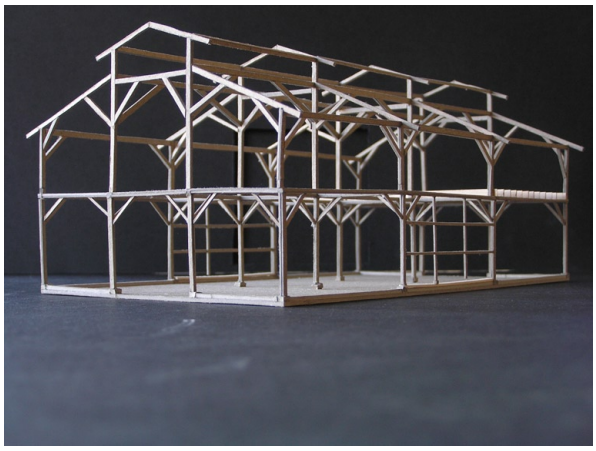
Model of existing older barn to the east

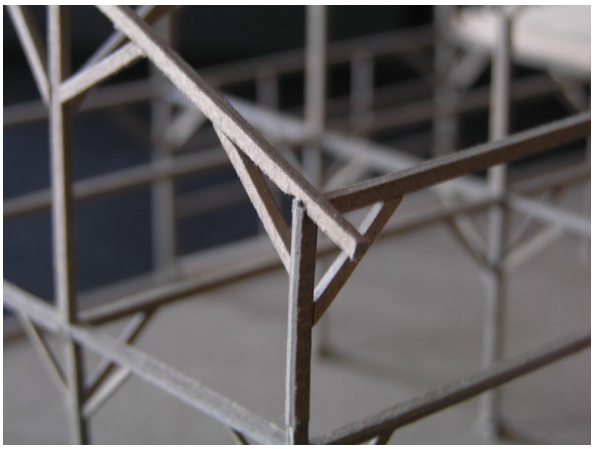


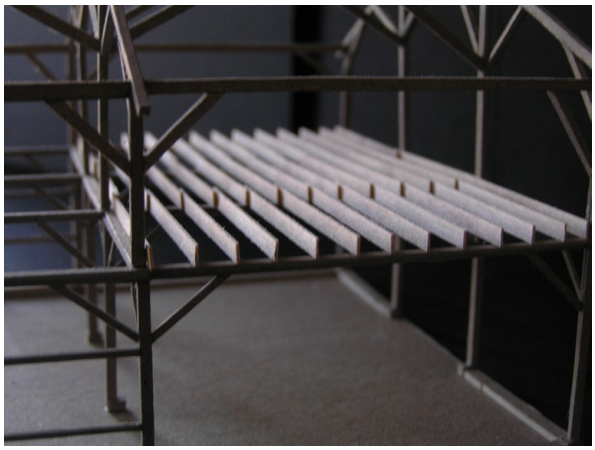


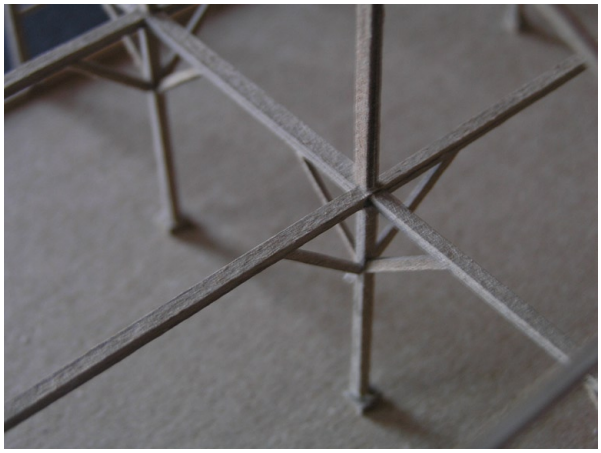






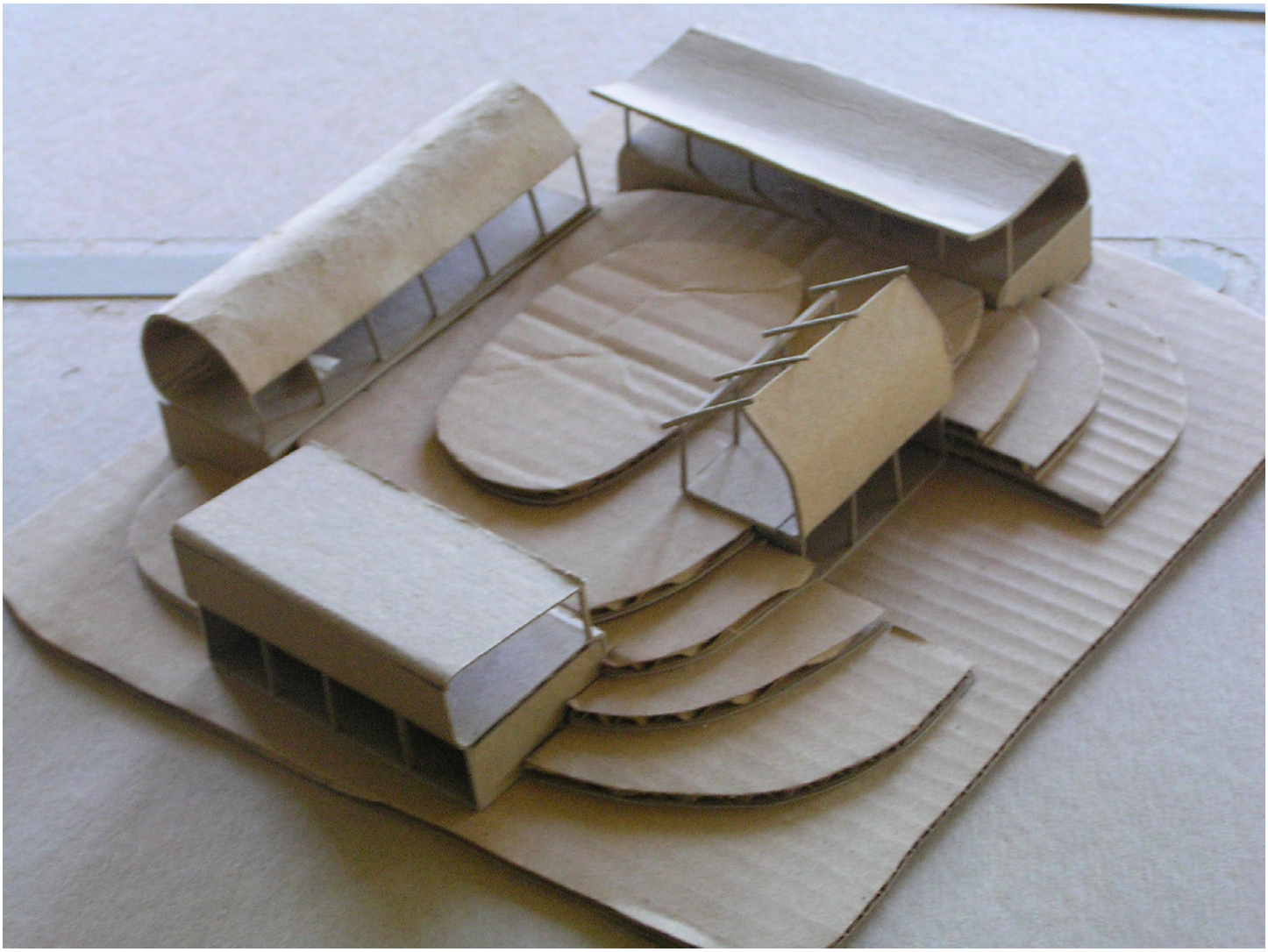


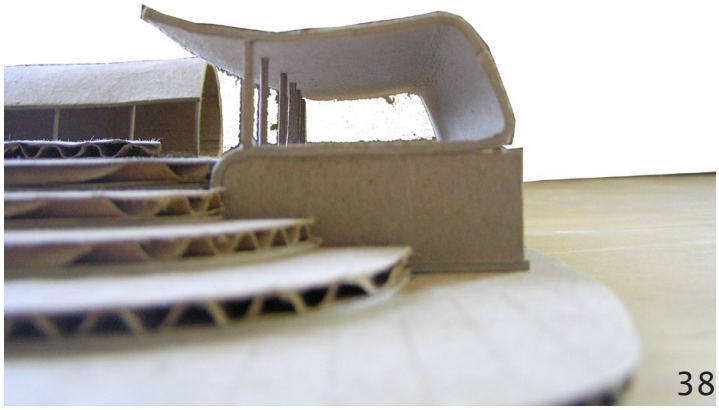


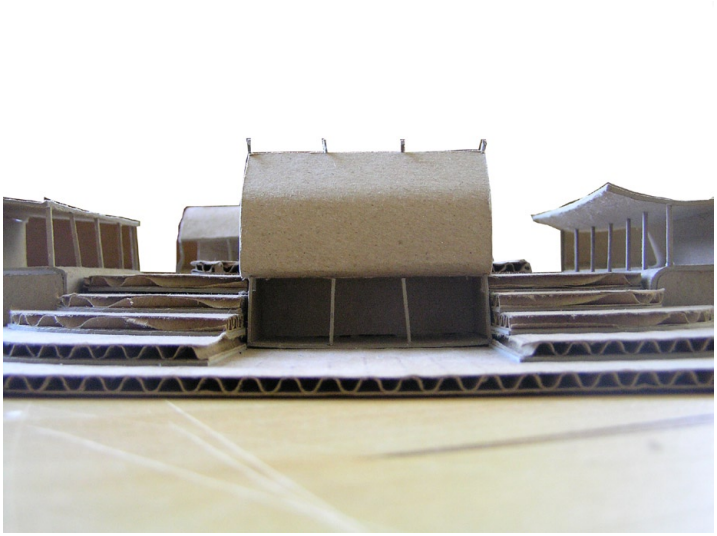


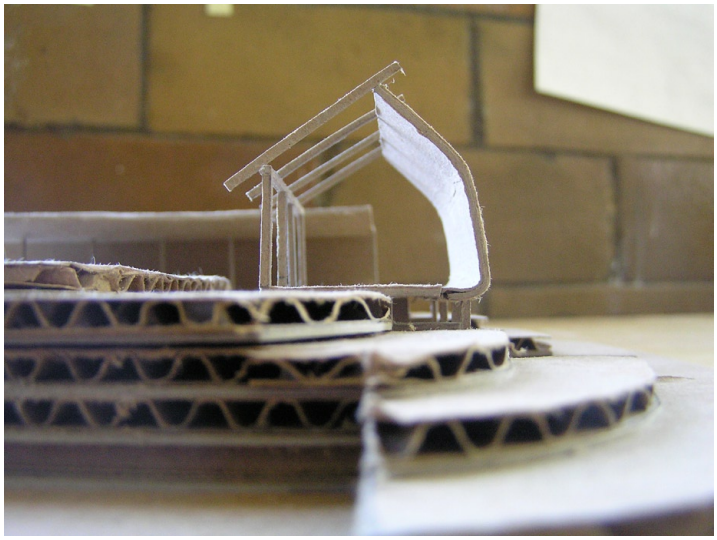
Structural Study Model

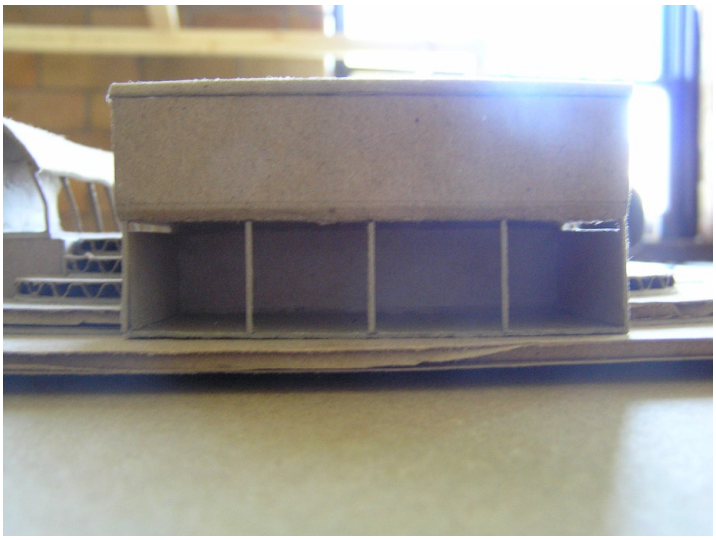
This early model utilized a glue-lam beam and column system to form bays that organized the space for the tractor exhibits.

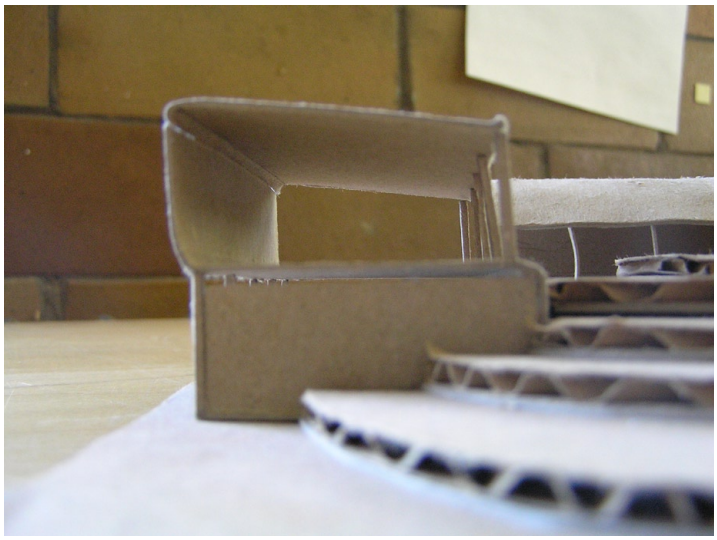


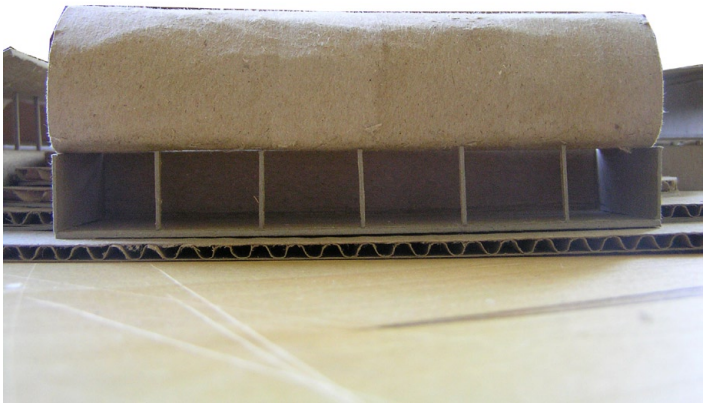


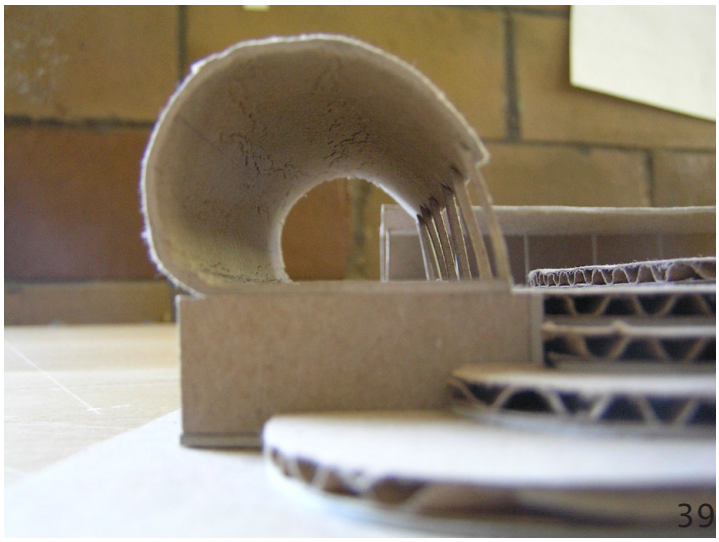




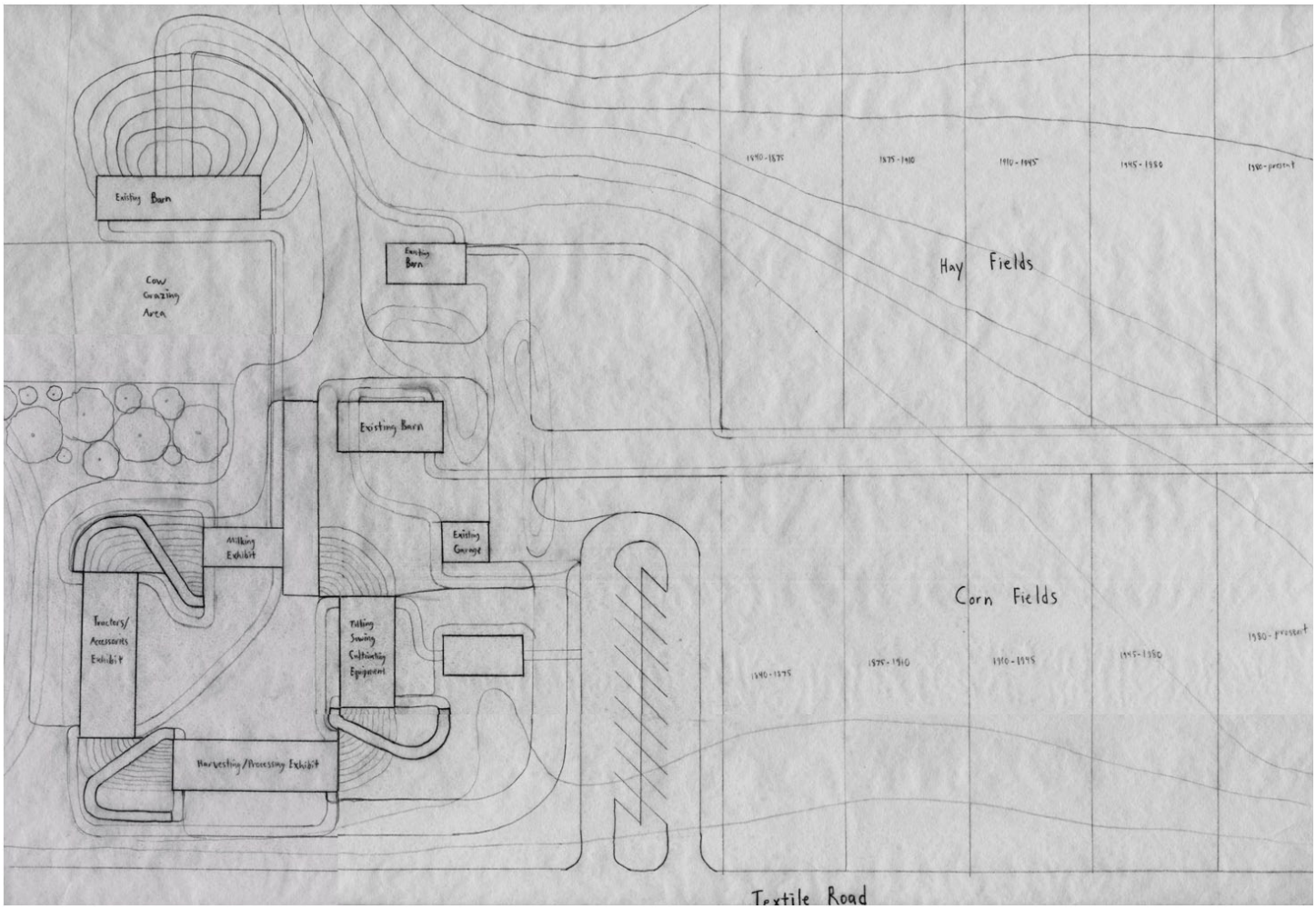






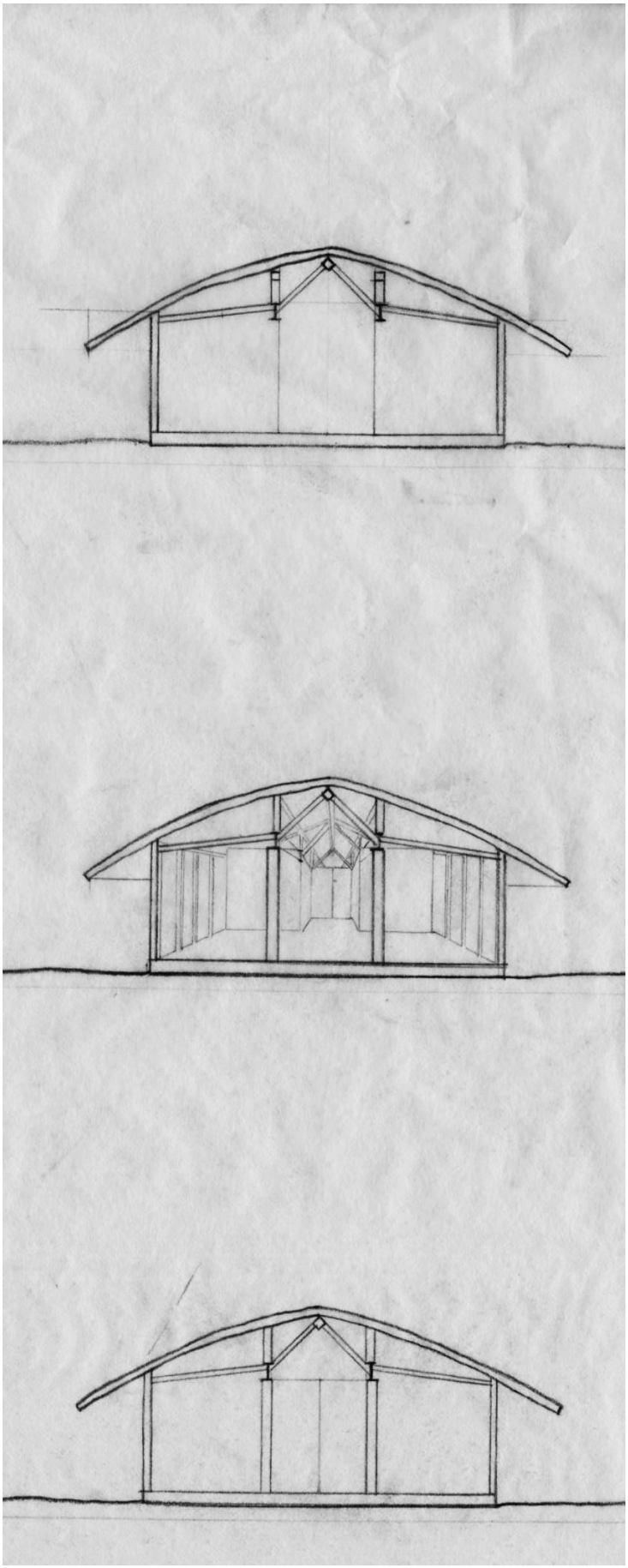


Design Development



During the first stage of design development, the hill upon where the existing house was to be demolished was to be the location of all the exhibition structures. By being built into the hill, the exhibition buildings would utilize the peak of the hill as a courtyard that could be accessed from their second floors. Arranging the exhibition structures around the hill allowed them to share one earthen ramp that was cut from the hill for vehicular access to the second floors. This arrangement also was the basis for the general forms of the exhibition structures. Where the structures were to be accessed by both farm equipment and visitors, existed the lightweight steel. Where the structure had to resist the forces of the earth, farm equipment, and weather, existed the massive concrete. However, it was decided that this arrangement alienated the exhibition structures from the existing barns and did not successfully integrate the old with the new.

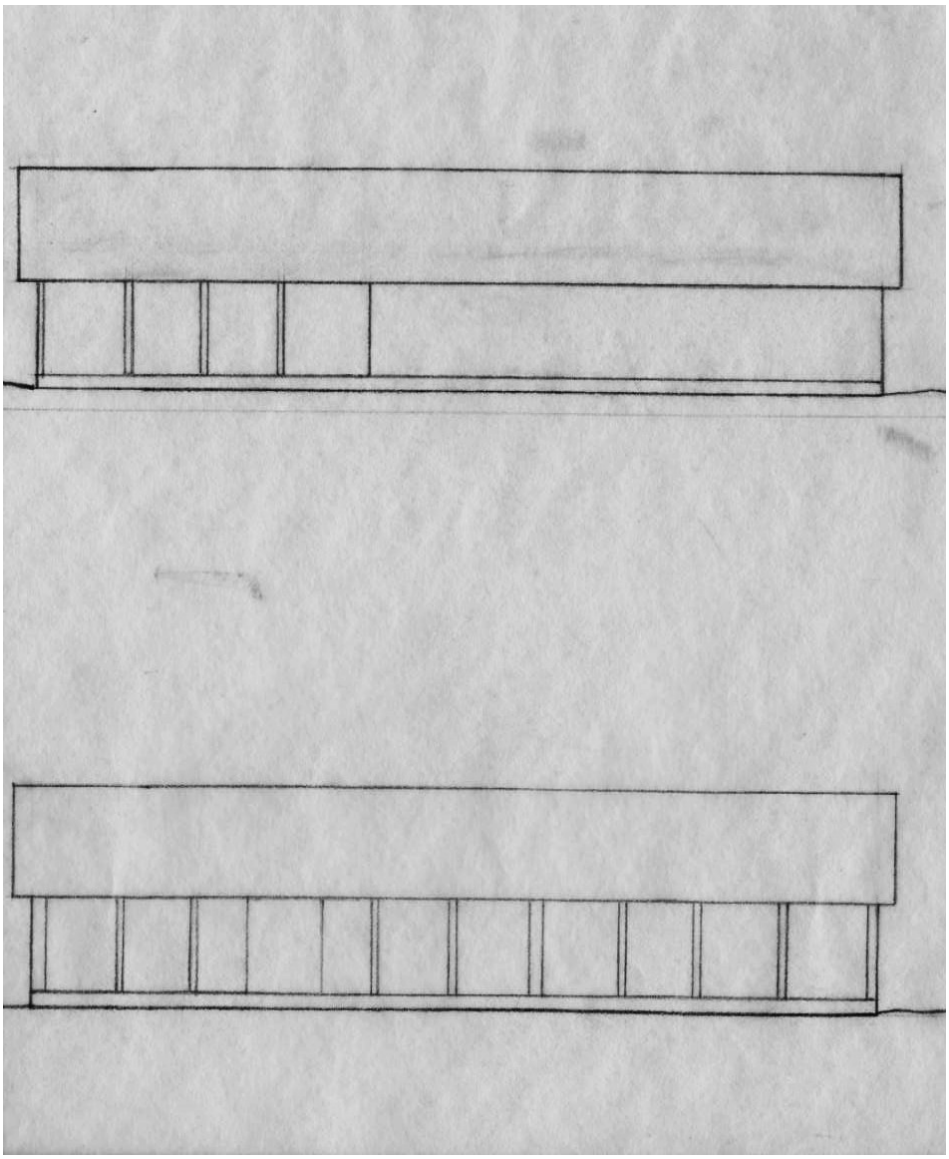
Entry/Gathering Space



Section

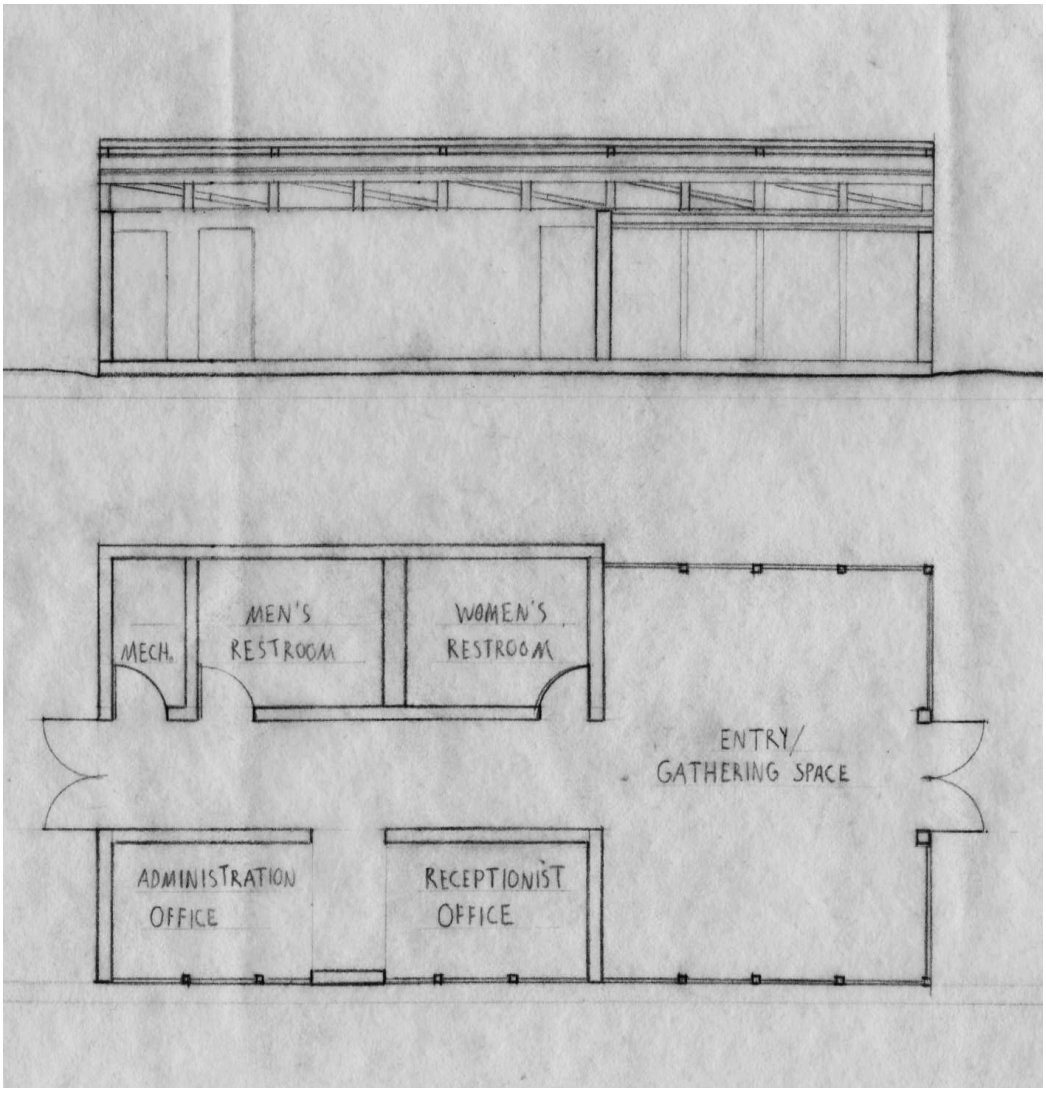
Section Perspective

Elevation



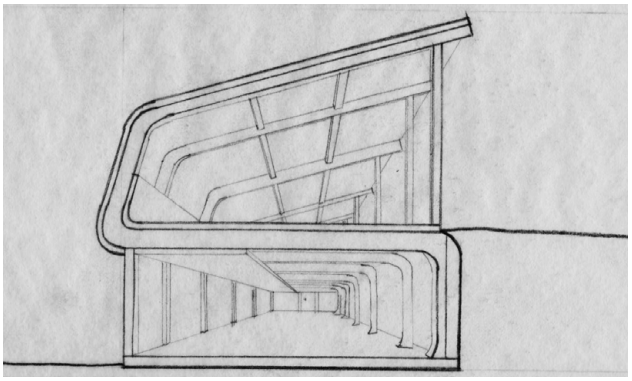
Elevation

Elevation

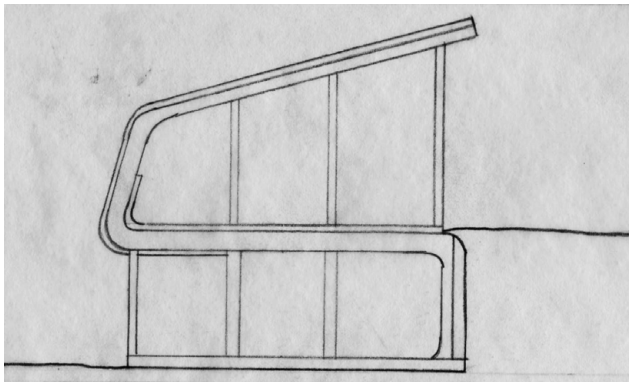


Section

Floor Plan



Section Perspective



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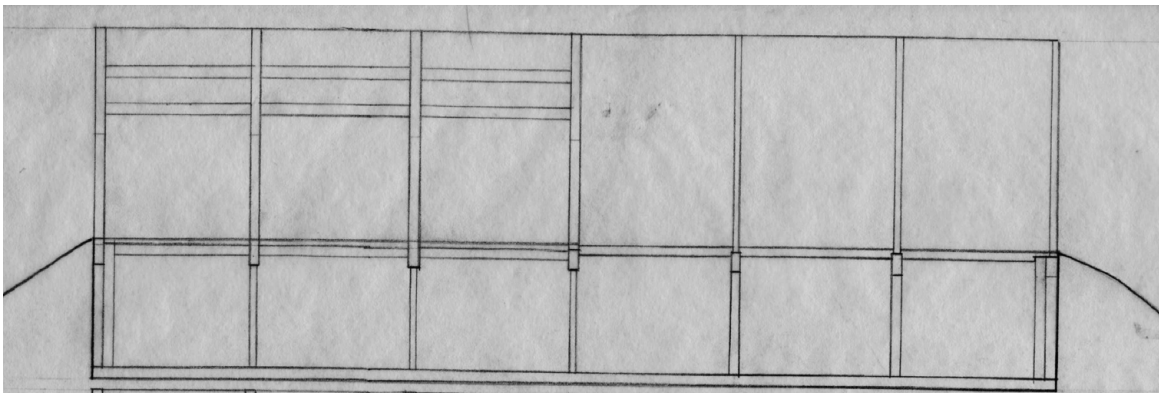

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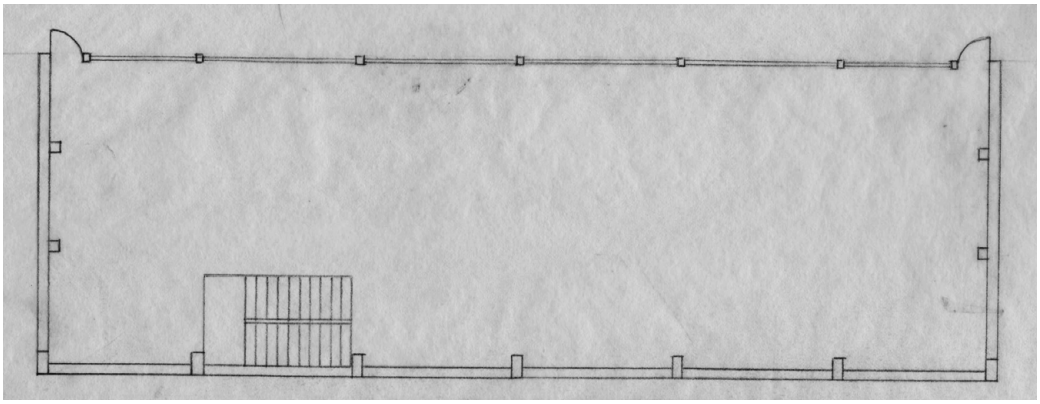
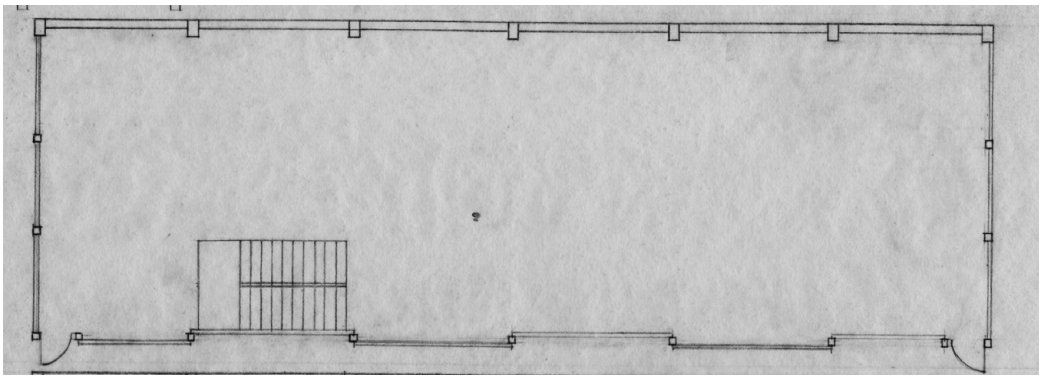
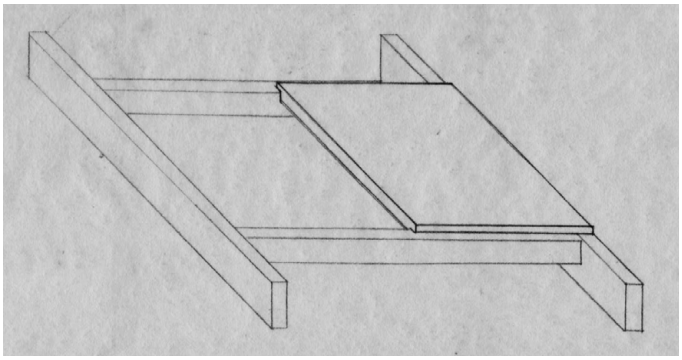


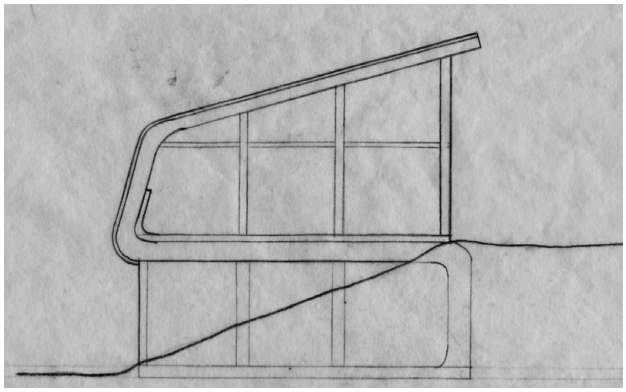
Second Floor Plan



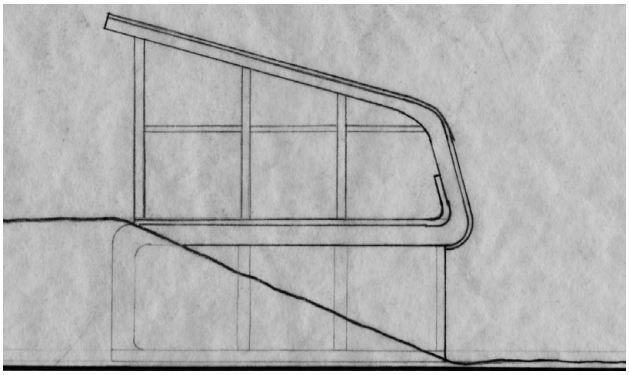
First Floor Plan

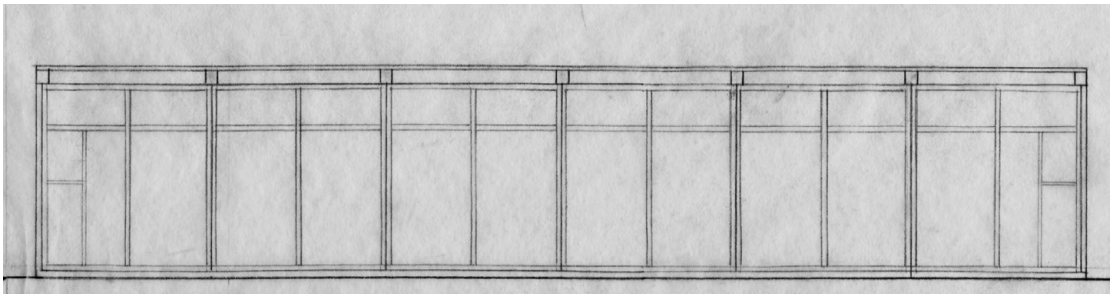


Second Floor Slab Detail

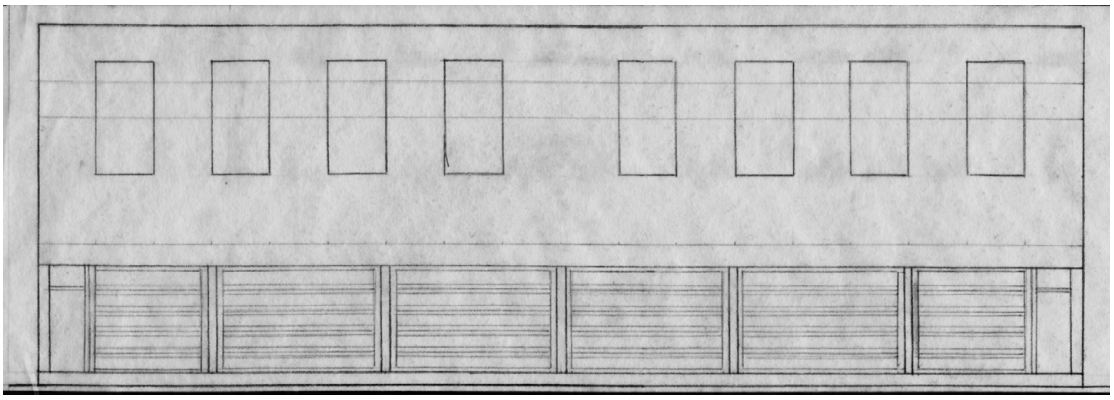


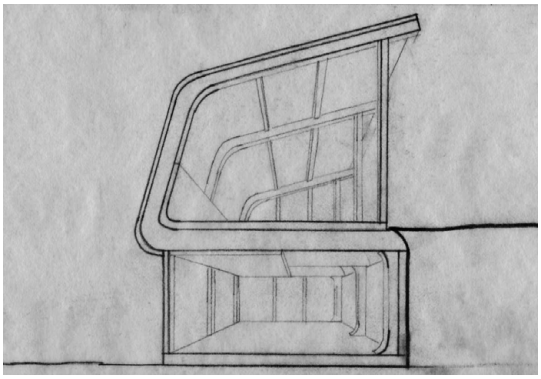
Elevations



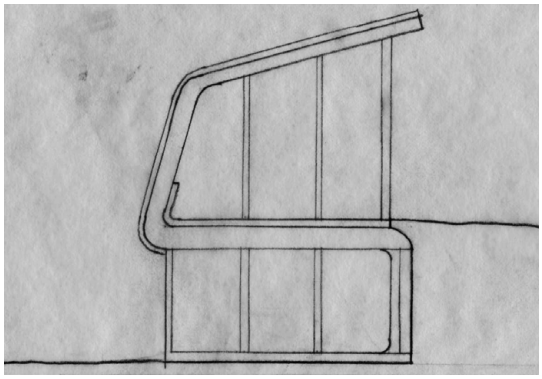


Elevations





Section Perspective



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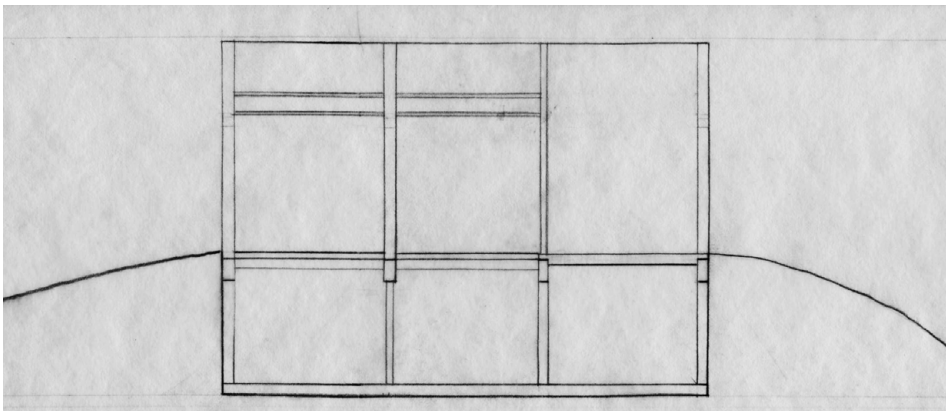

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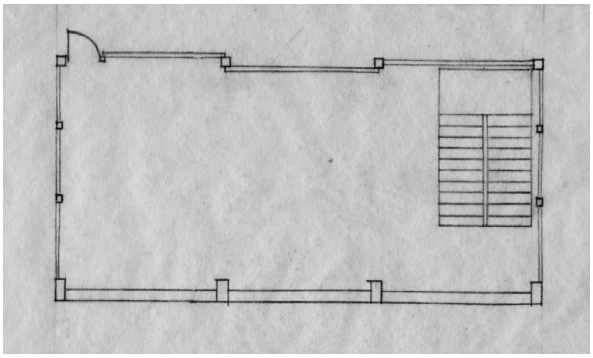
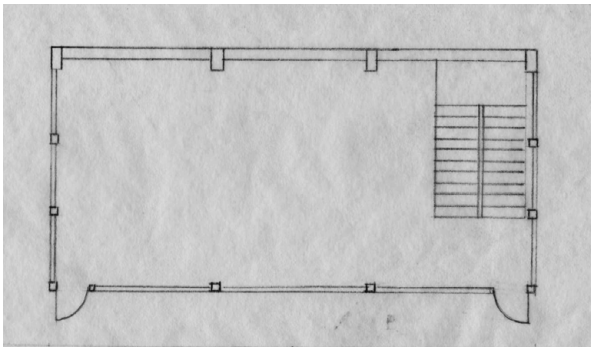
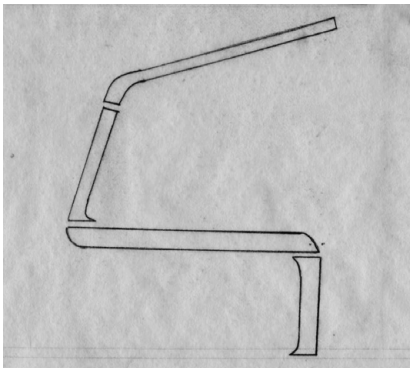


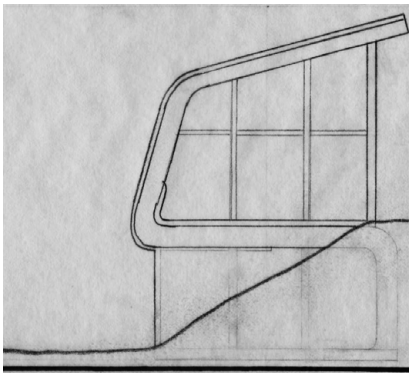
Second Floor Plan



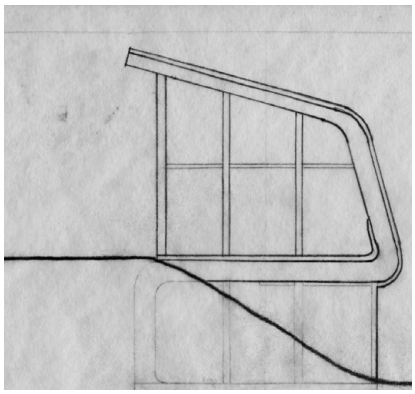
First Floor Plan

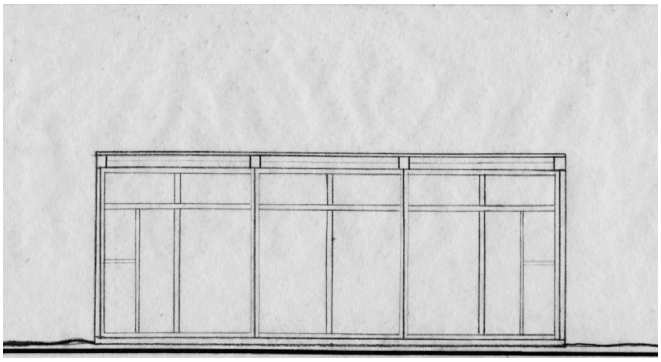


Precast Concrete Diagram



Elevations





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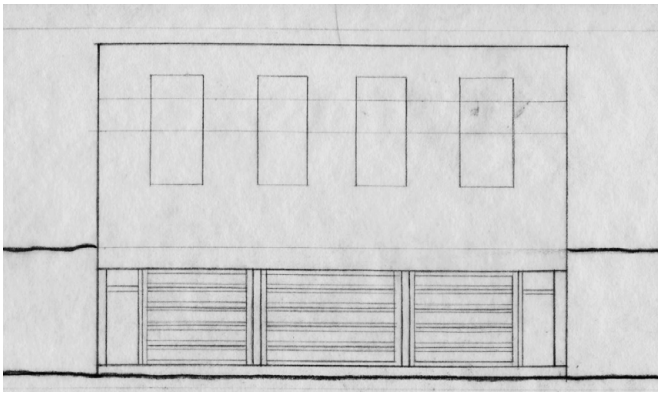
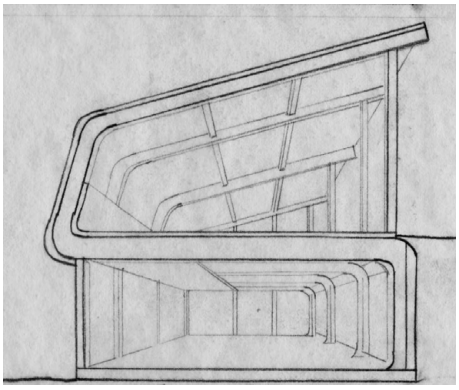
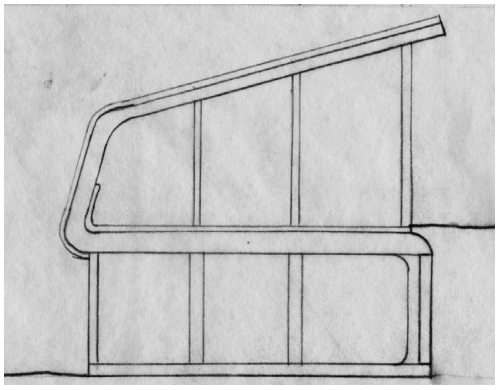




Section Perspective



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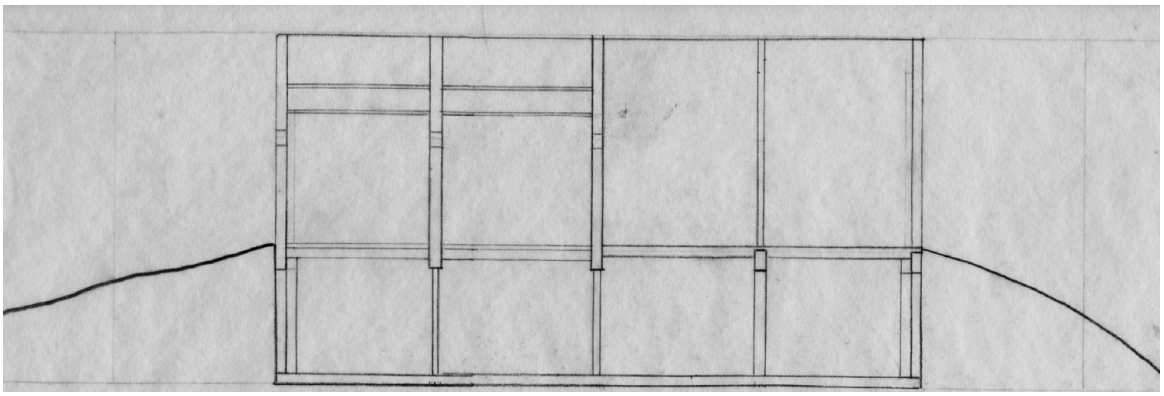

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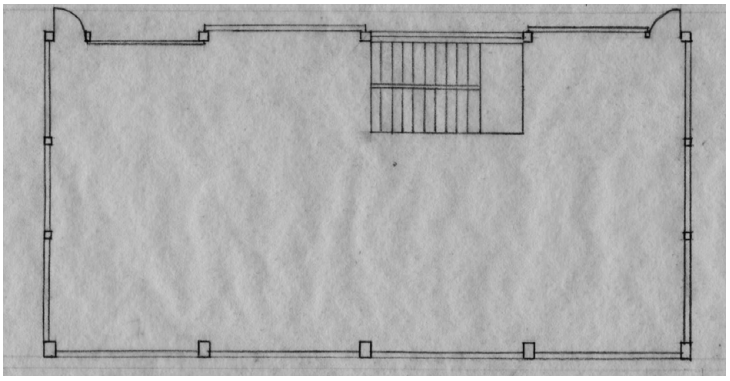
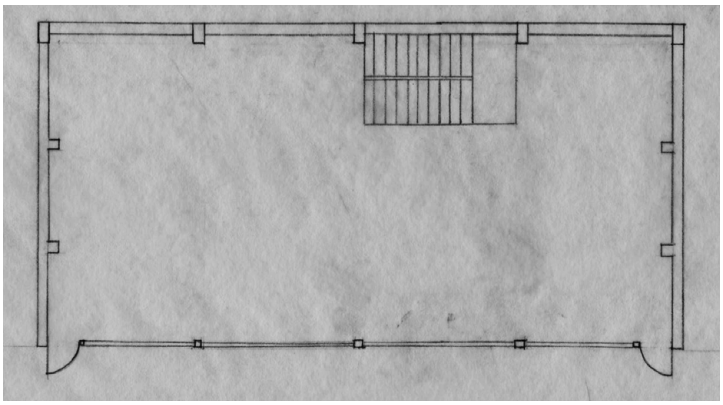
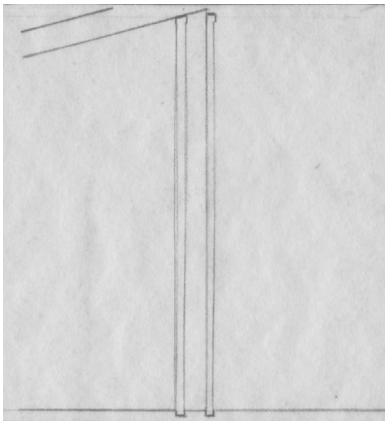


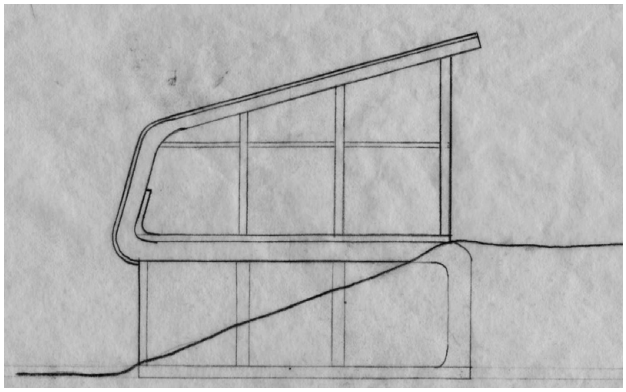
Second Floor Plan



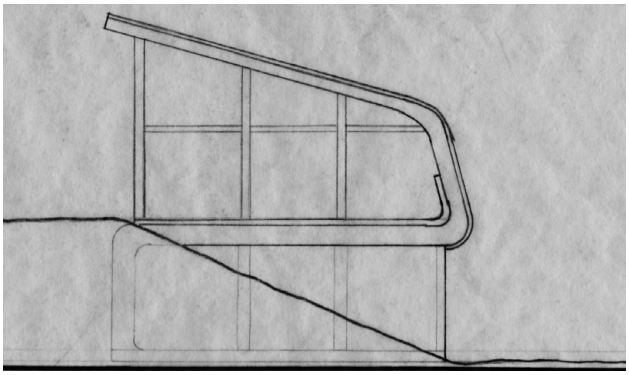
First Floor Plan

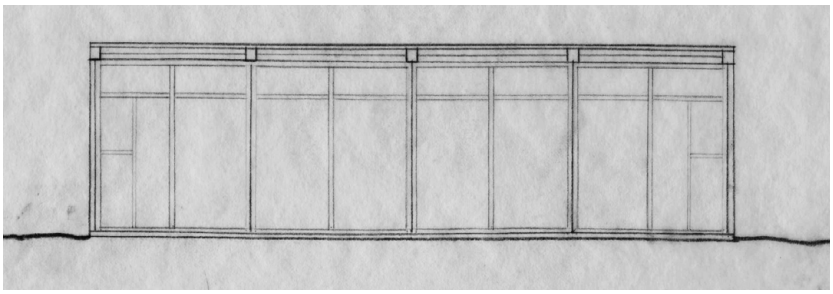


Sliding Door Detail

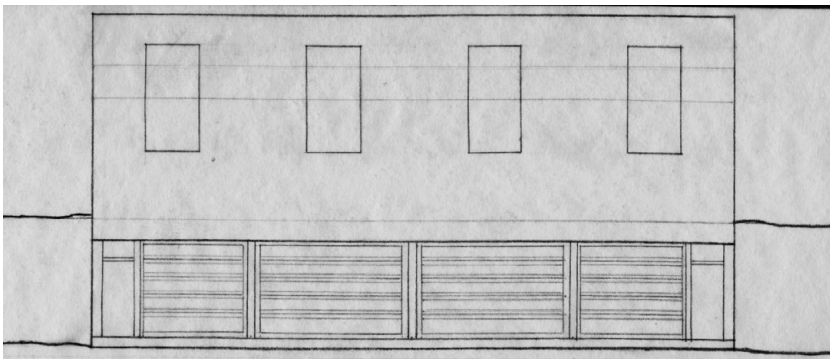


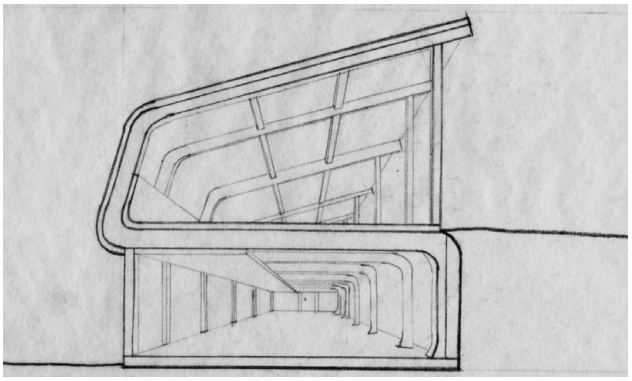
Elevations



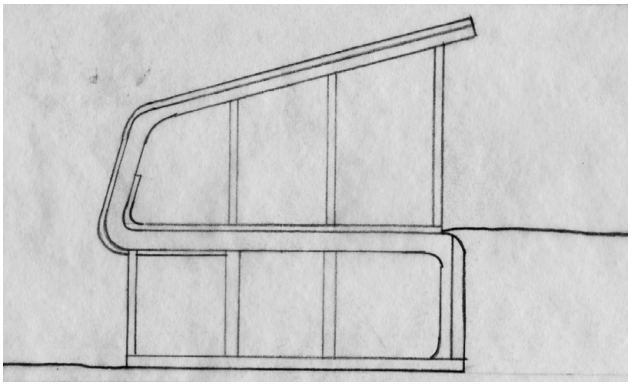


Elevations





Section Perspective



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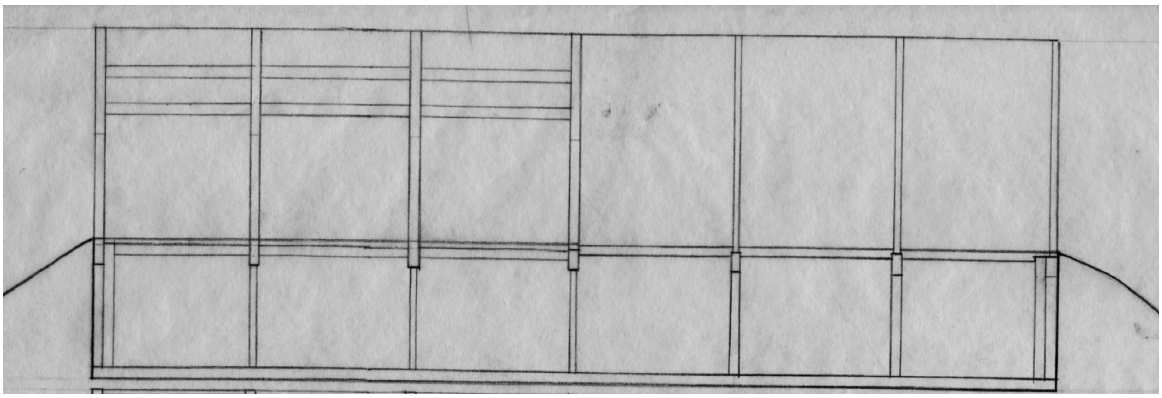

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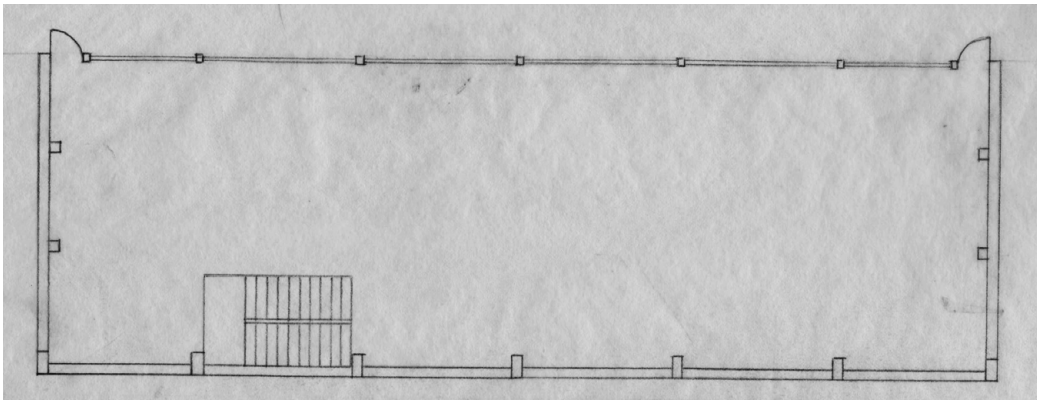
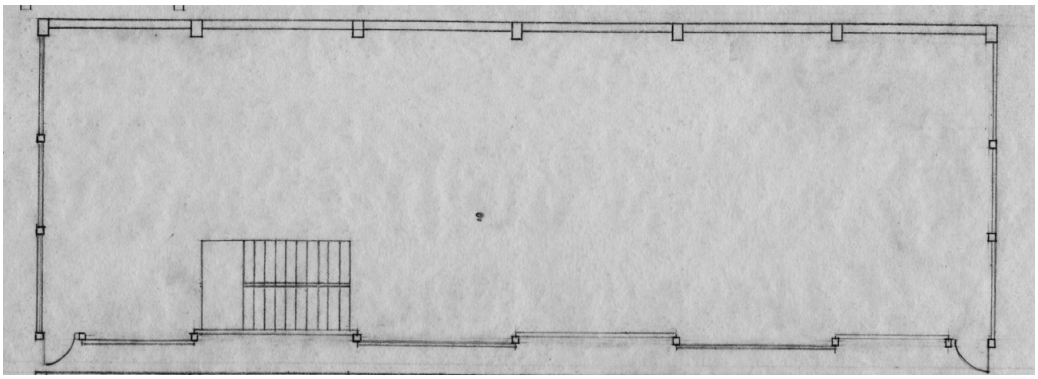
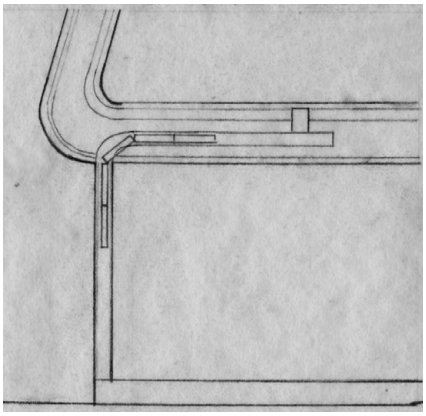


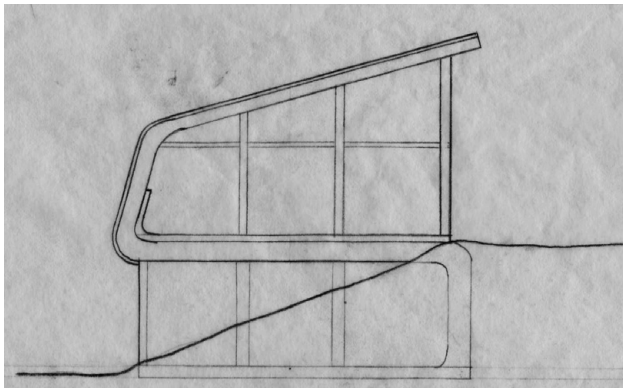
Second Floor Plan



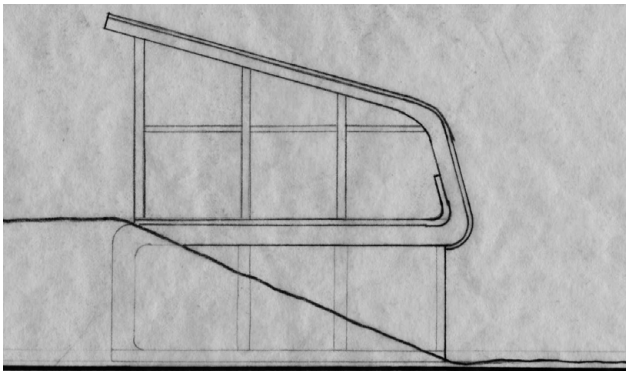
First Floor Plan

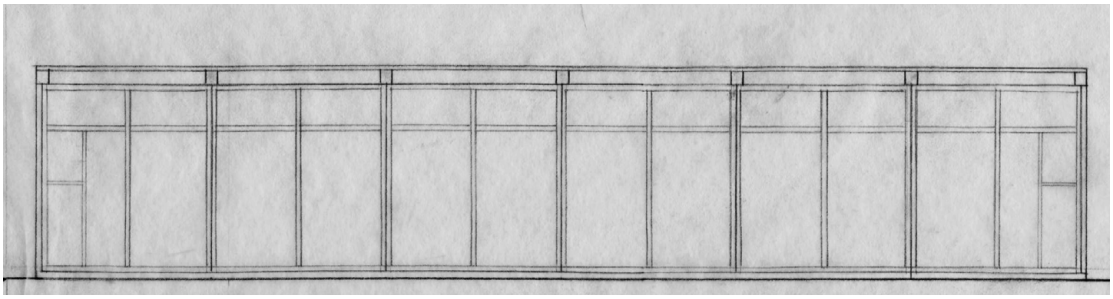


Overhead Door Detail

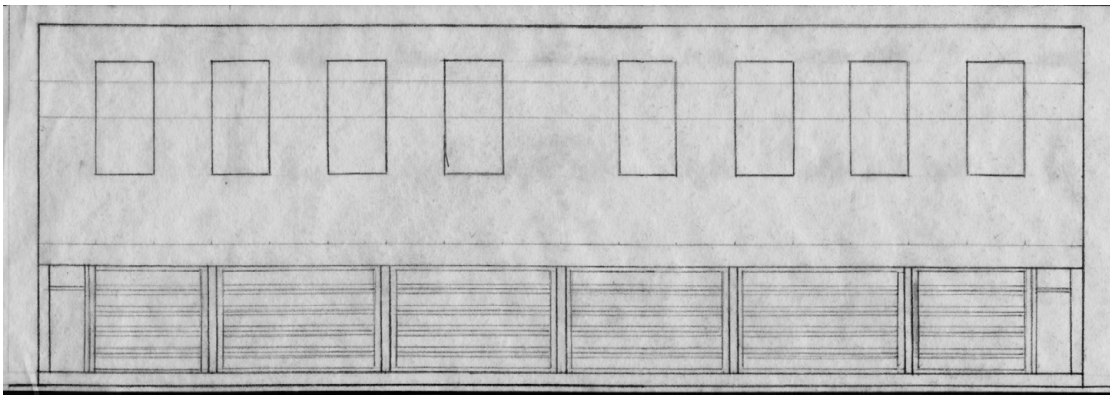


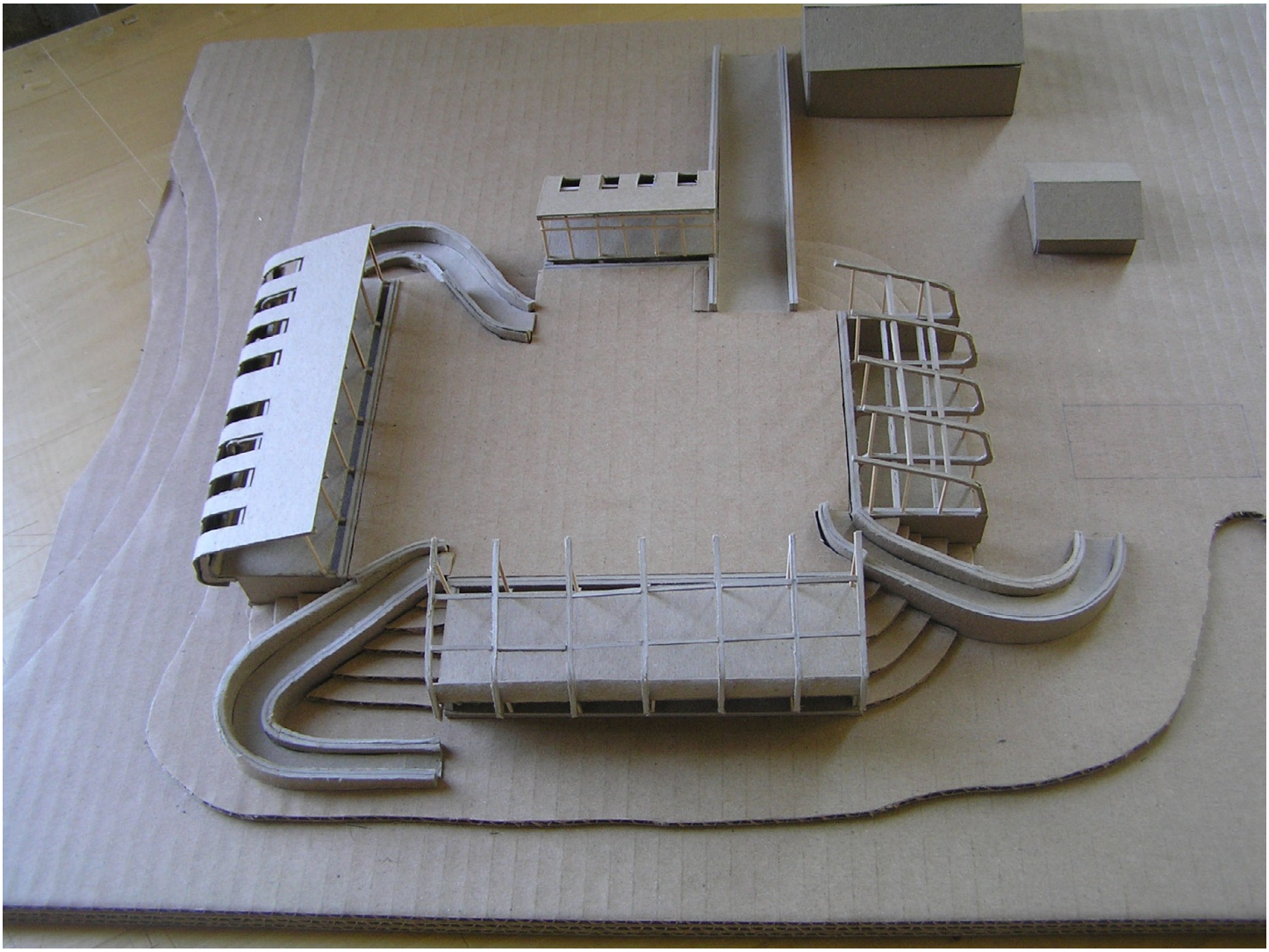
Elevations

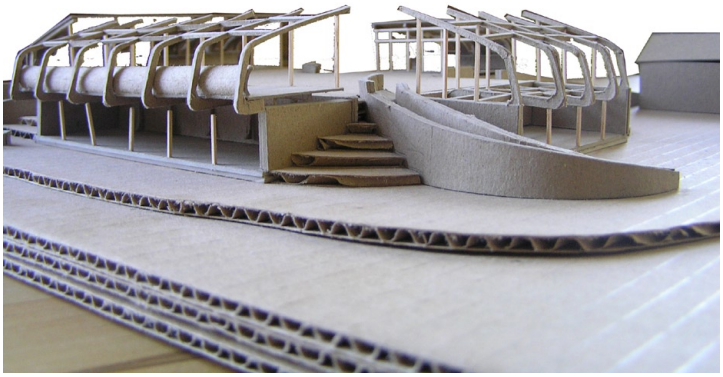


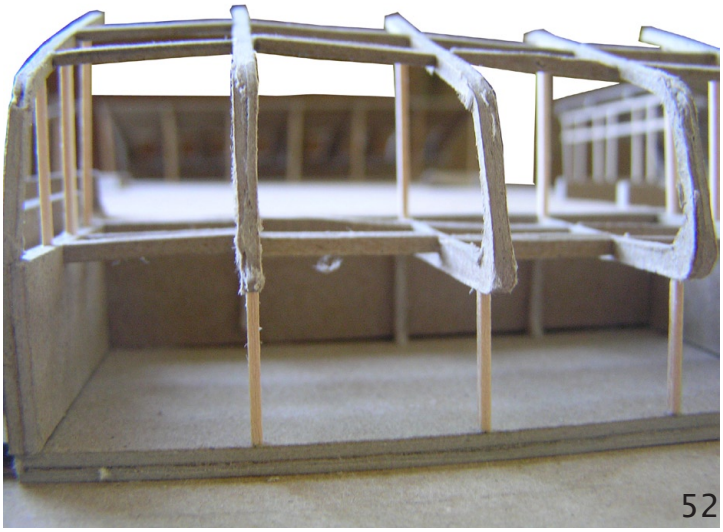


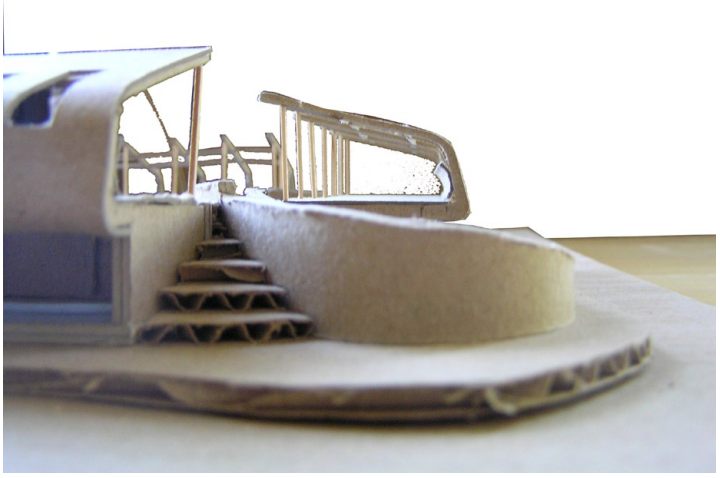
Elevations

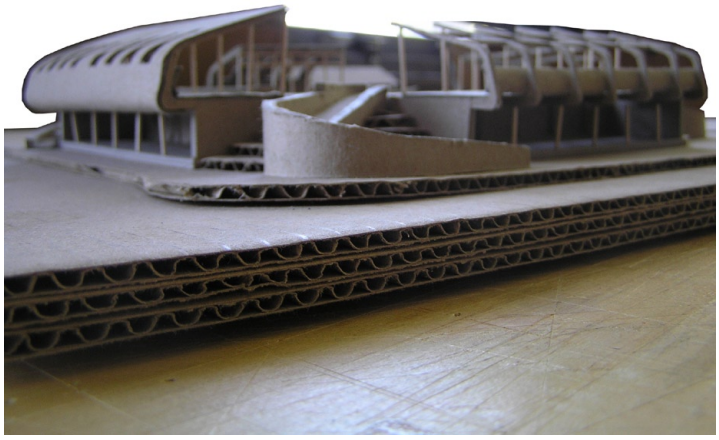


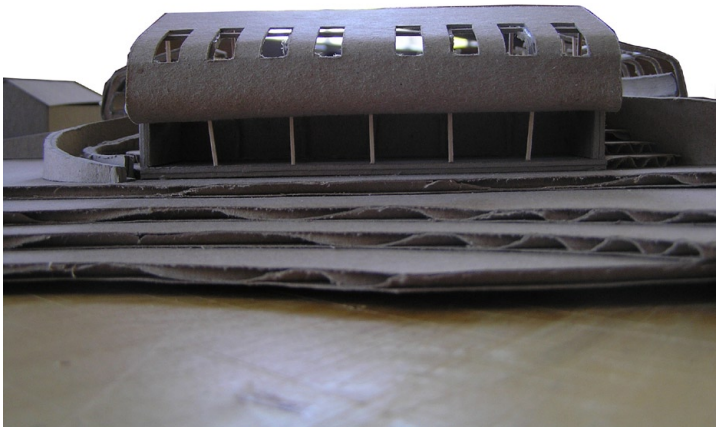


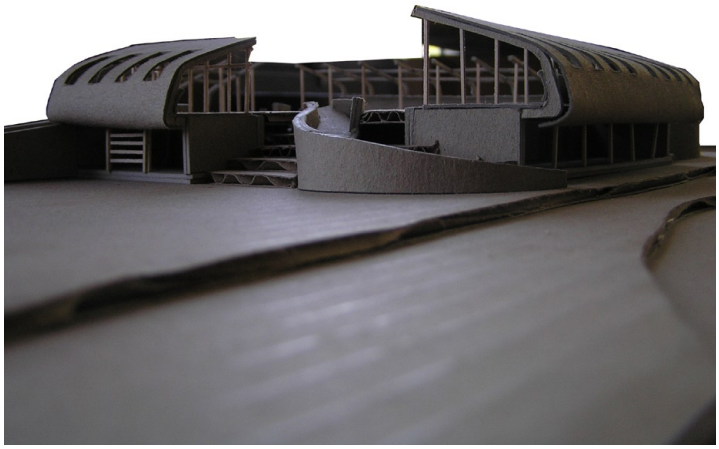


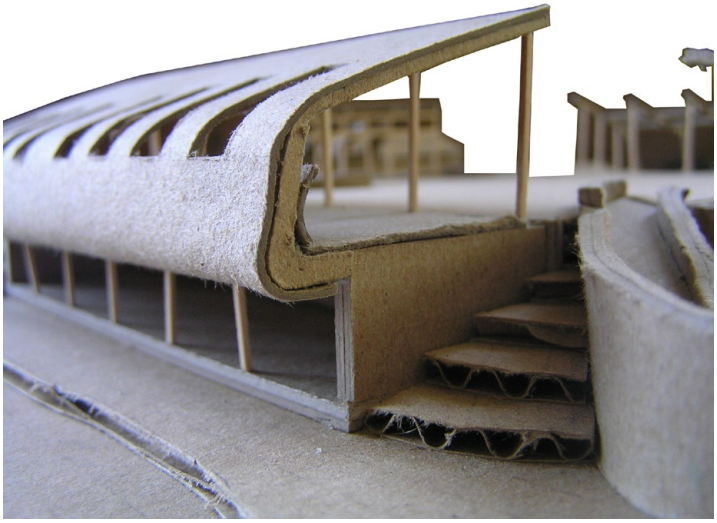


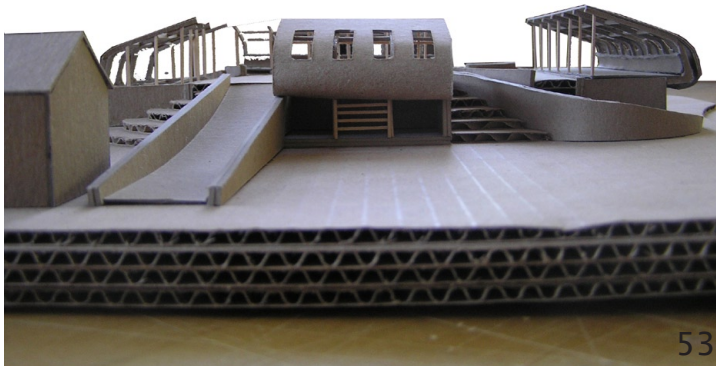


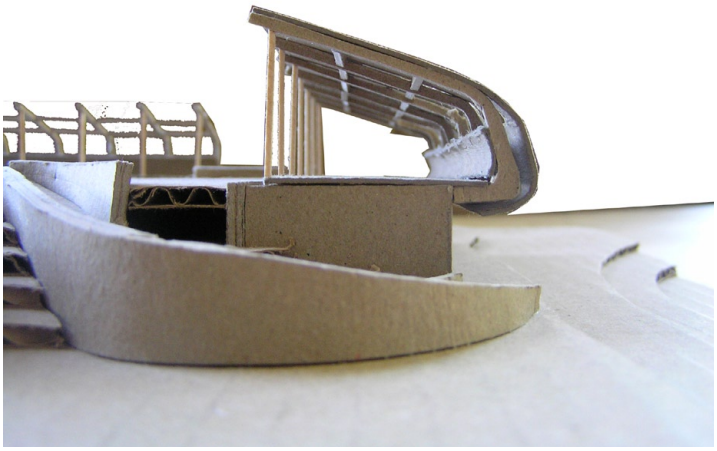


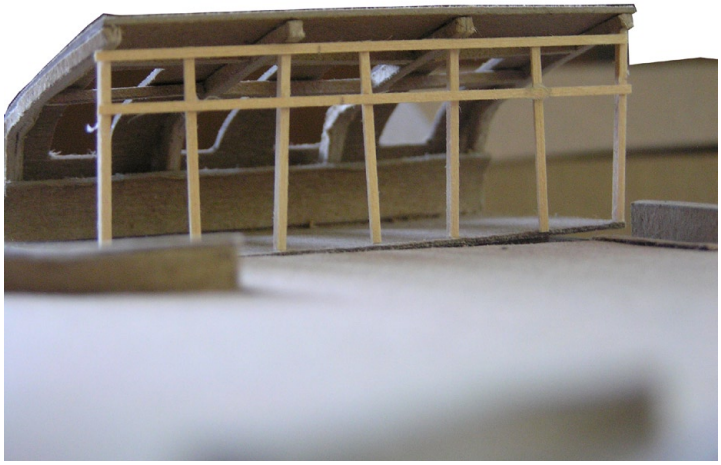


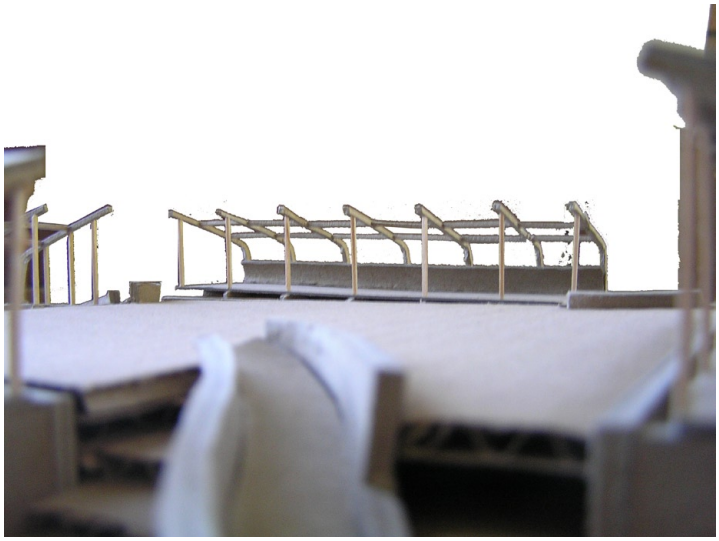


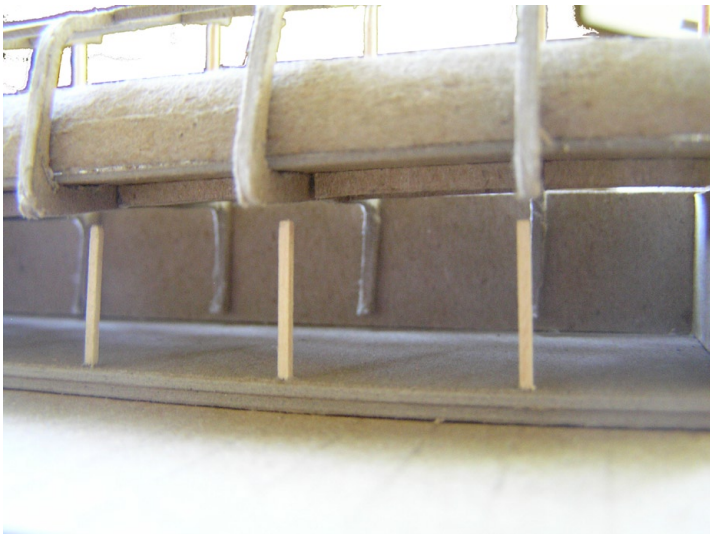


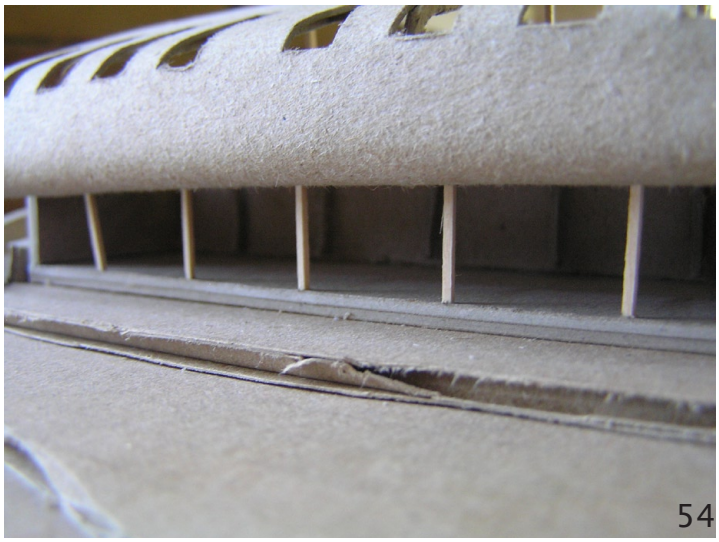




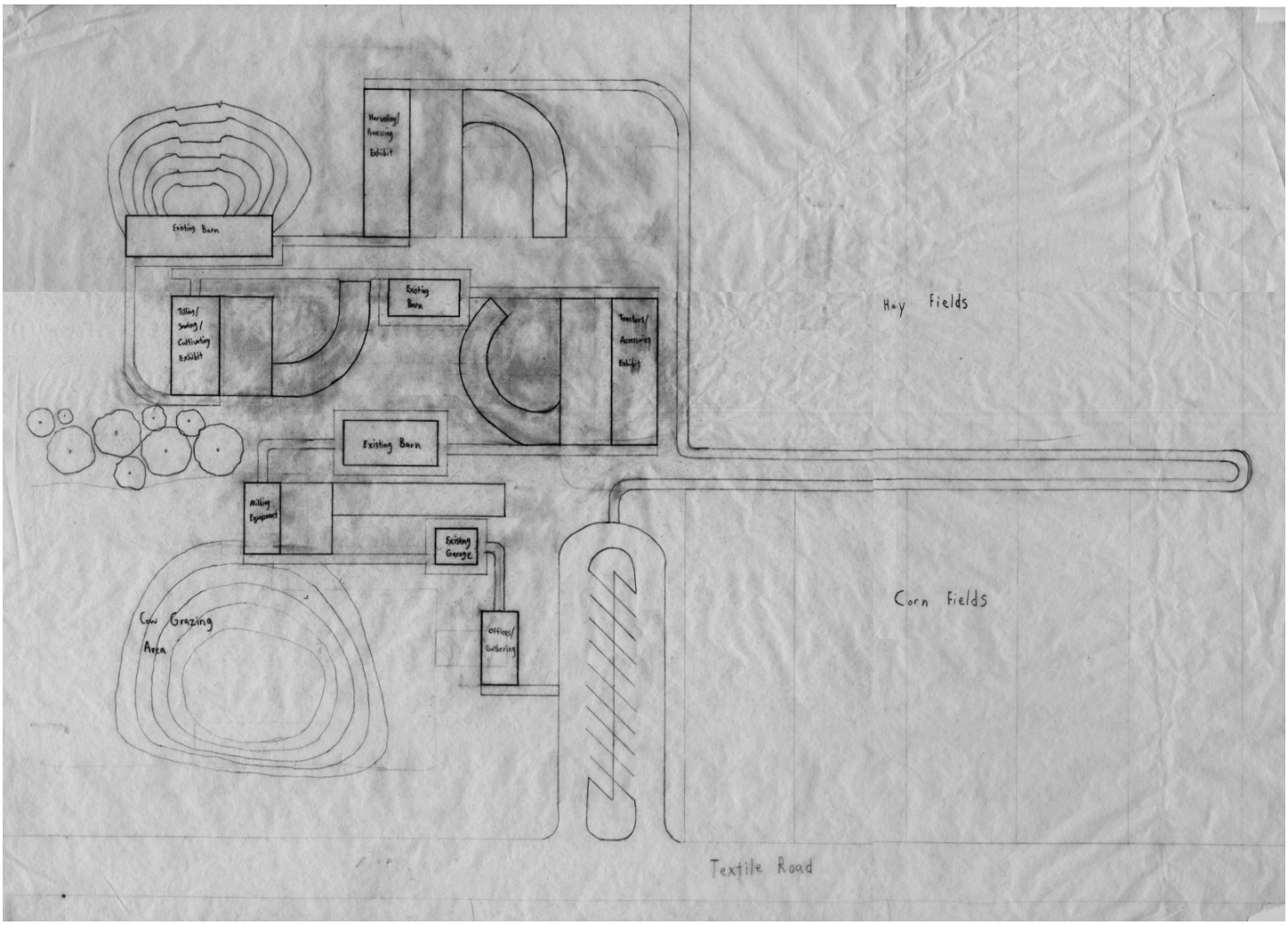




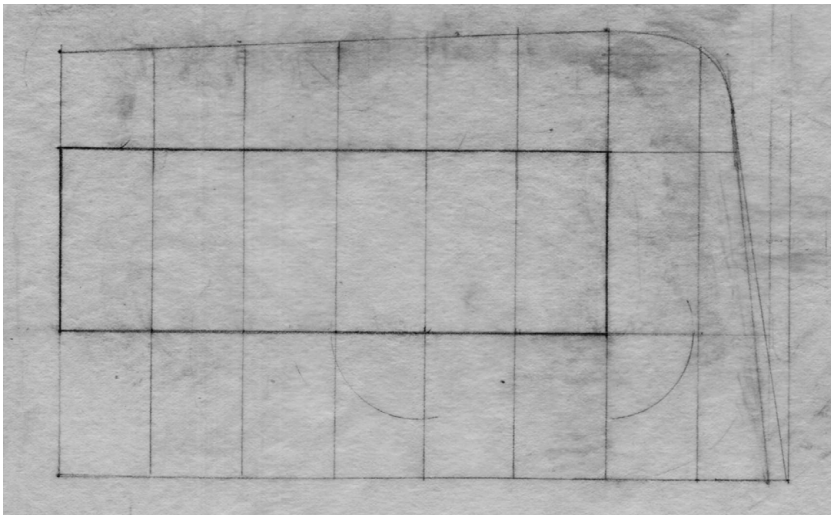




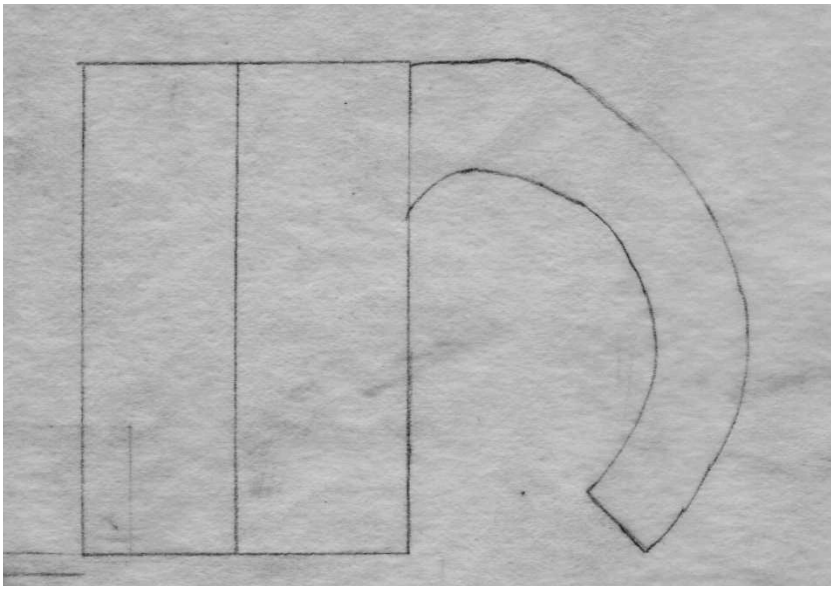
Further Design Development



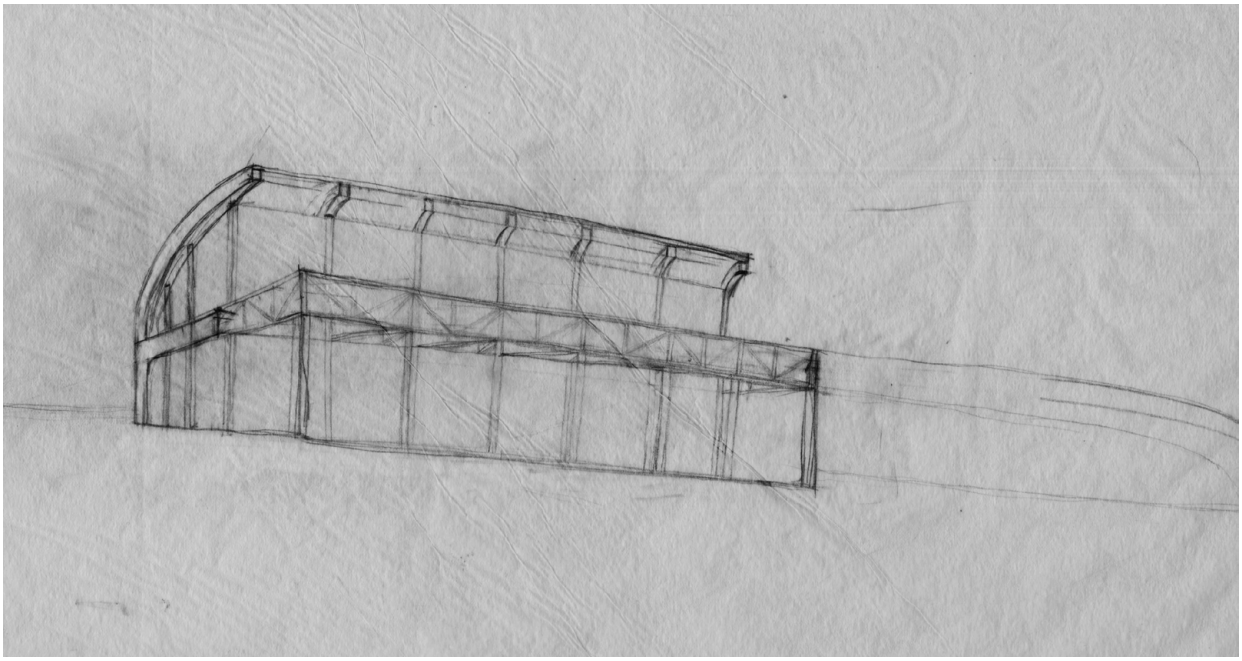
During the final stage of design development, the hill no longer determined the layout of the exhibition structures. Instead, the organization of the exhibition structures was determined by the procession of the visitors and routes of the farm machinery to and from the fields. This layout allowed the procession of the visitors to alternate between existing barn and exhibition structure. The layout also reduced the number of necessary vehicular pathways to just two main axis so that more grassland could remain. Because the hill was no longer utilized by the exhibition structures, they would each need their own separate balcony and ramping system. Therefore, the general form of the exhibition structures was altered to accommodate these changes. To help keep the scale of the exhibition structures similar to the existing barns, the ramp and balcony were constructed of steel trusses and steel grating to minimize their presence. However, at the center of this arrangement two existing barns and two exhibition structures formed what inherently wanted to become a courtyard. This inherent courtyard was being disrupted by the exhibition structures' ramps, and it was decided that further modifications to this arrangement were warranted.

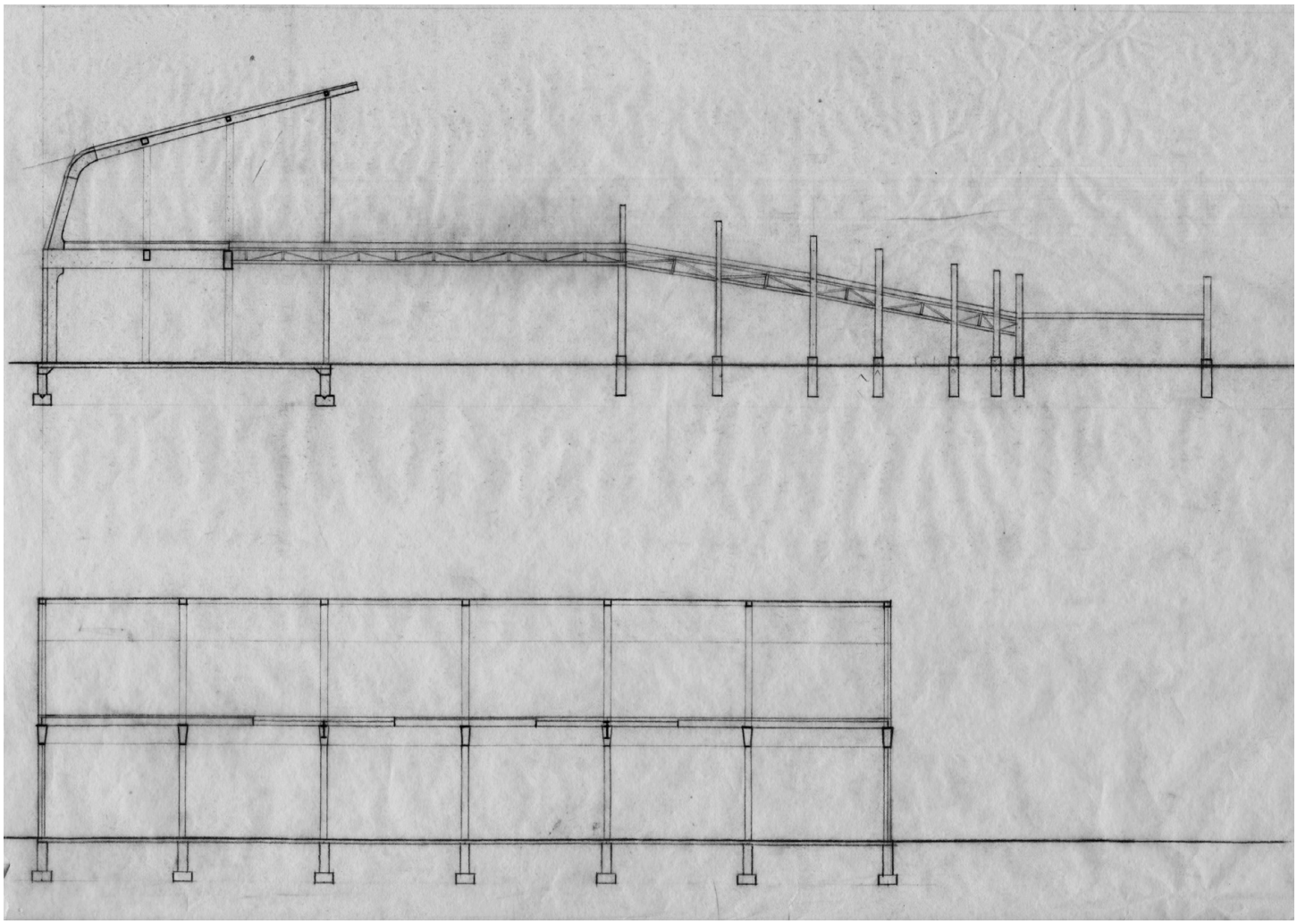


Sketches showing options for ramp and balcony design

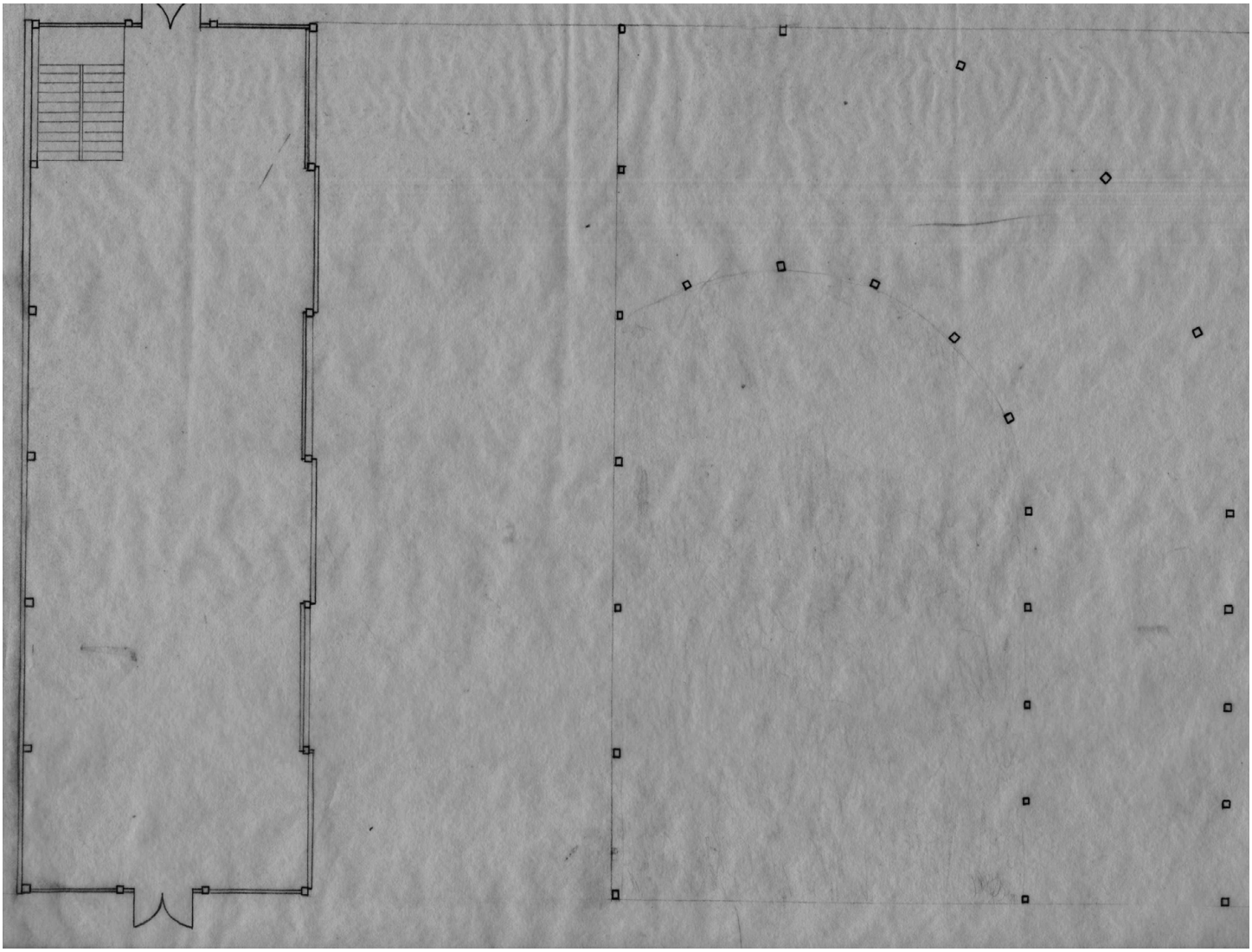


Sketch showing balcony and exterior of exhibit structure

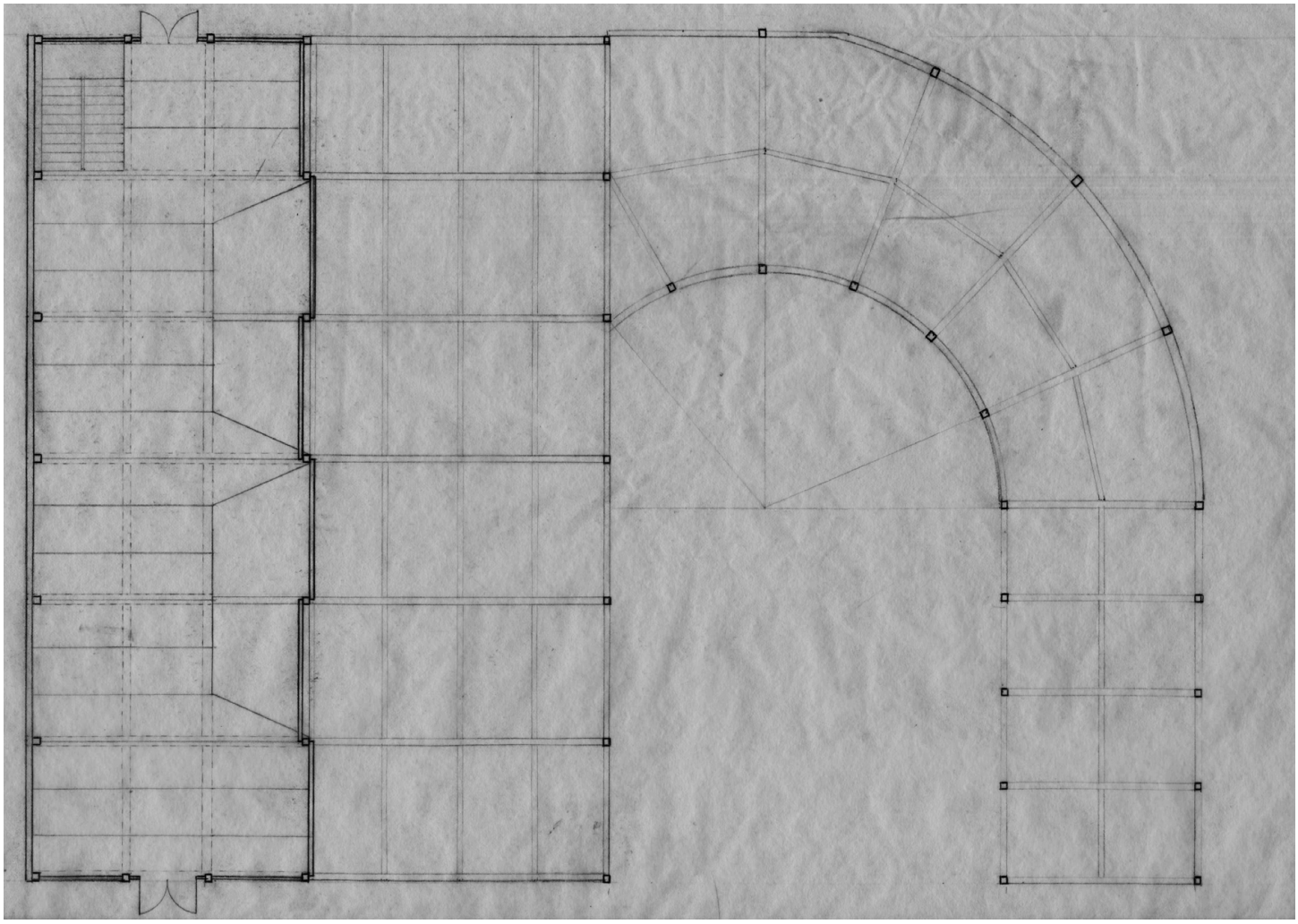




Overall Sections

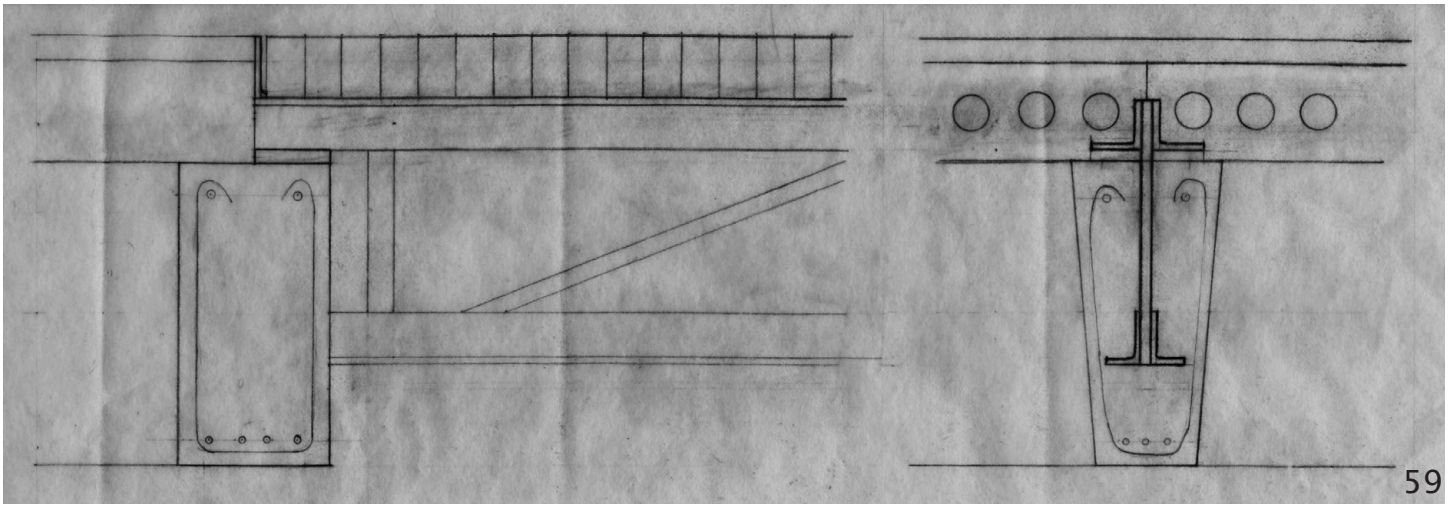


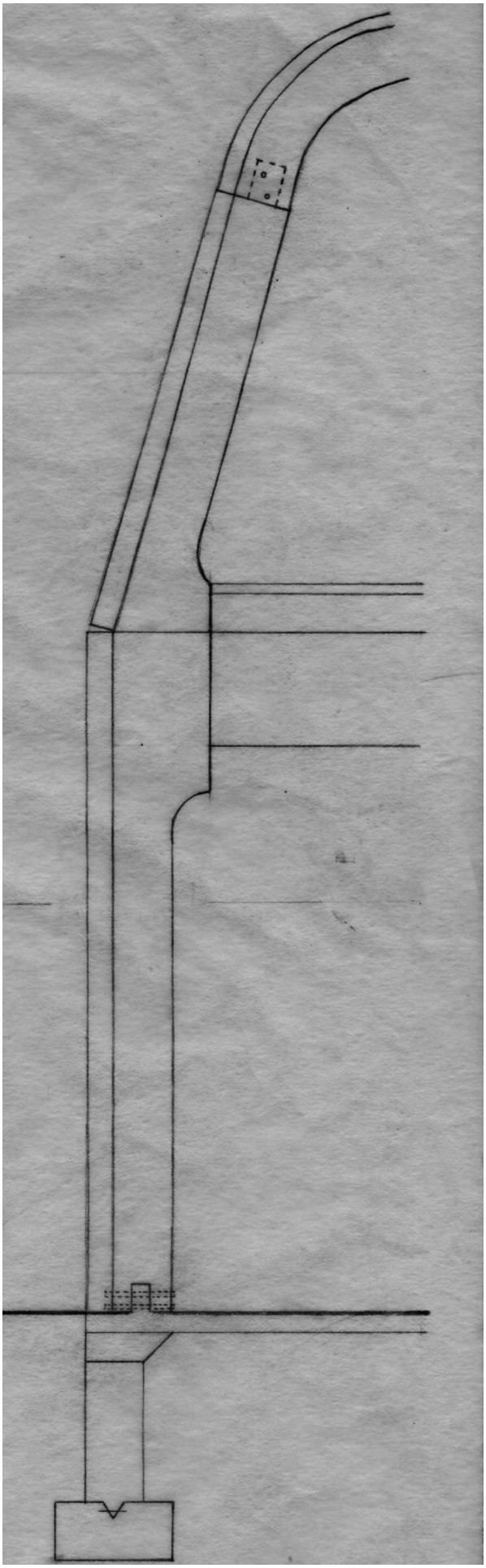
First Floor Plan



Second Floor Plan

Detail showing how the steel balcony meets
the second precast concrete floor slab

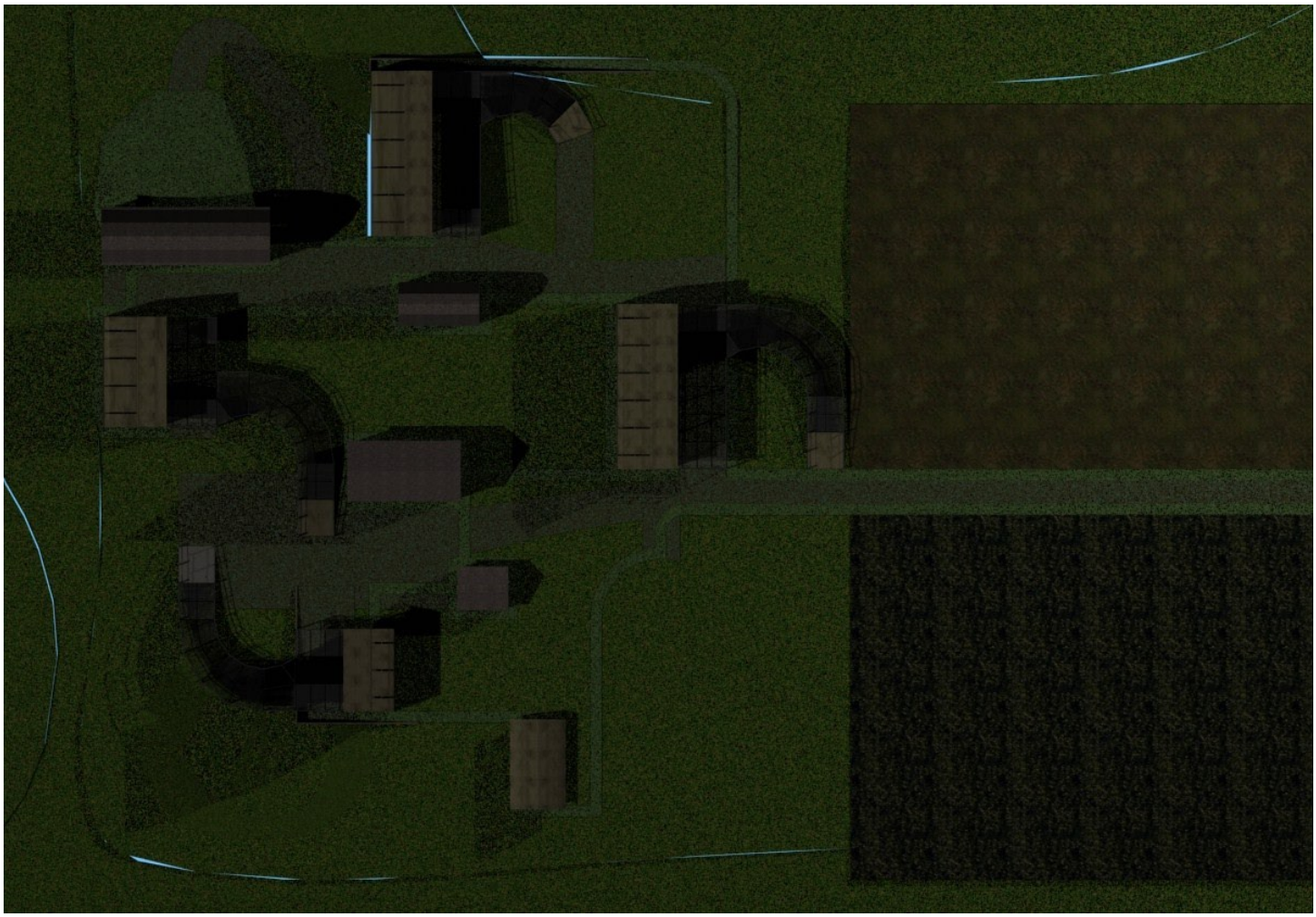


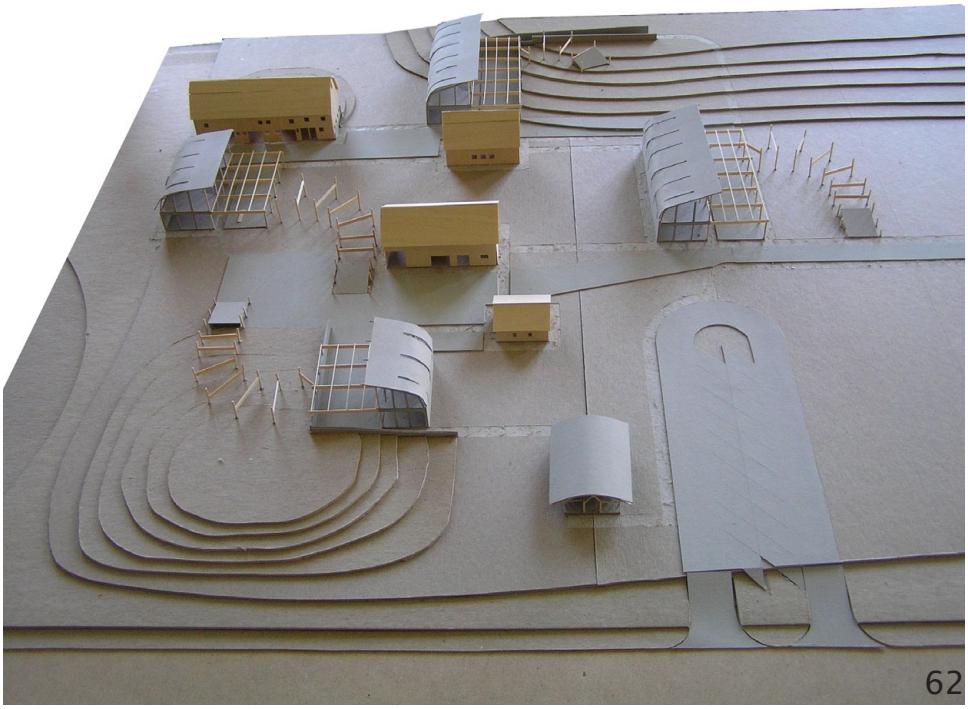


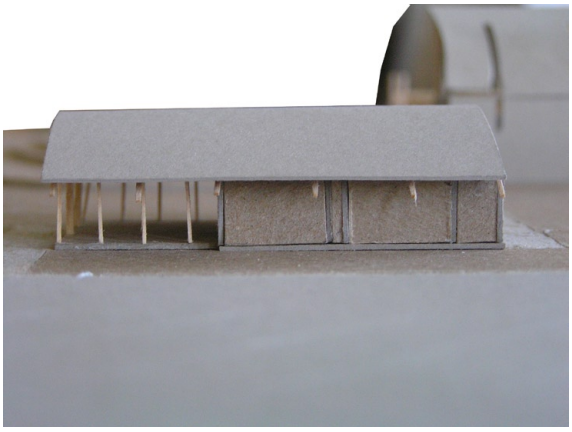
Wall section showing concrete side of exhibit structure

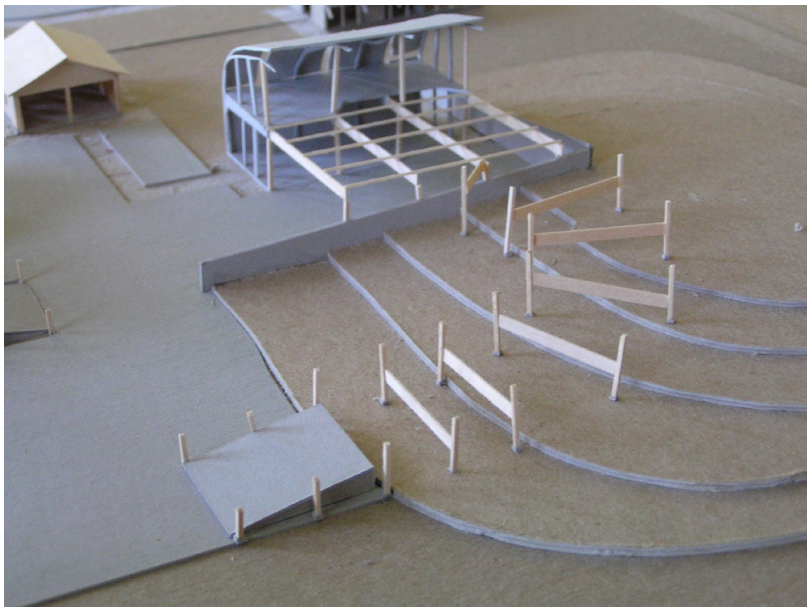
Final Design

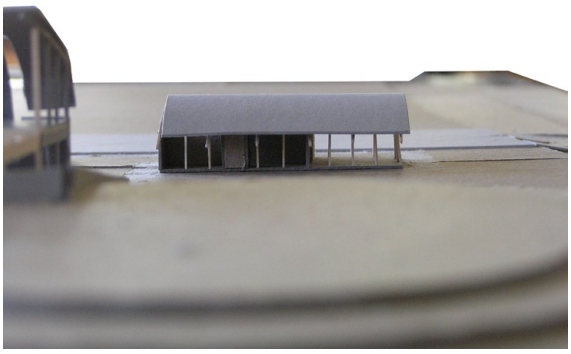
The final design was a logical progression from the final stage of design development. For the most part the locations of the buildings remained the same, the two exhibition structures were either rotated or had their balcony/ramp adjusted so that the courtyard in the center of the campus could become uninterrupted. The location of the entrances to the entry/gathering/welcoming space and exhibition structures was finalized to the center of their north and south ends. The first floor of the exhibition structures was to be lighted only by the north and south end walls and clerestories. The light from the clerestory on the balcony side would be dappled from the steel grating that penetrates into the second floor. This would make the light slightly dim with higher concentrations of light and shadow. The second floor of the exhibition structures would be lighted directly from the balcony side and from the north and south end walls. The light here would be bright and somewhat diffused. The procession of the visitors would start from the parking lot to the entry/gathering/welcoming building. From there, they would travel past the cow grazing area to the milking exhibition and then to the garage to see restorations of farm equipment in progress. Next, they would travel to the newer balloon framed barn and then to the tractor exhibition. After visiting the tractor exhibition, they would travel to the older and smaller heavy timber framed barn and then to the tilling/sowing/and cultivating exhibition. From there, the visitors would travel to the larger heavy timber framed barn and then to the harvesting/processing exhibition. The last stop before ending back at the parking lot would be a path along the hay and corn fields.

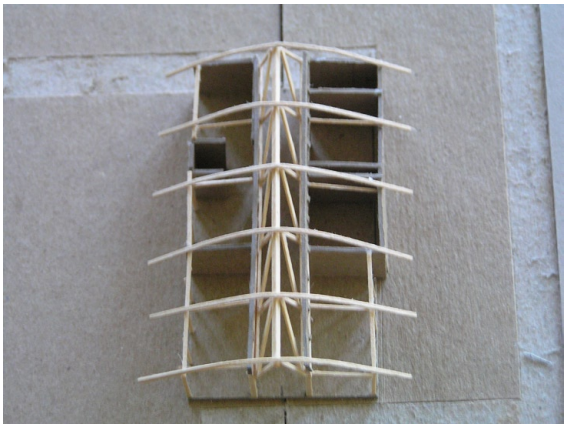


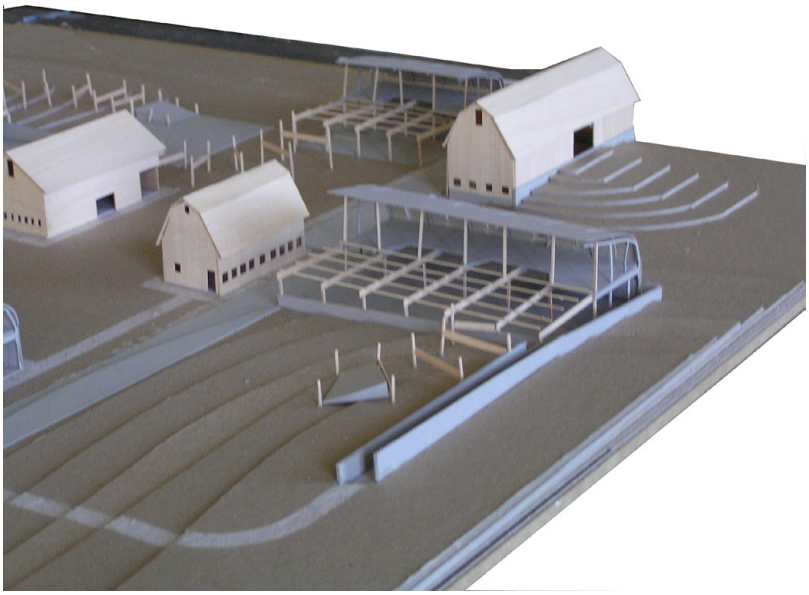


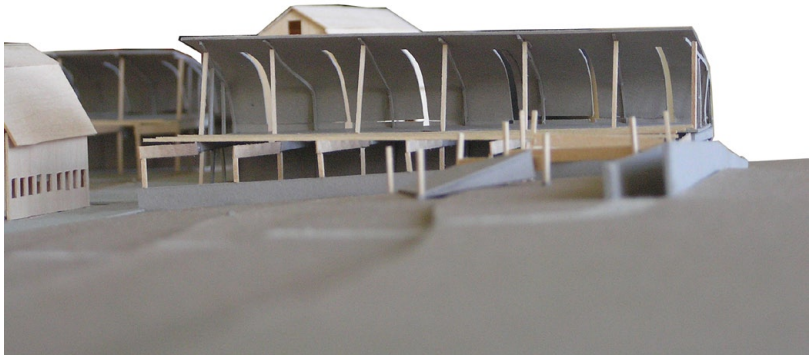


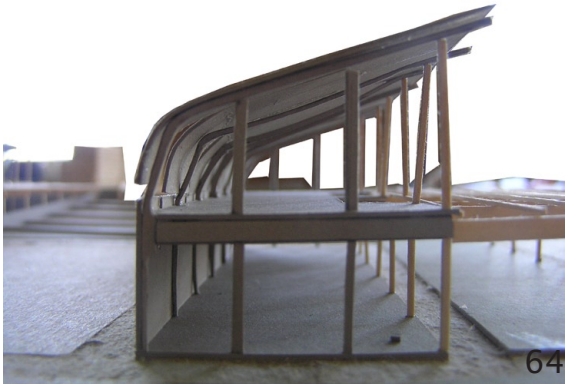


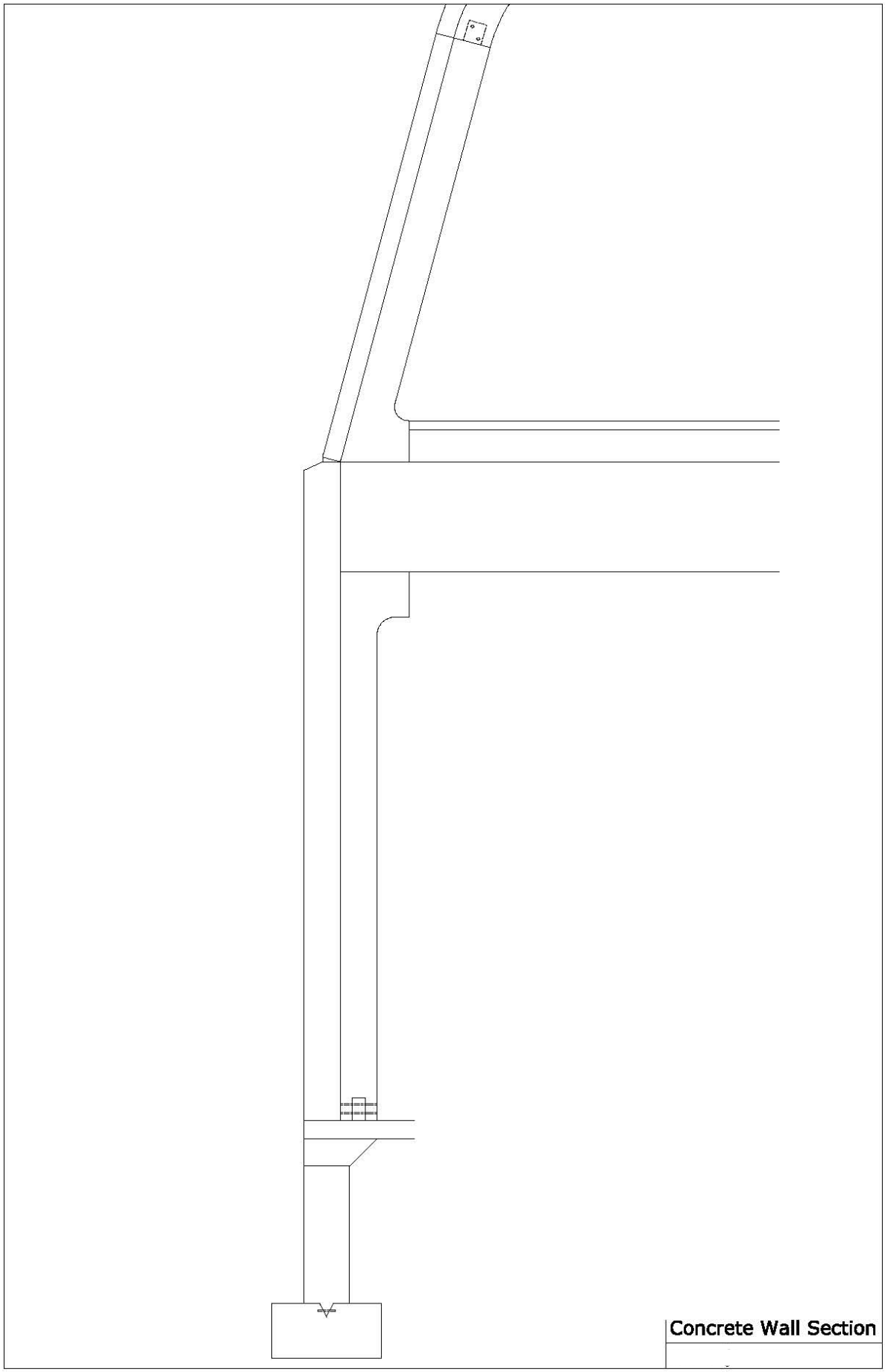


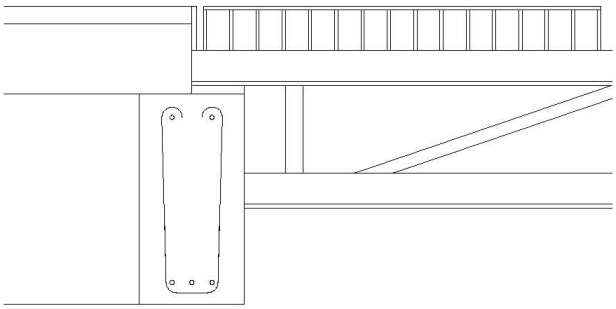




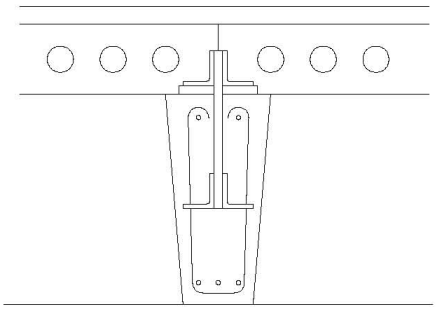





Concrete Wall Section



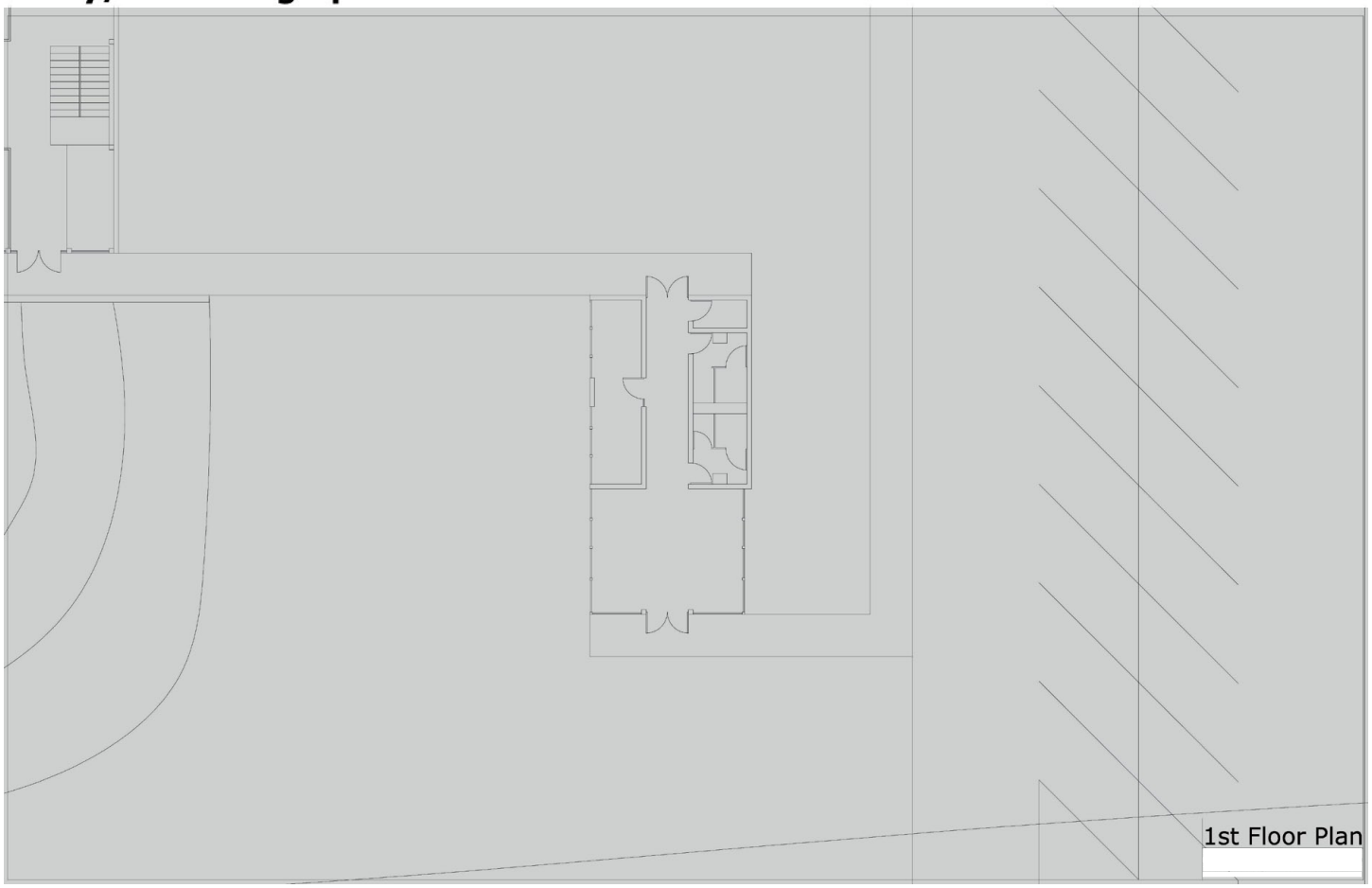
Floor Detail

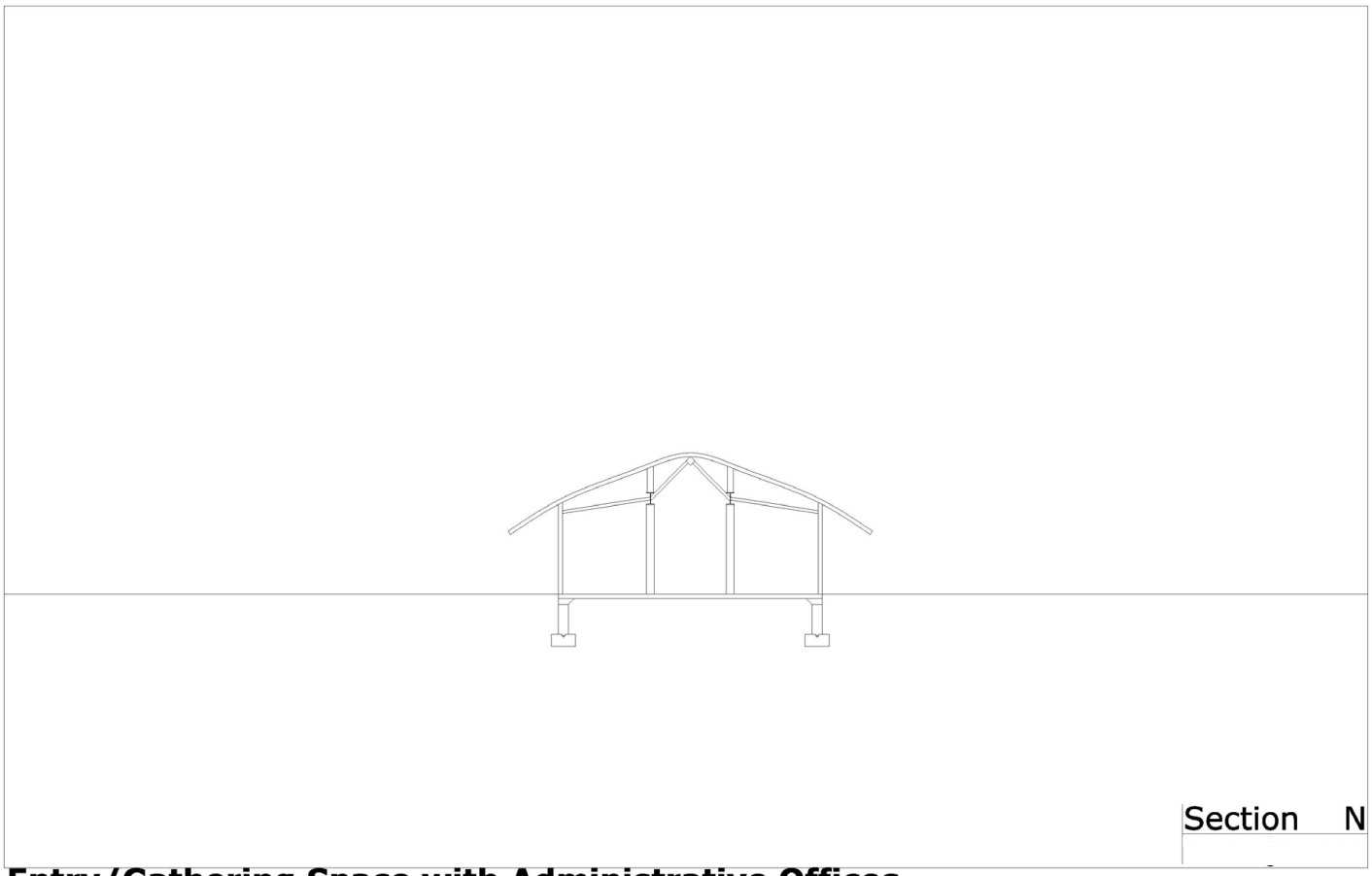


Floor Detail

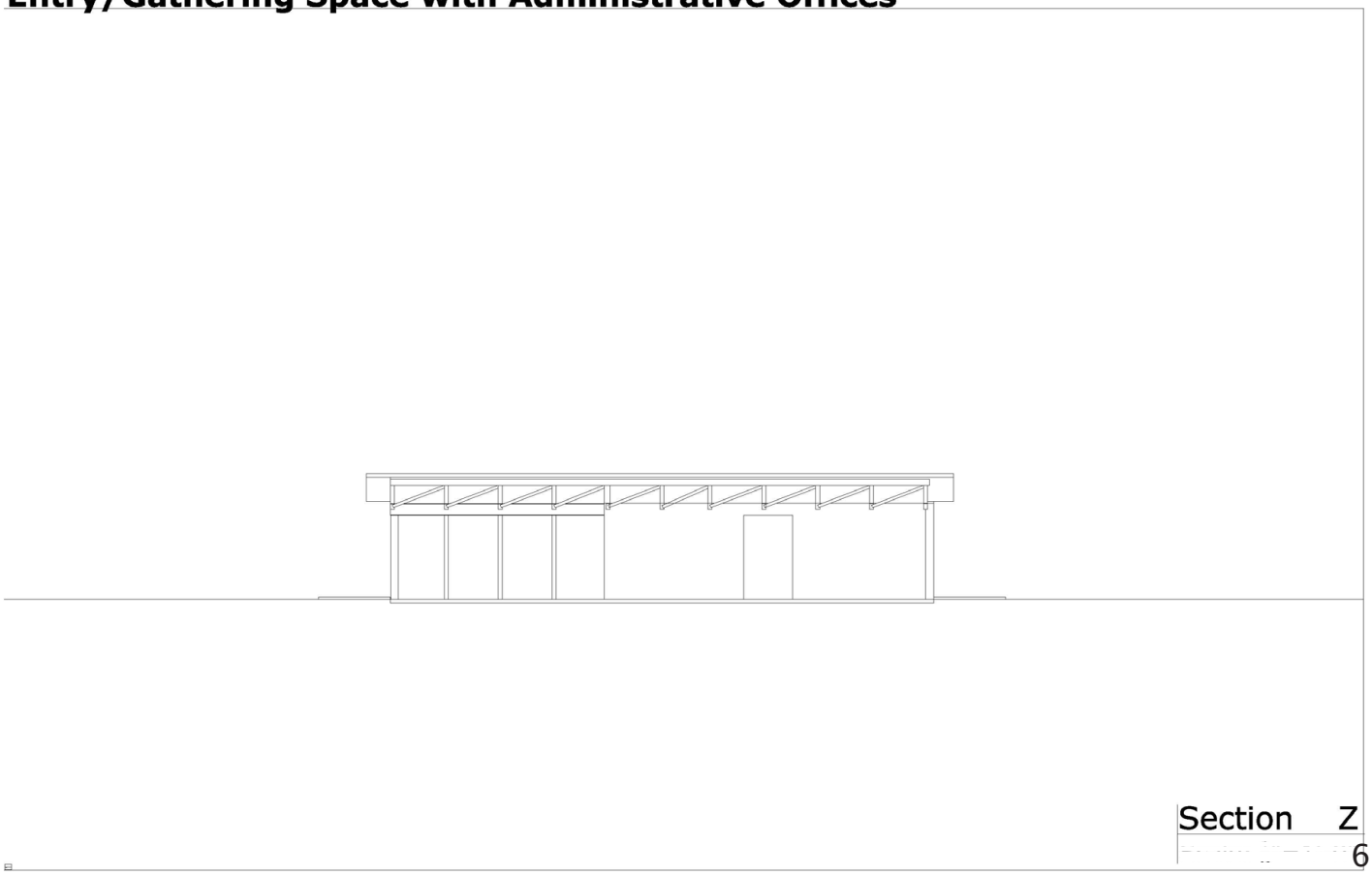
Interior Perspective N

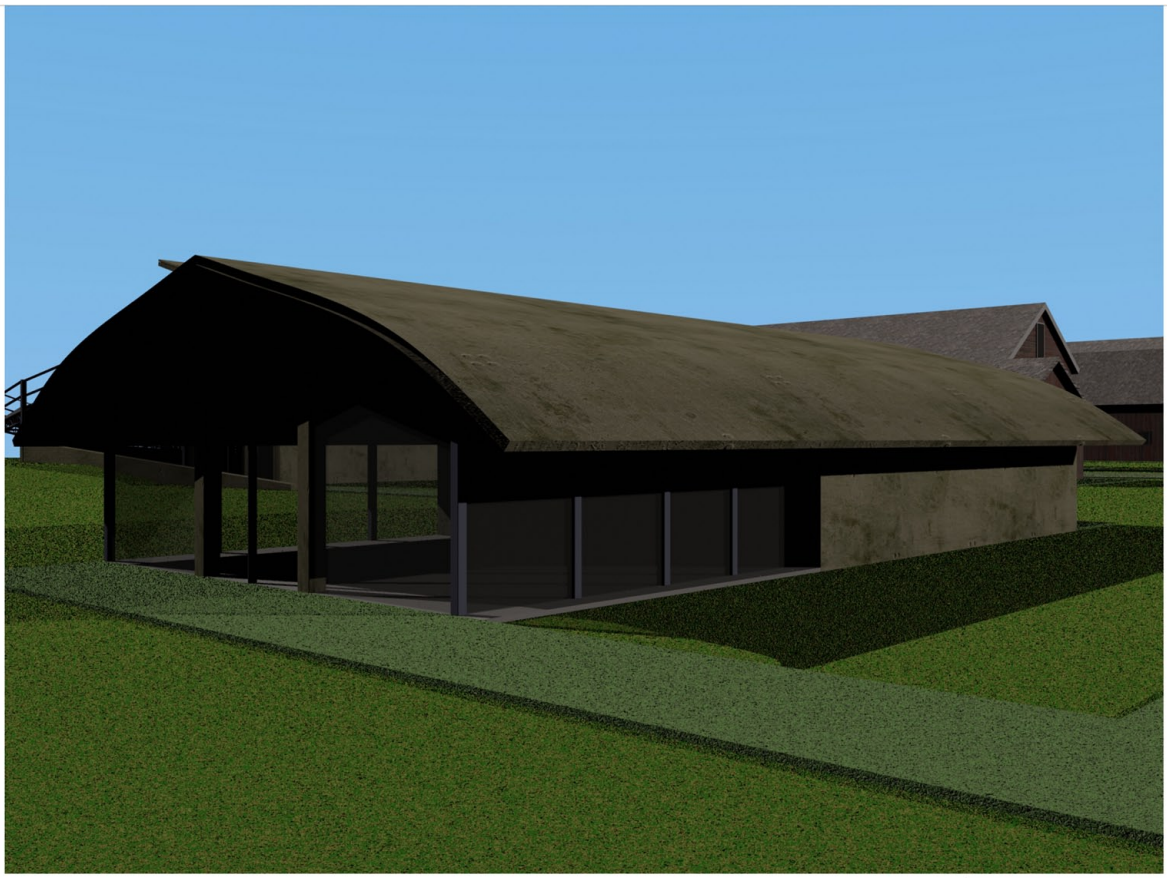
Entry/Gathering Space and Administrative Offices





Entry/Gathering Space with Administrative Offices

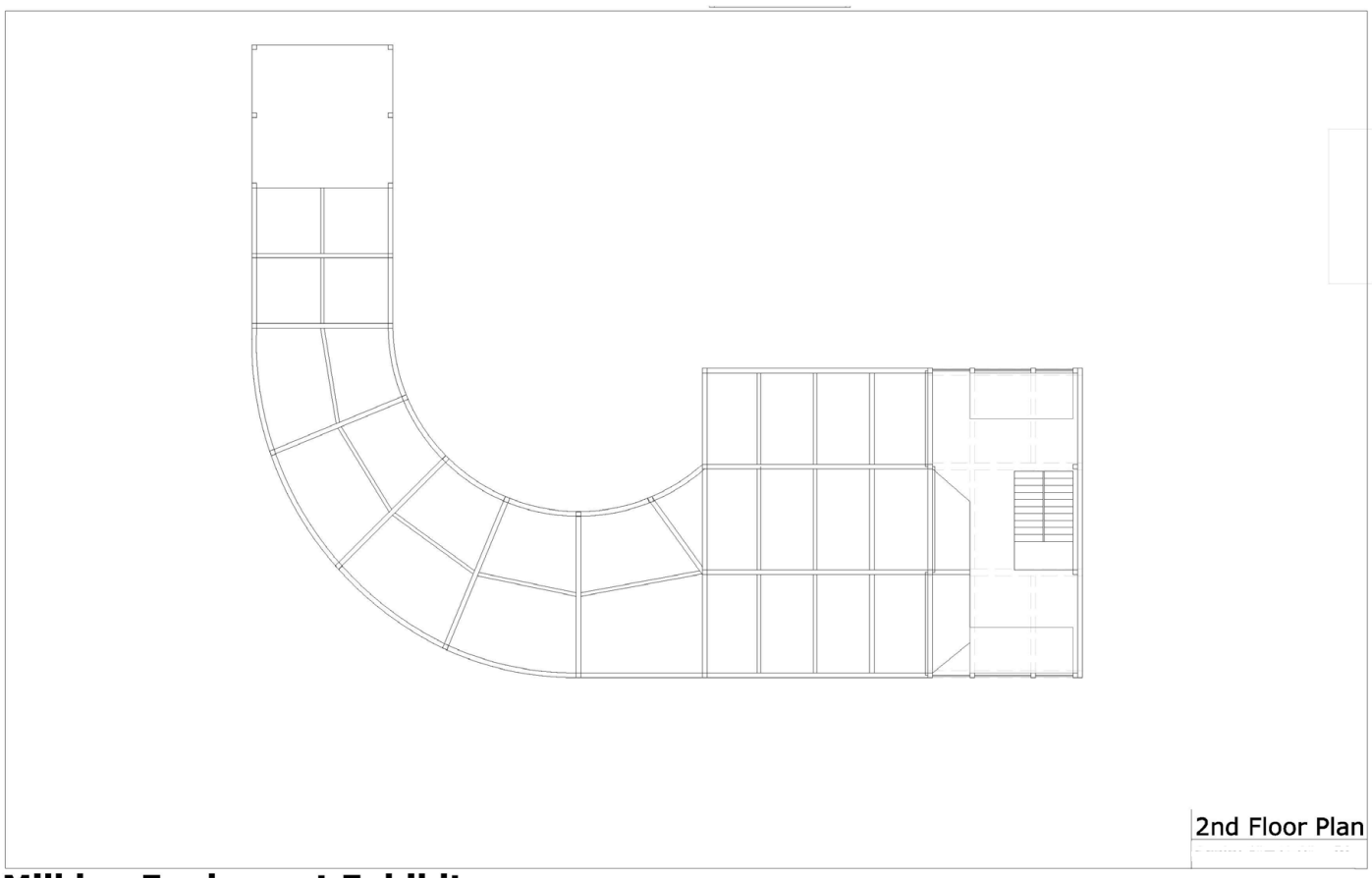




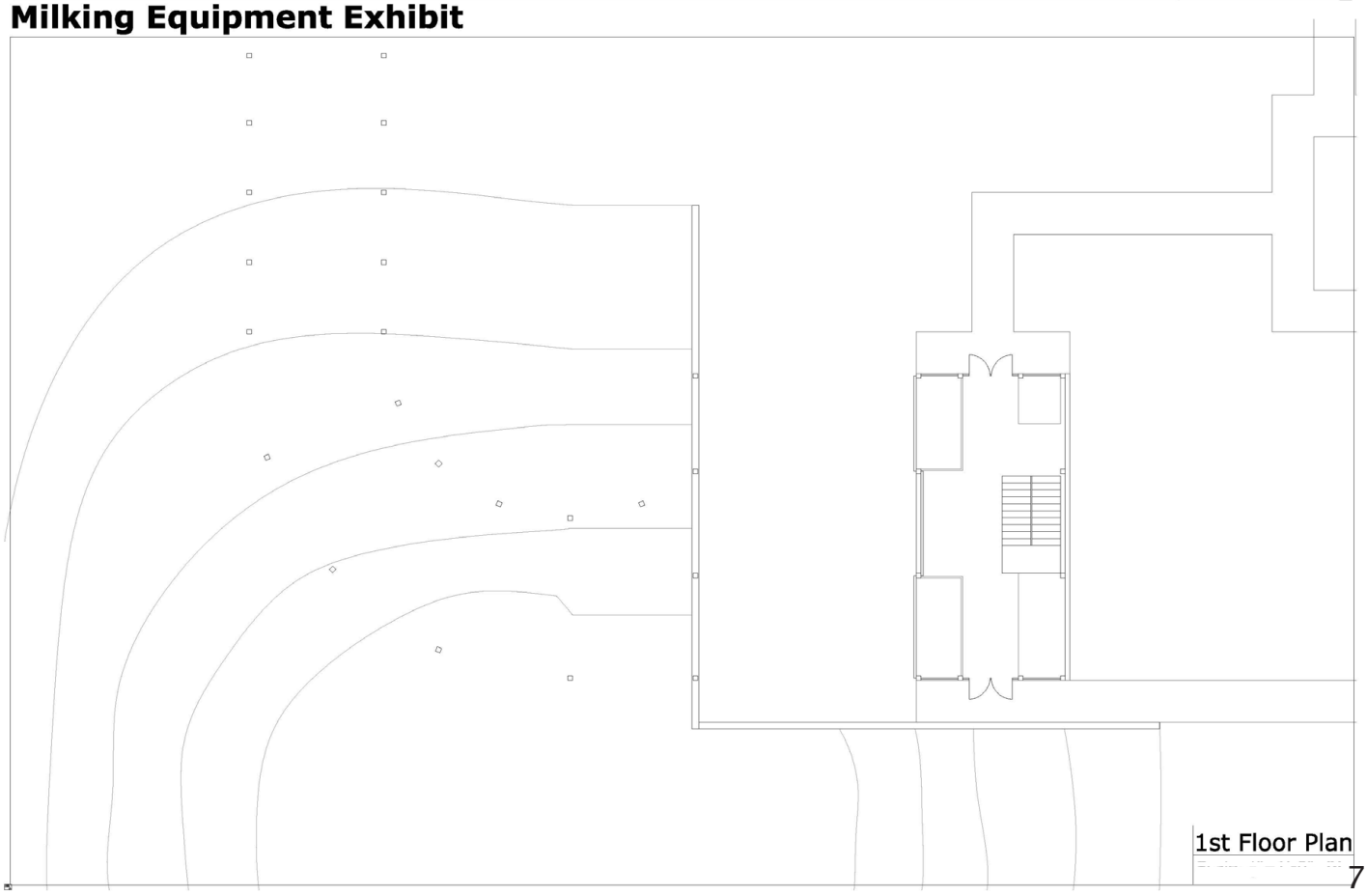
Southeast Elevation

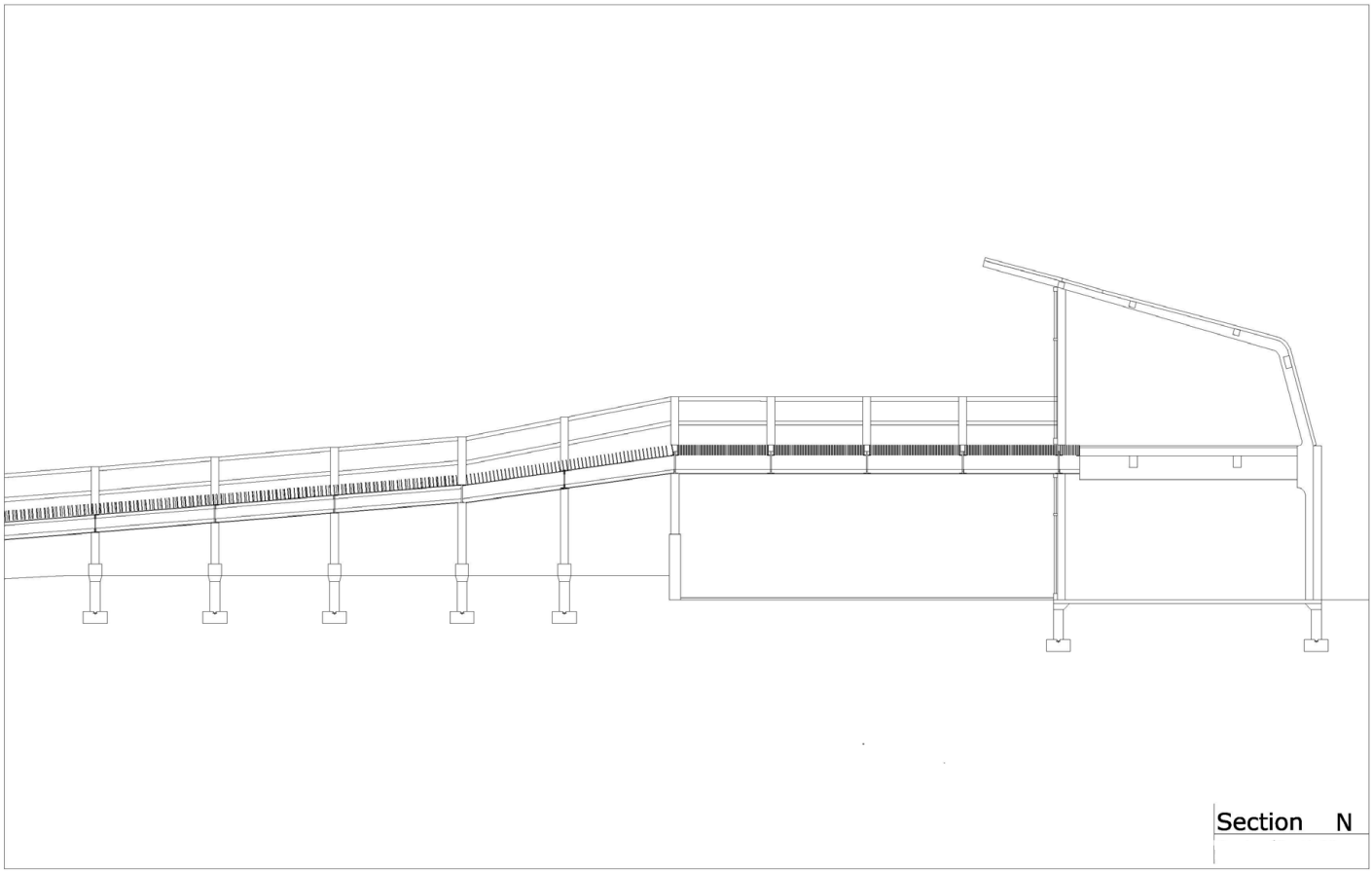
Entry/Gathering Space and Administrative Offices

Northwest Elevation



Milking Equipment Exhibit





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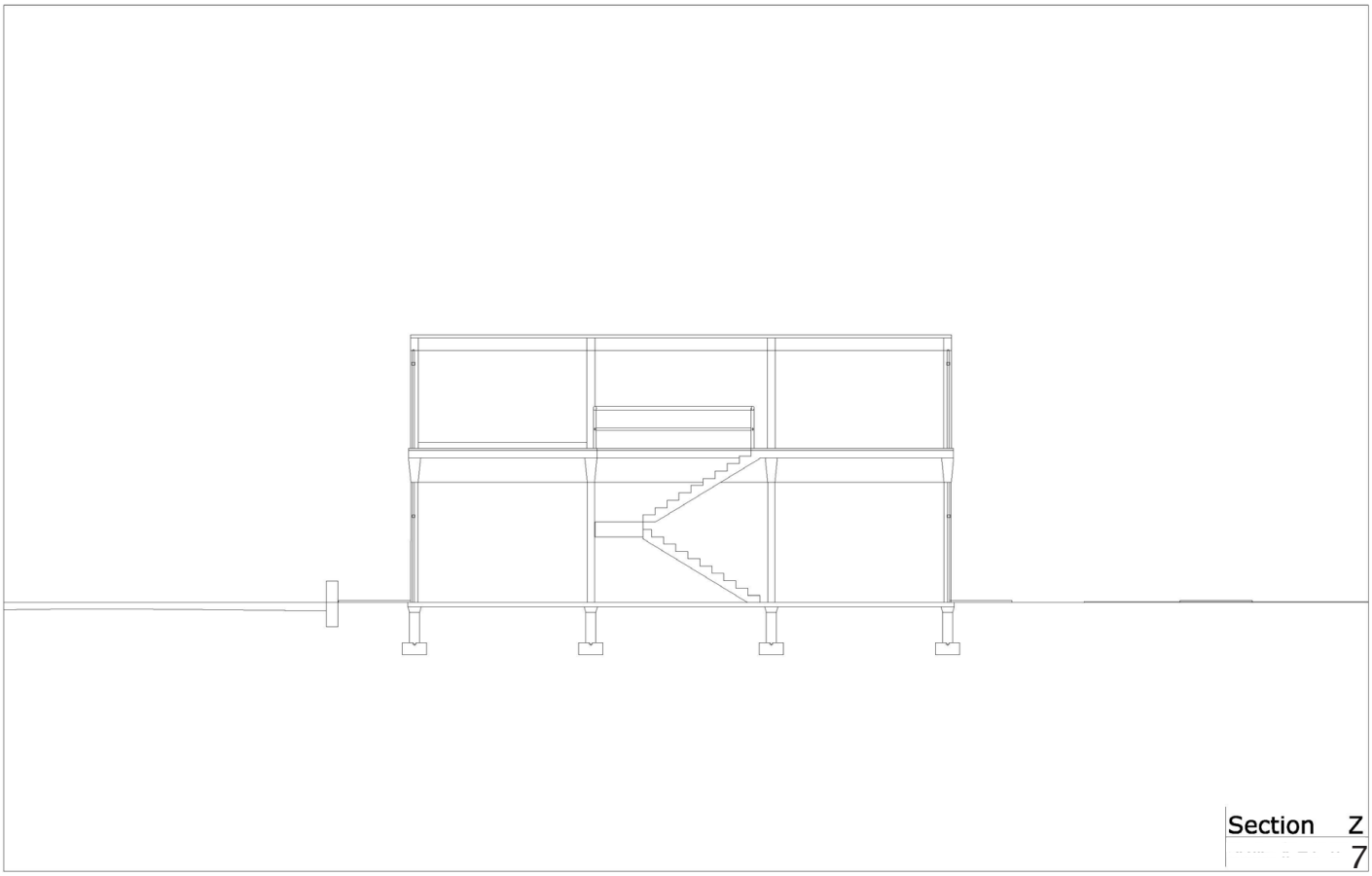
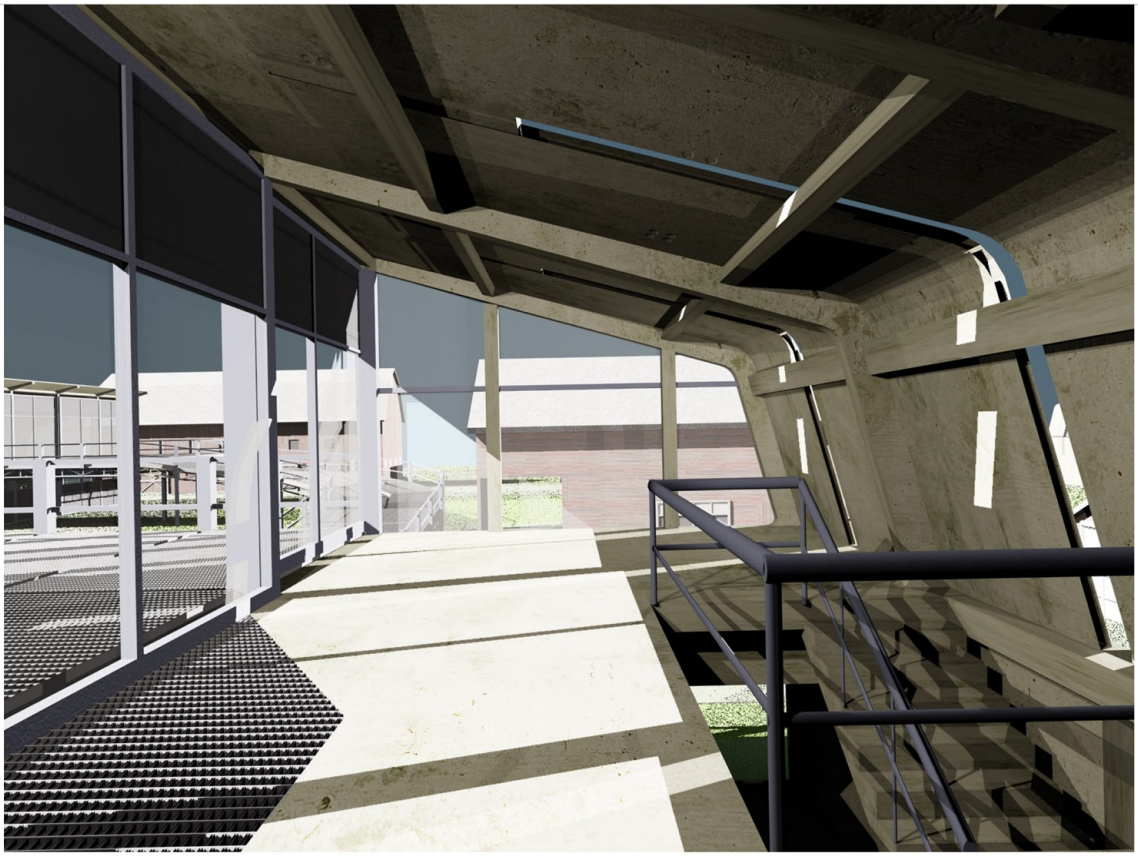
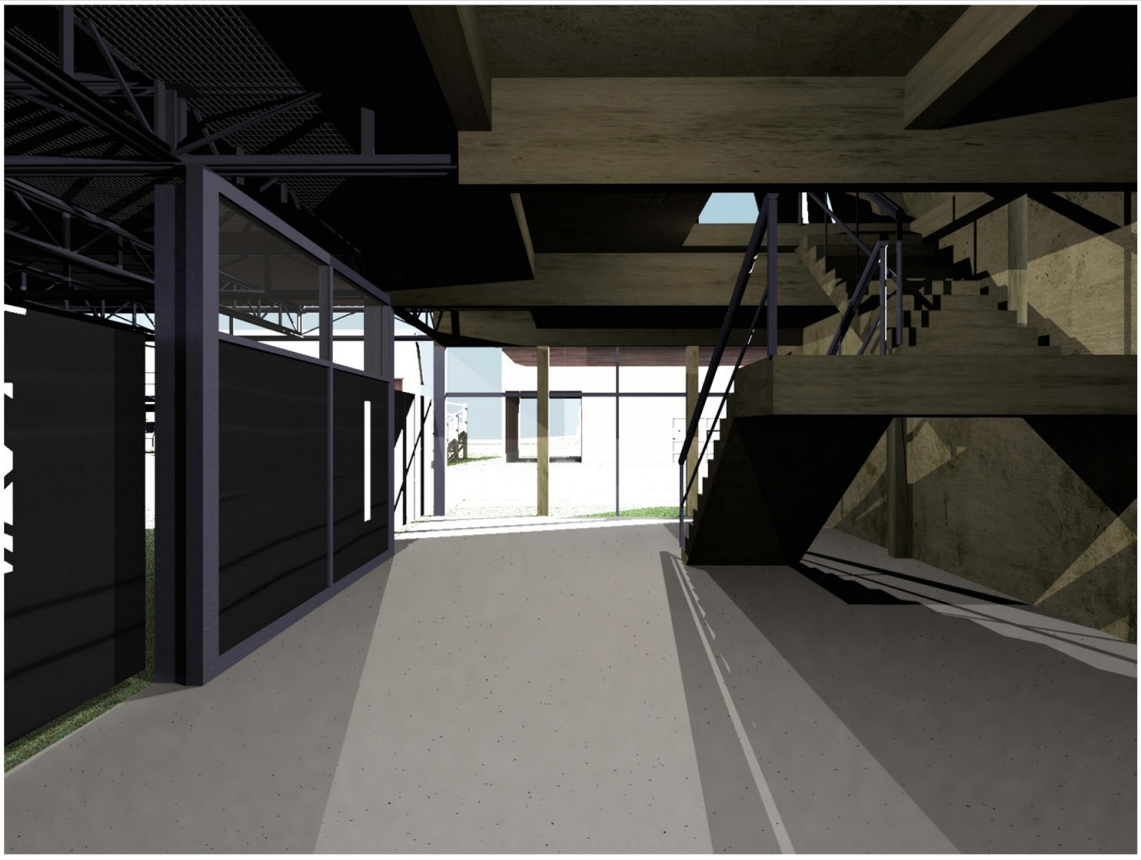


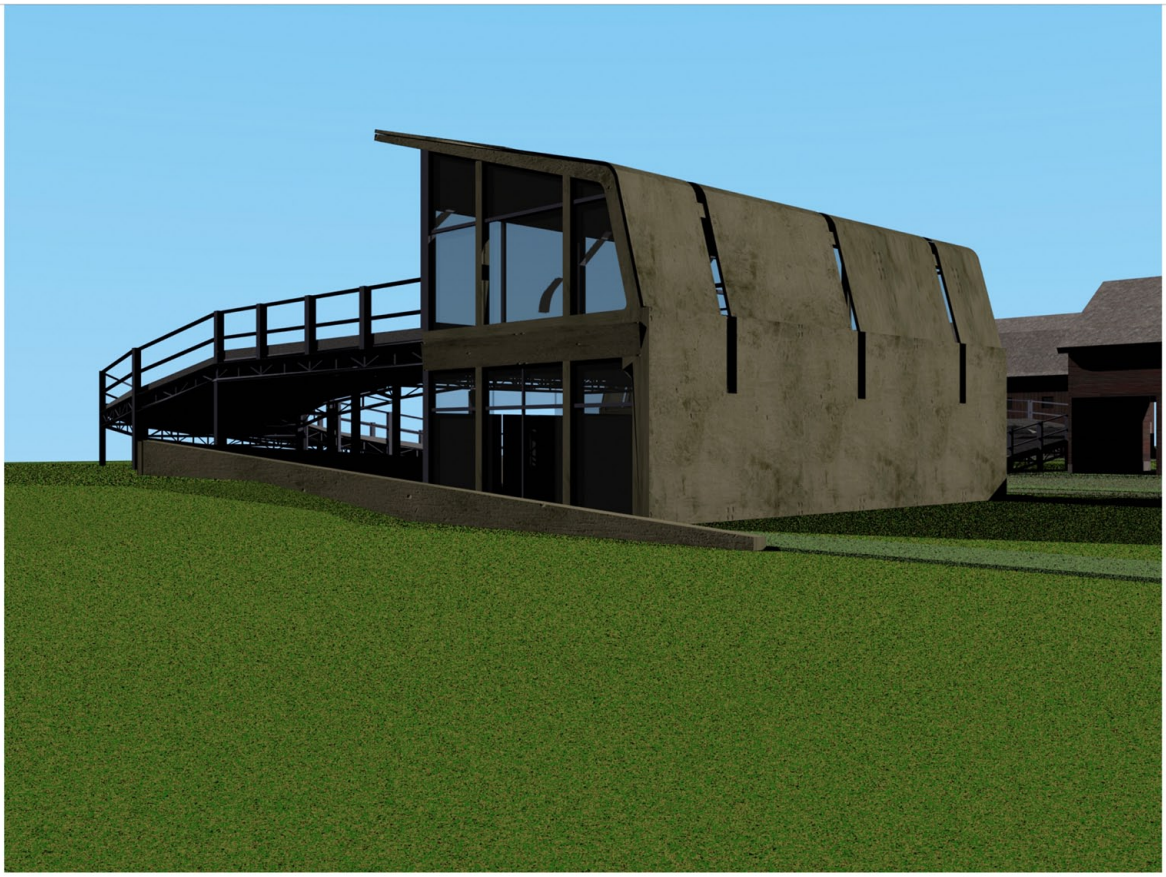


2nd Floor N

Milking Equipment Exhibit

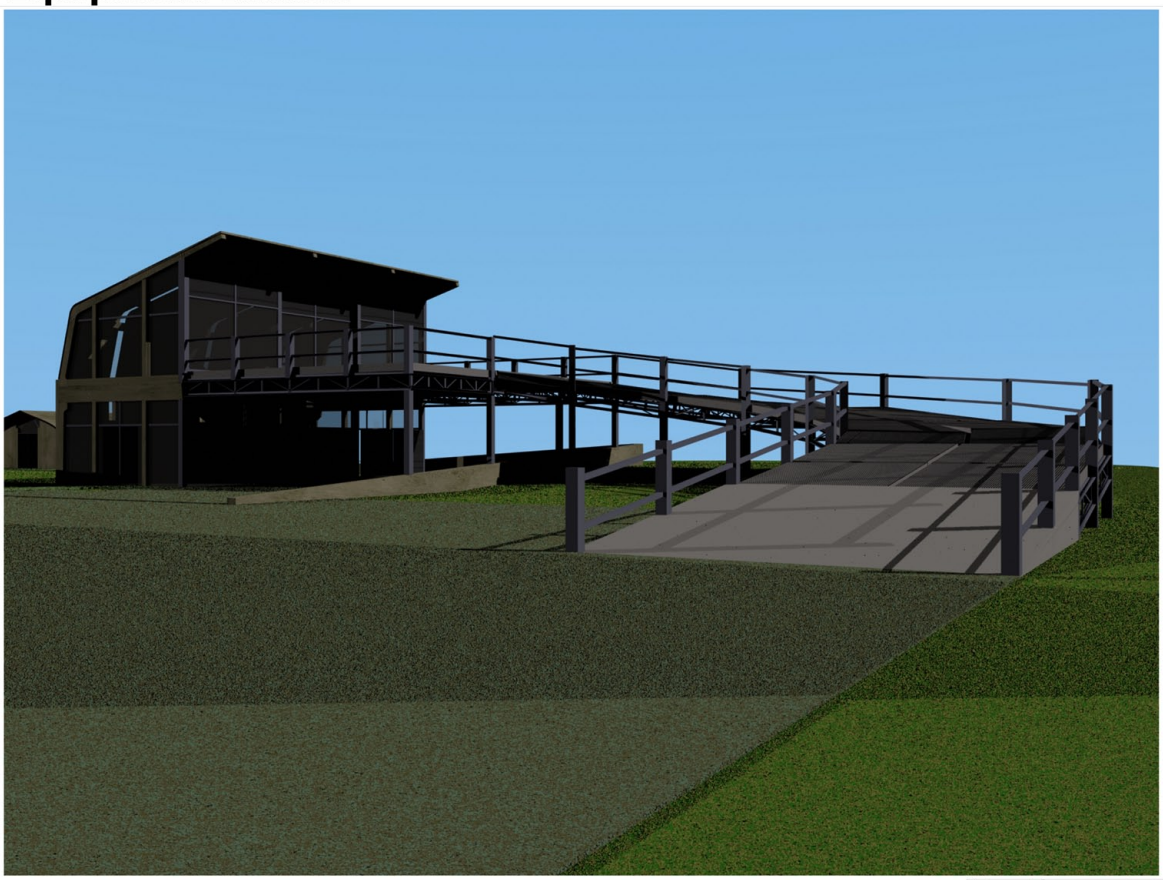


First Floor Z

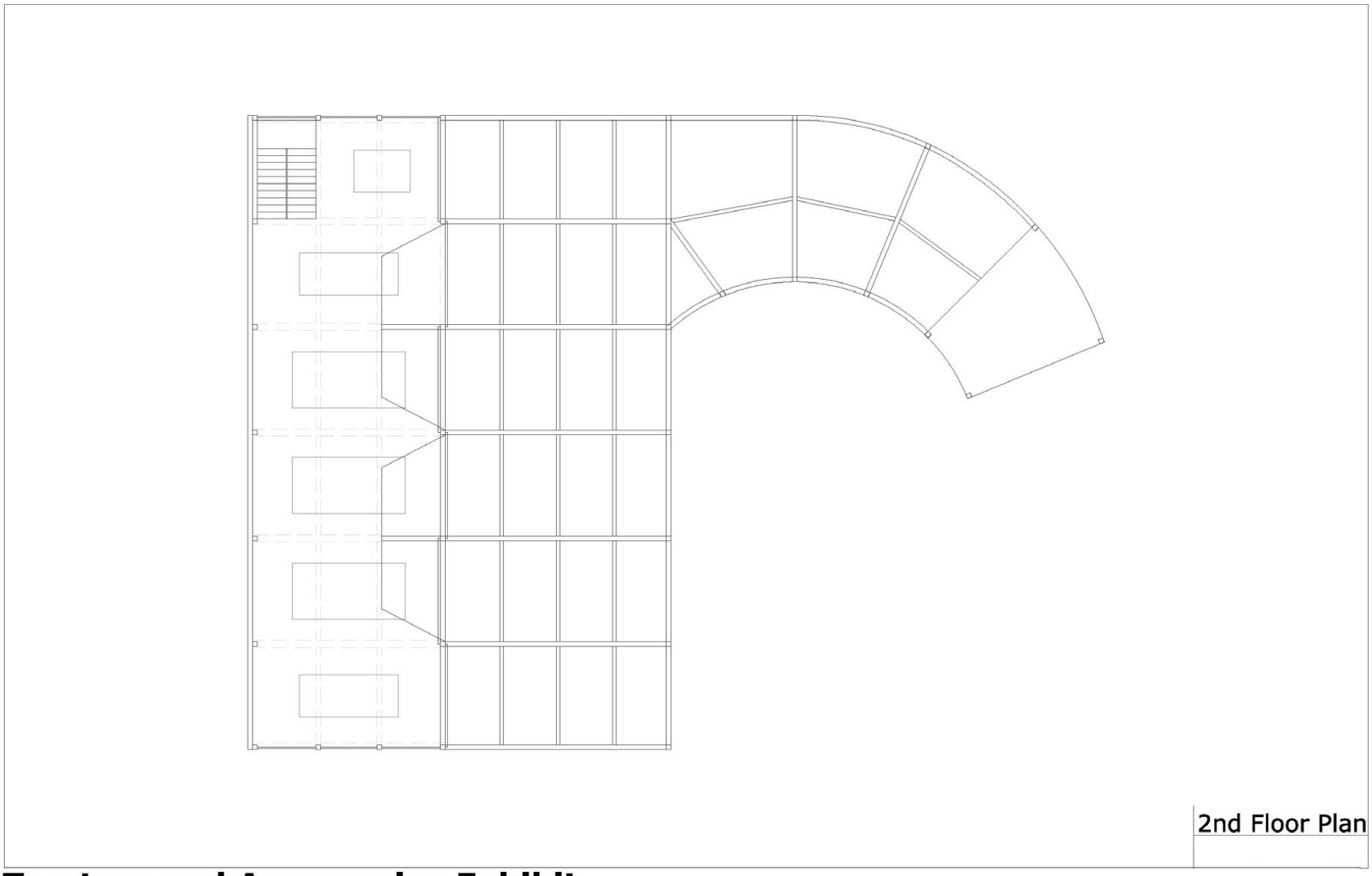


Southeast Elevation

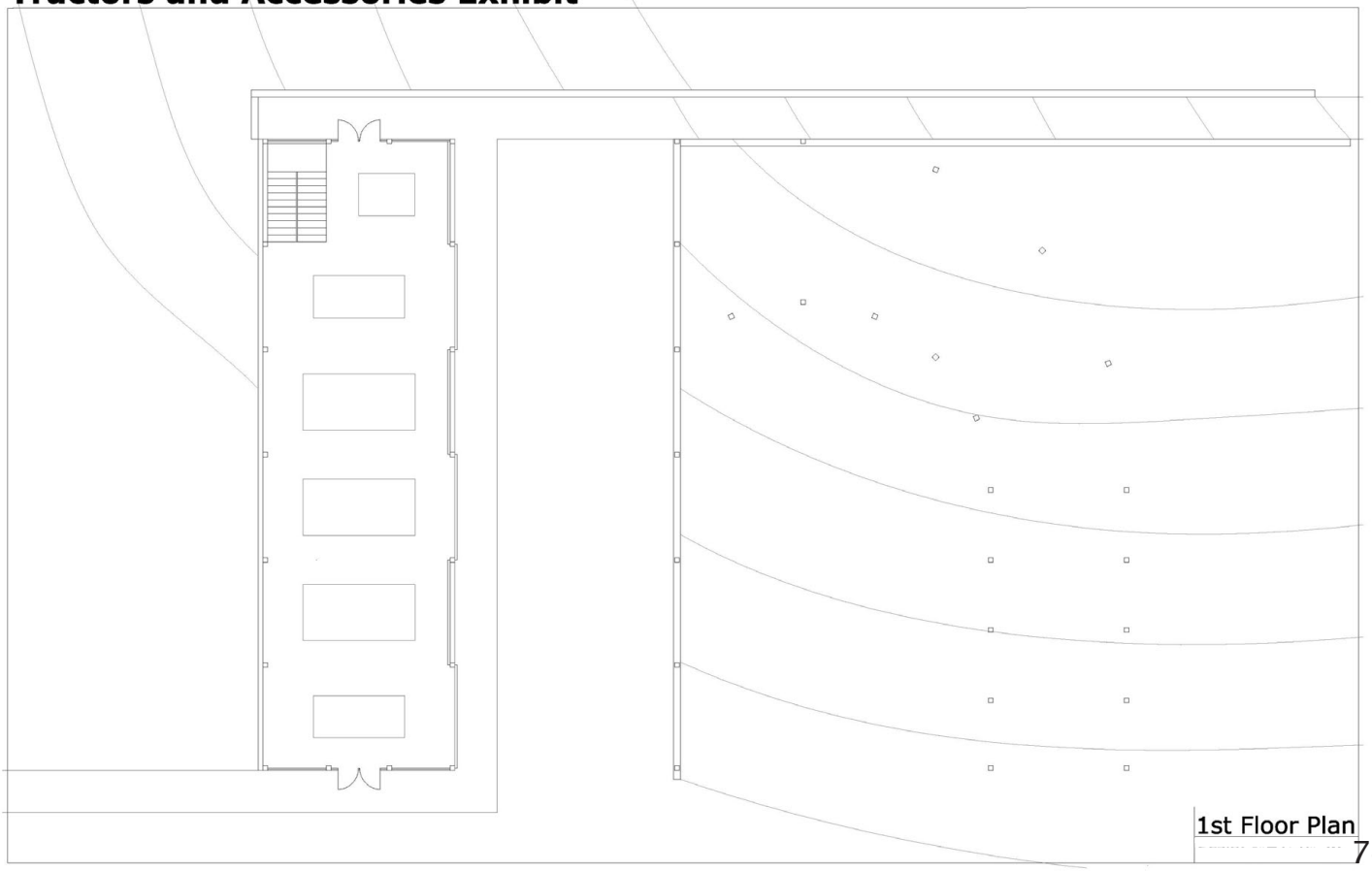
Milking Equipment Exhibit

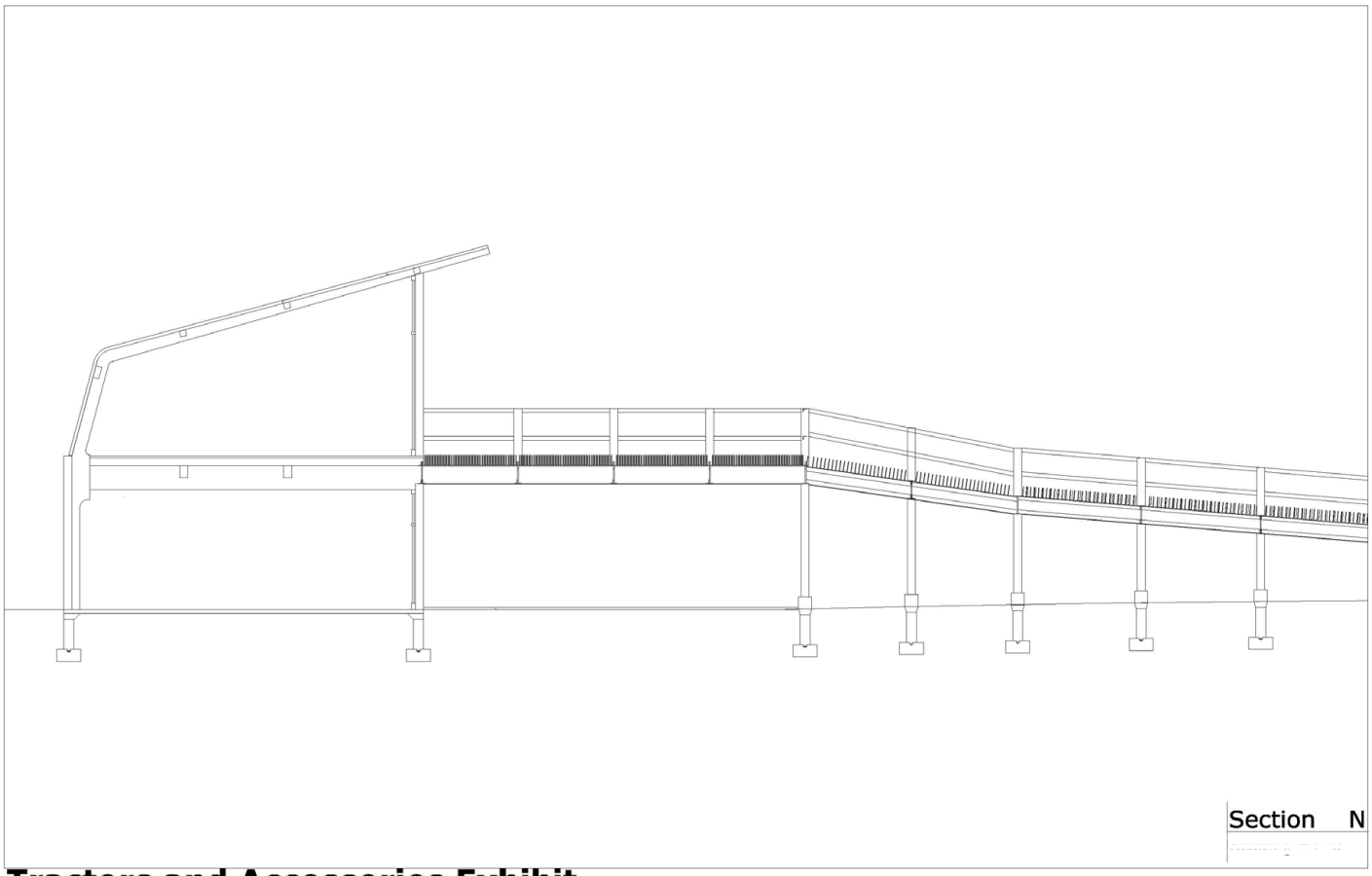


Northwest Elevation



Tractors and Accessories Exhibit



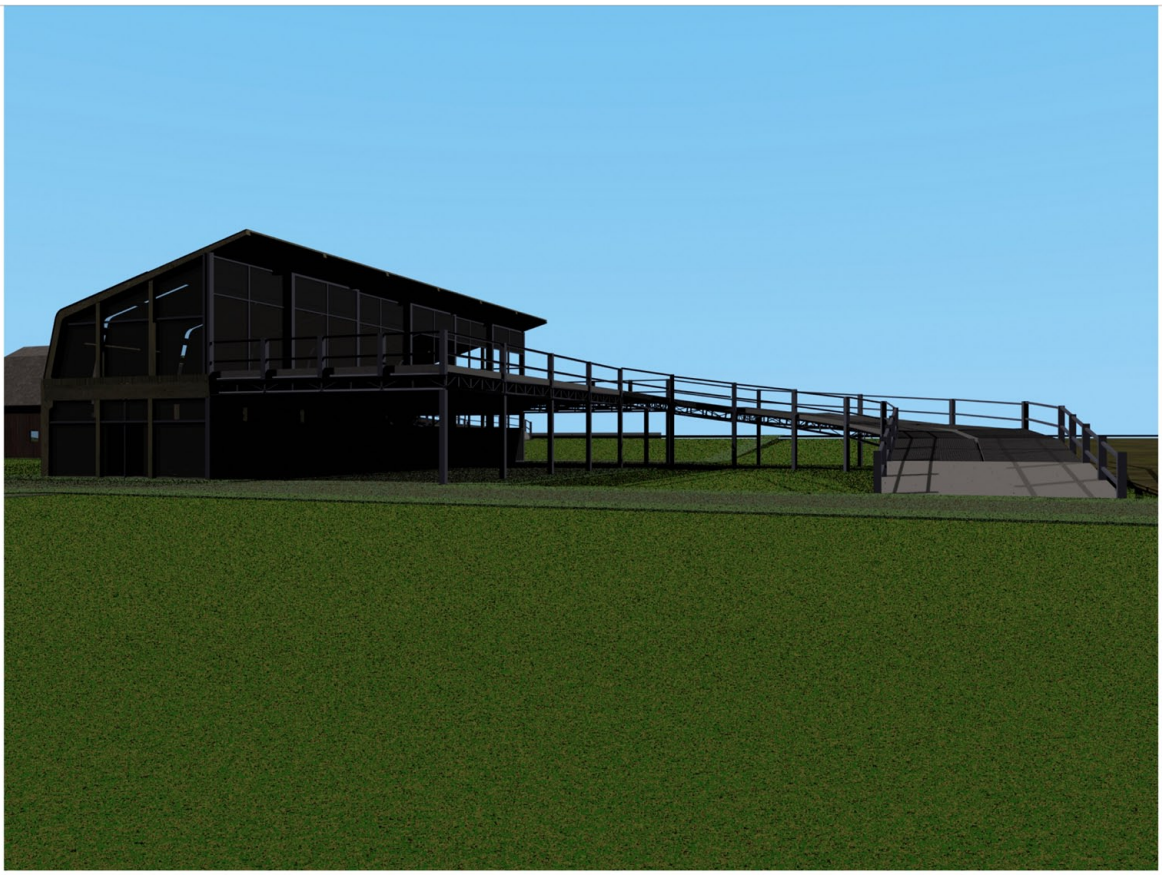


Tractors and Accessories Exhibit

2nd Floor N

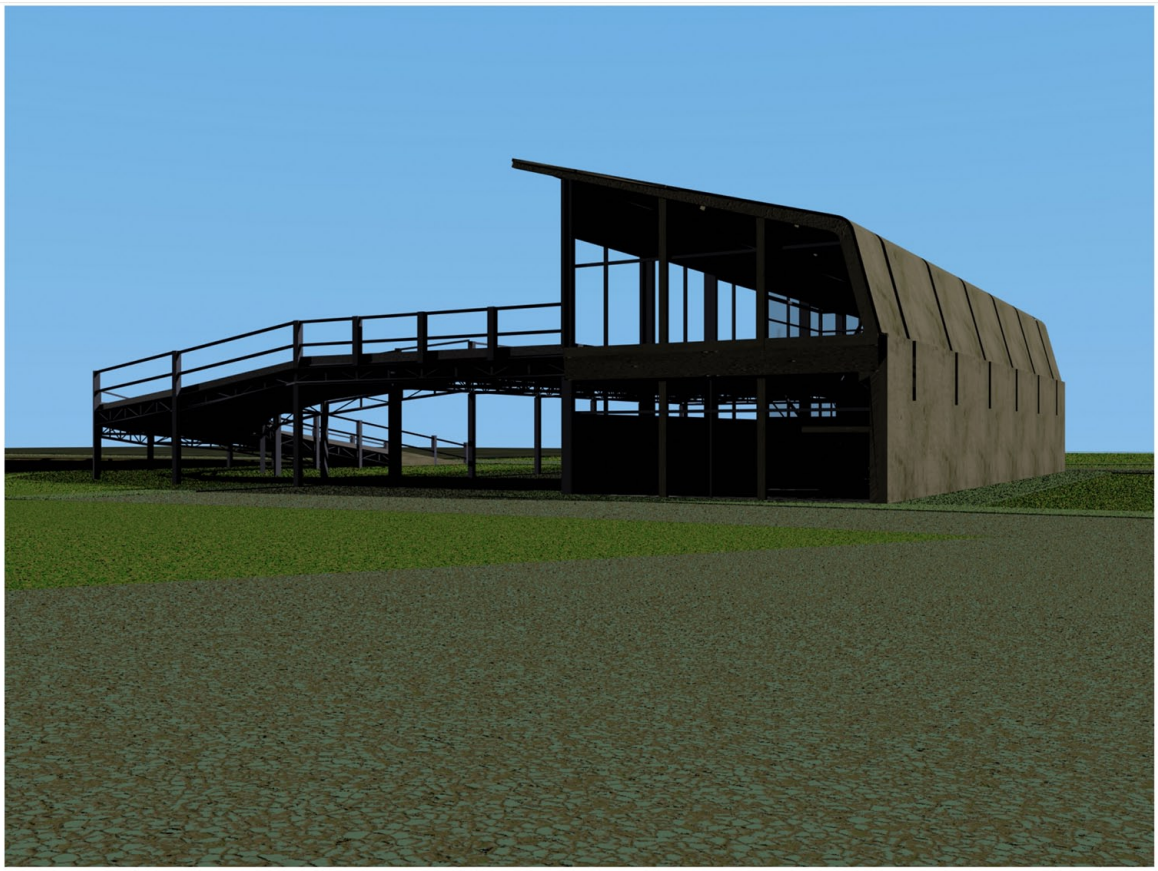
Tractors and Accessories Exhibit

First Floor Z

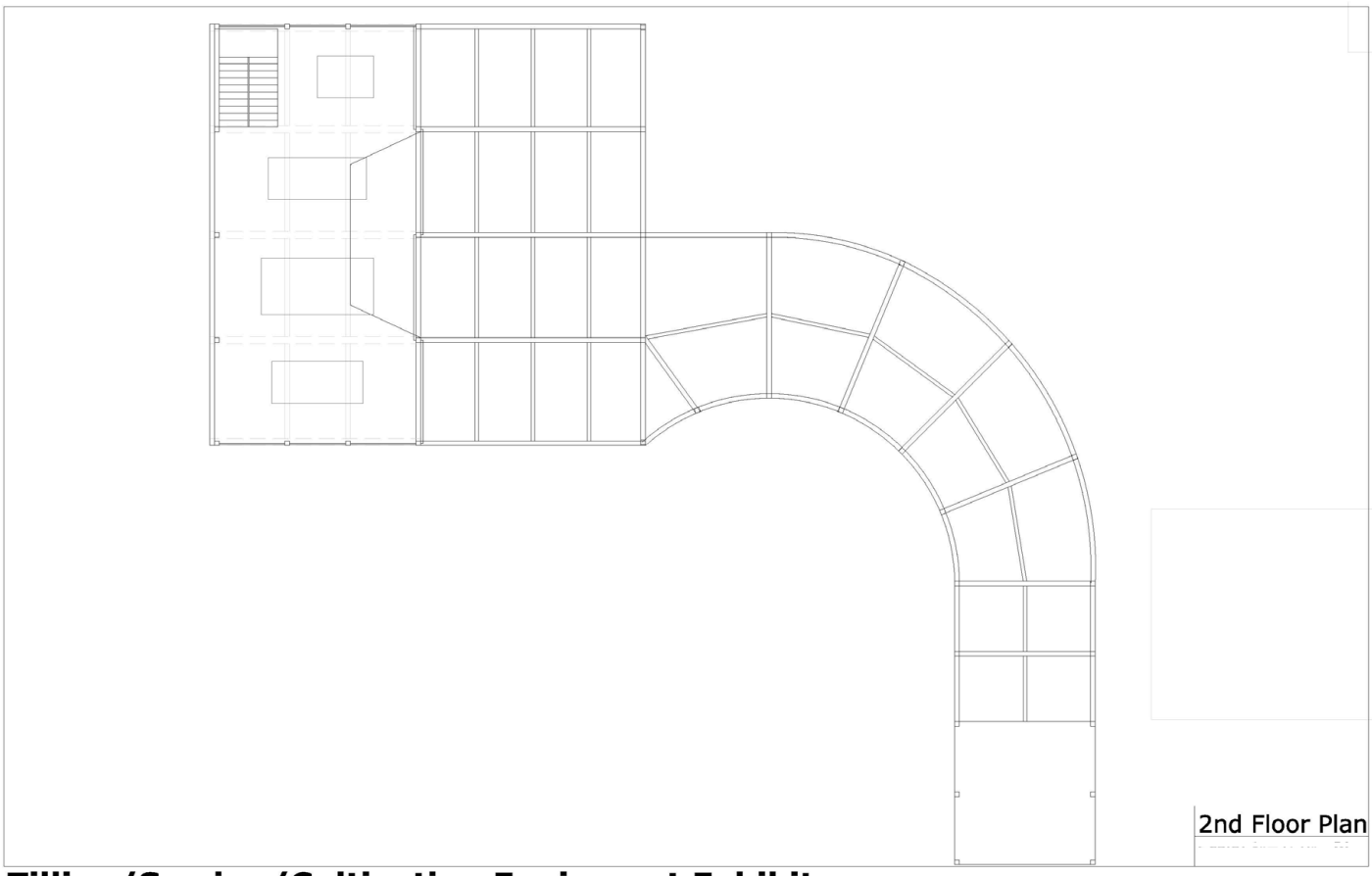


Southeast Elevation

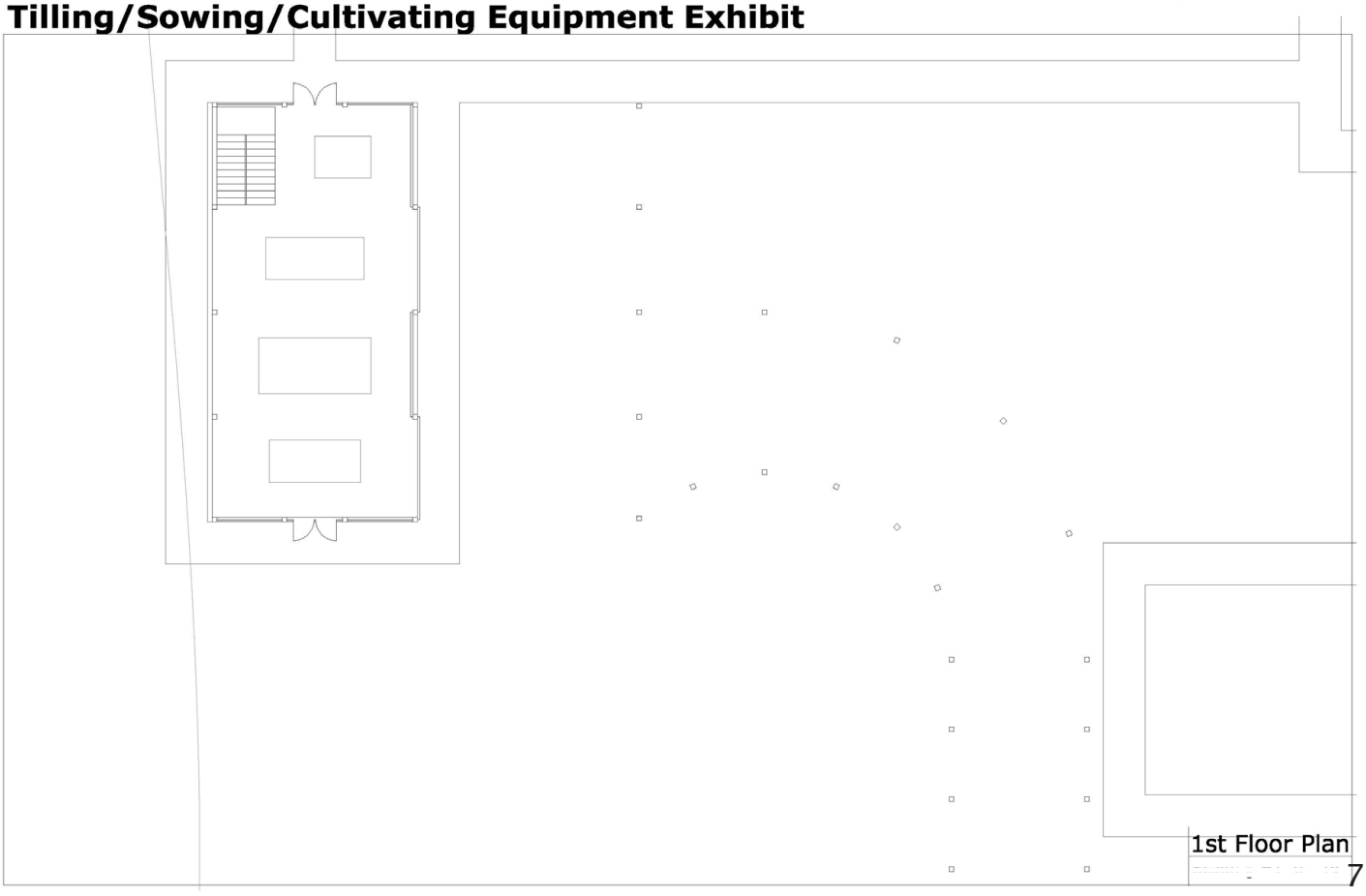
Tractors and Accessories Exhibit

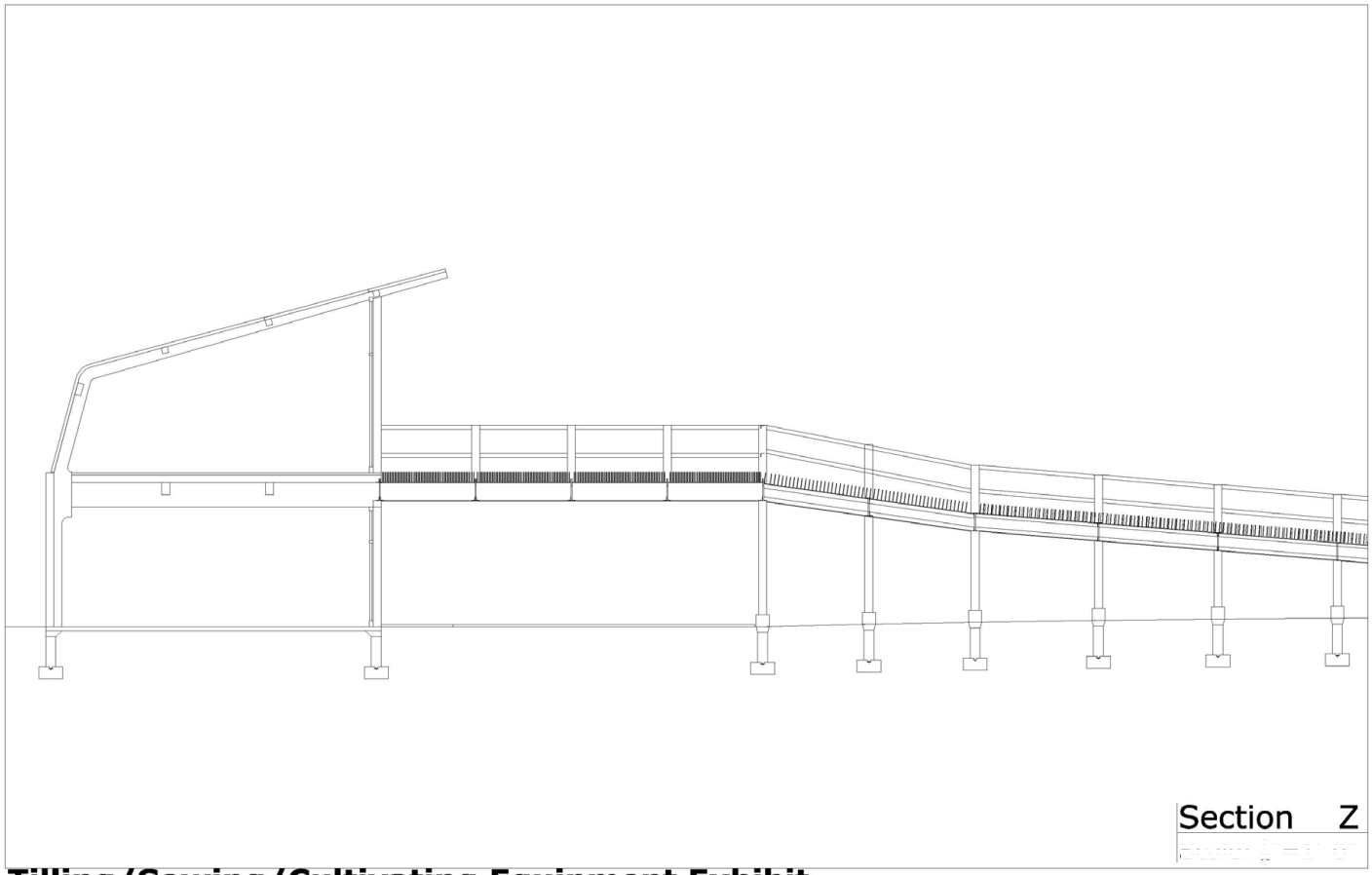


Northwest Elevation

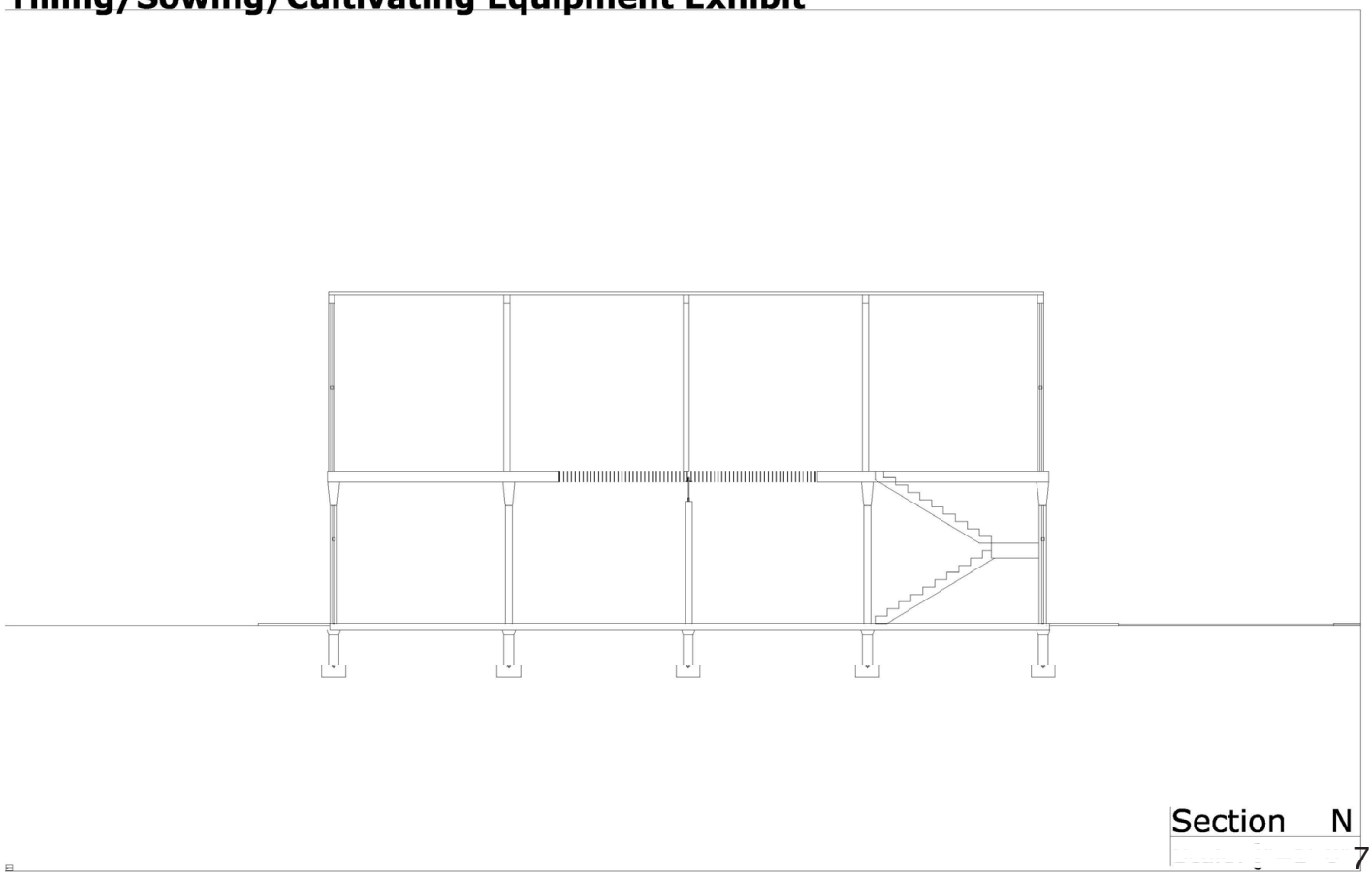


Tilling/Sowing/Cultivating Equipment Exhibit





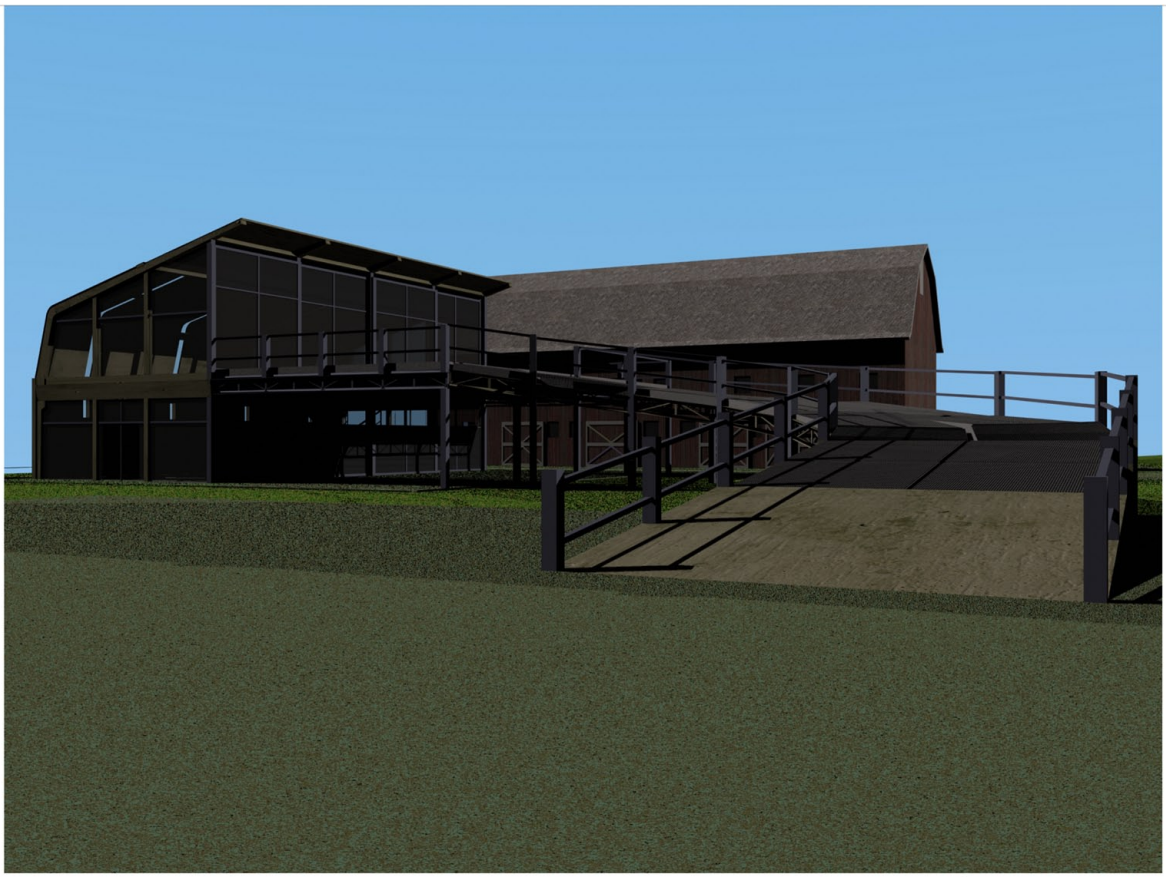
Tilling/Sowing/Cultivating Equipment Exhibit



2nd Floor N

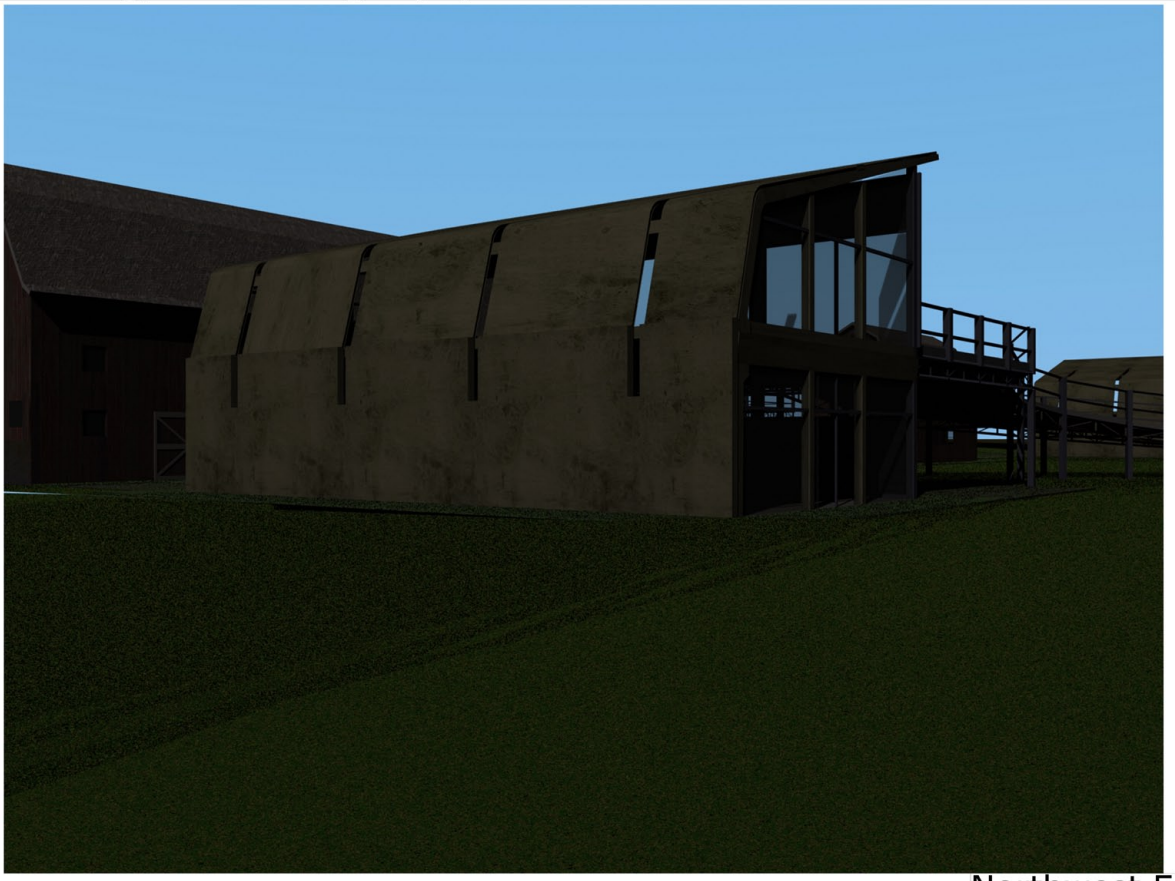
Tilling/Sowing/Cultivating Equipment Exhibit

First Floor Z

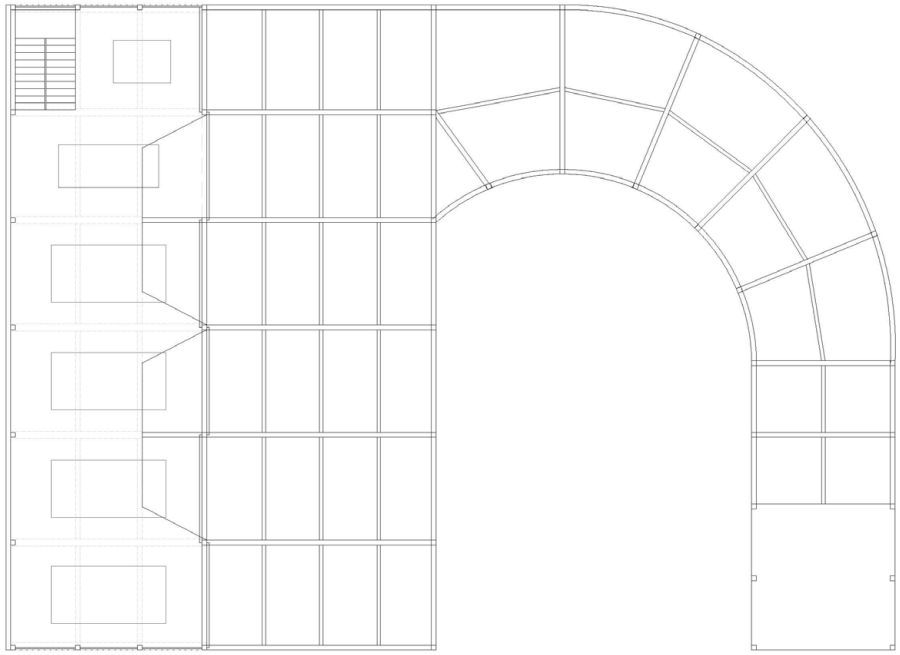


Southeast Elevation

Tilling/Sowing/Cultivating Equipment Exhibit

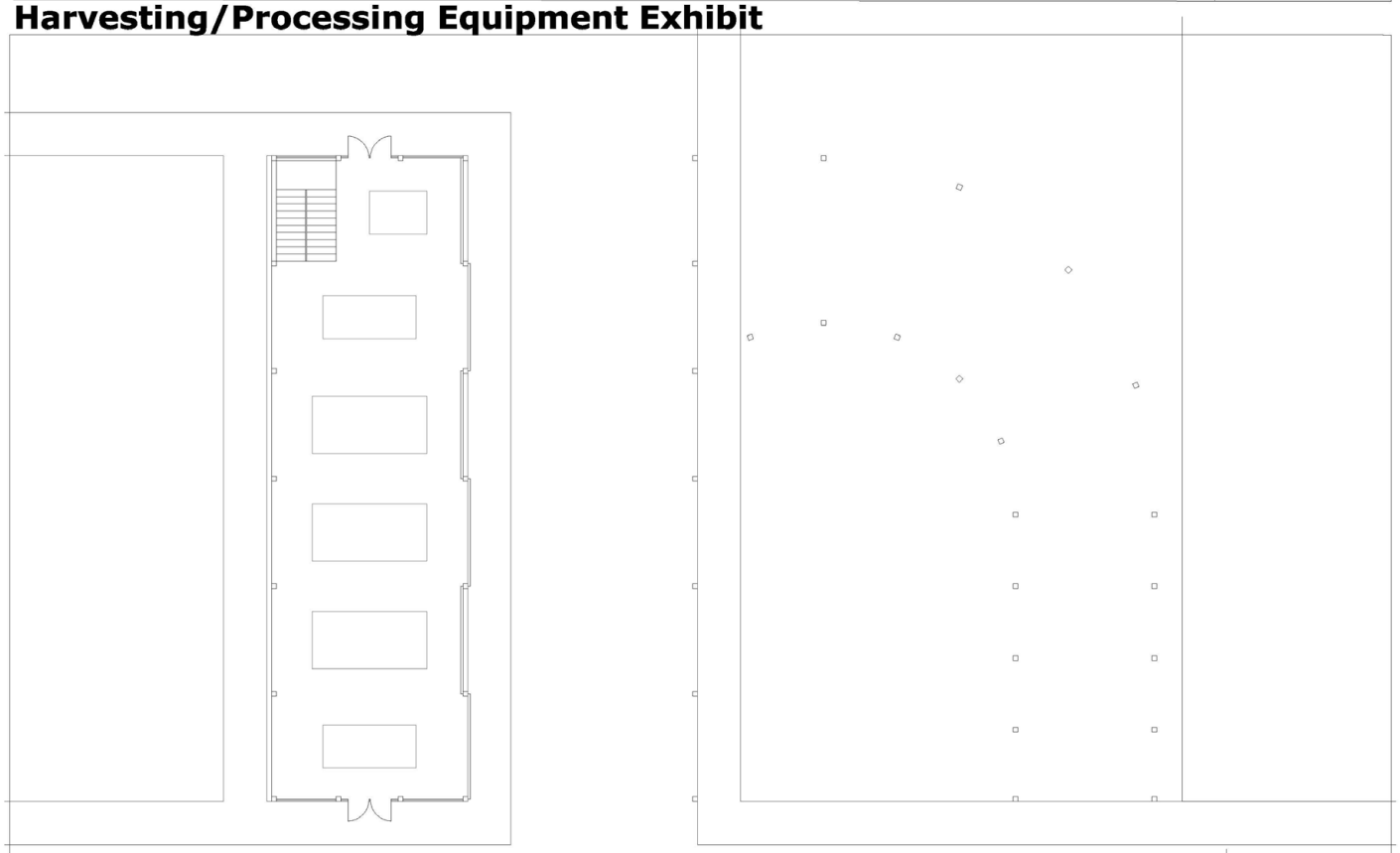


Northwest Elevation



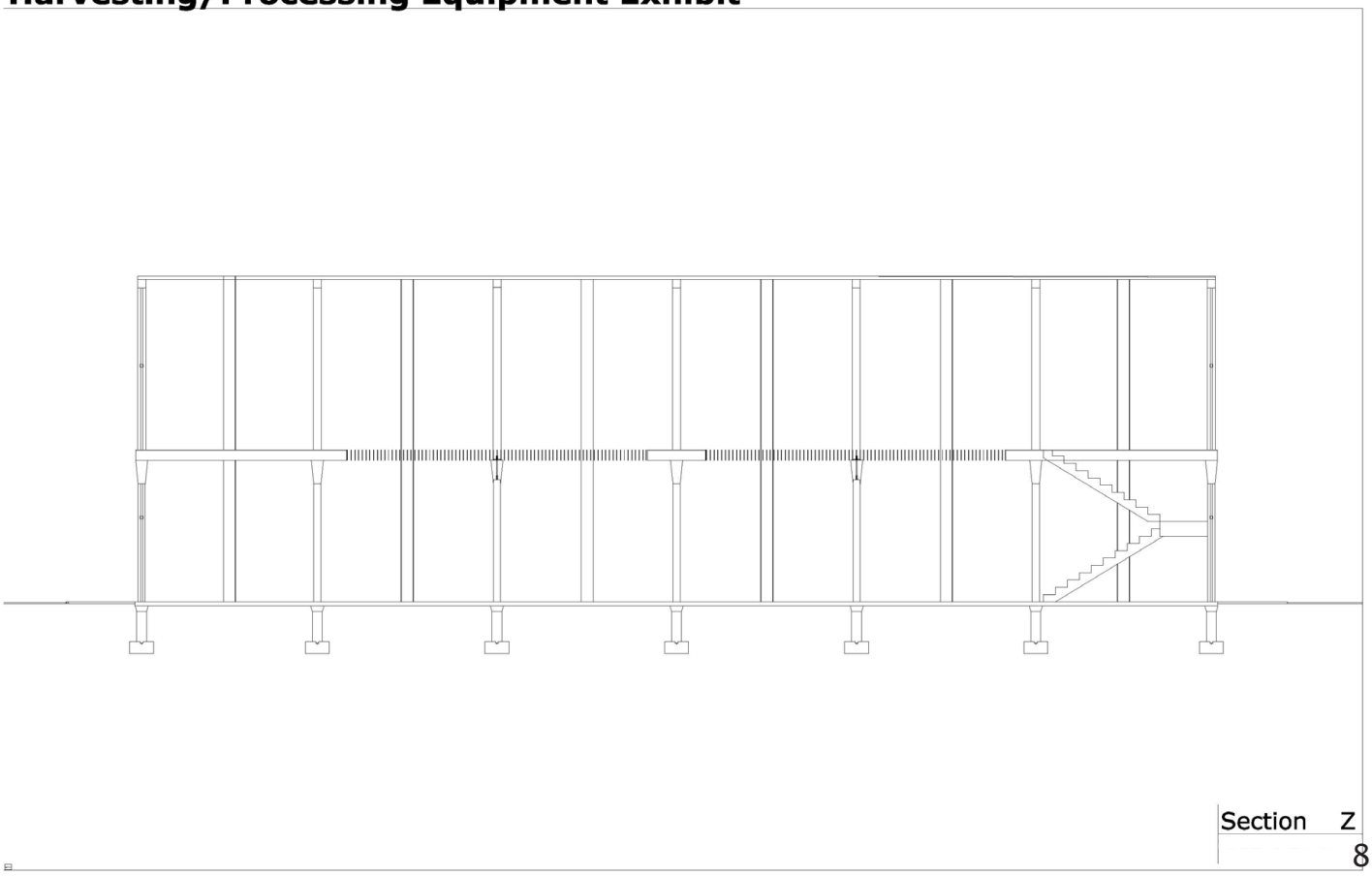
2nd Floor Plan

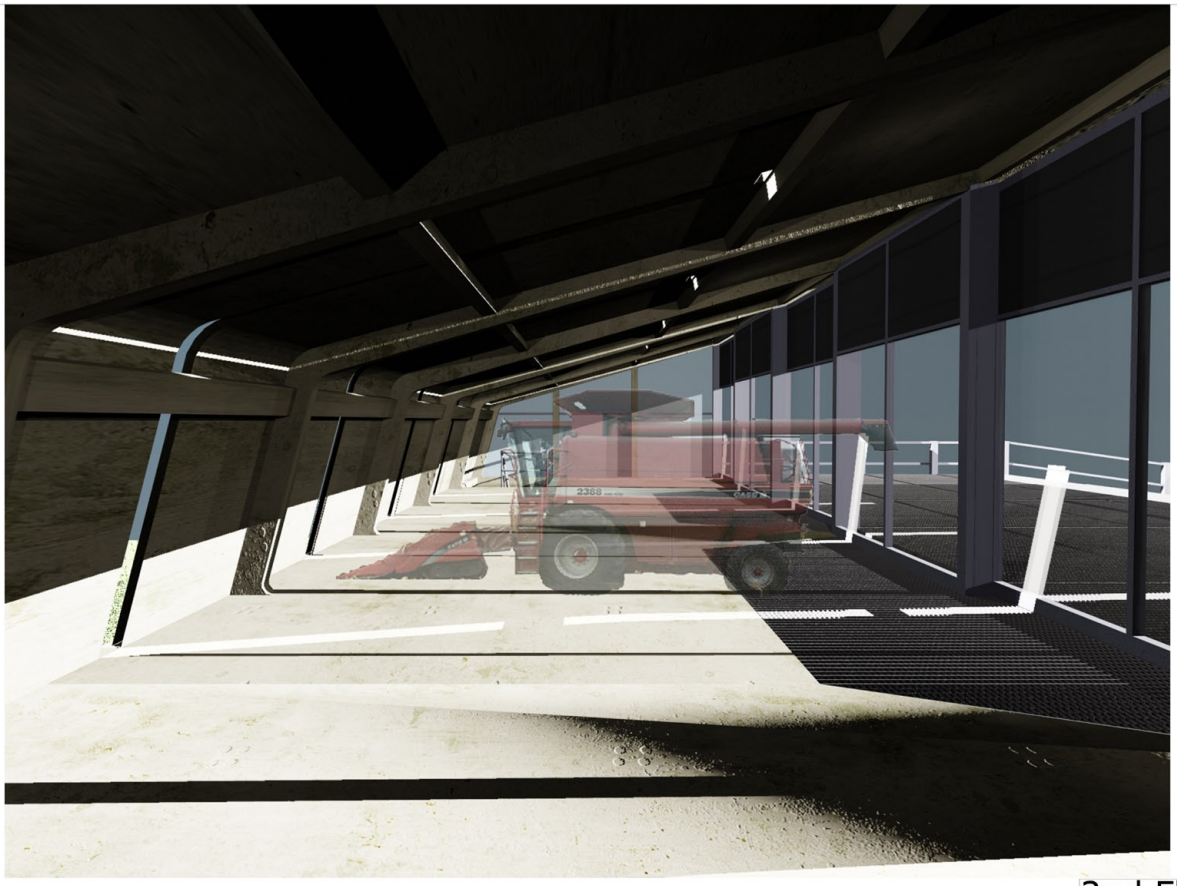
Harvesting/Processing Equipment Exhibit



1st Floor Plan

Harvesting/Processing Equipment Exhibit

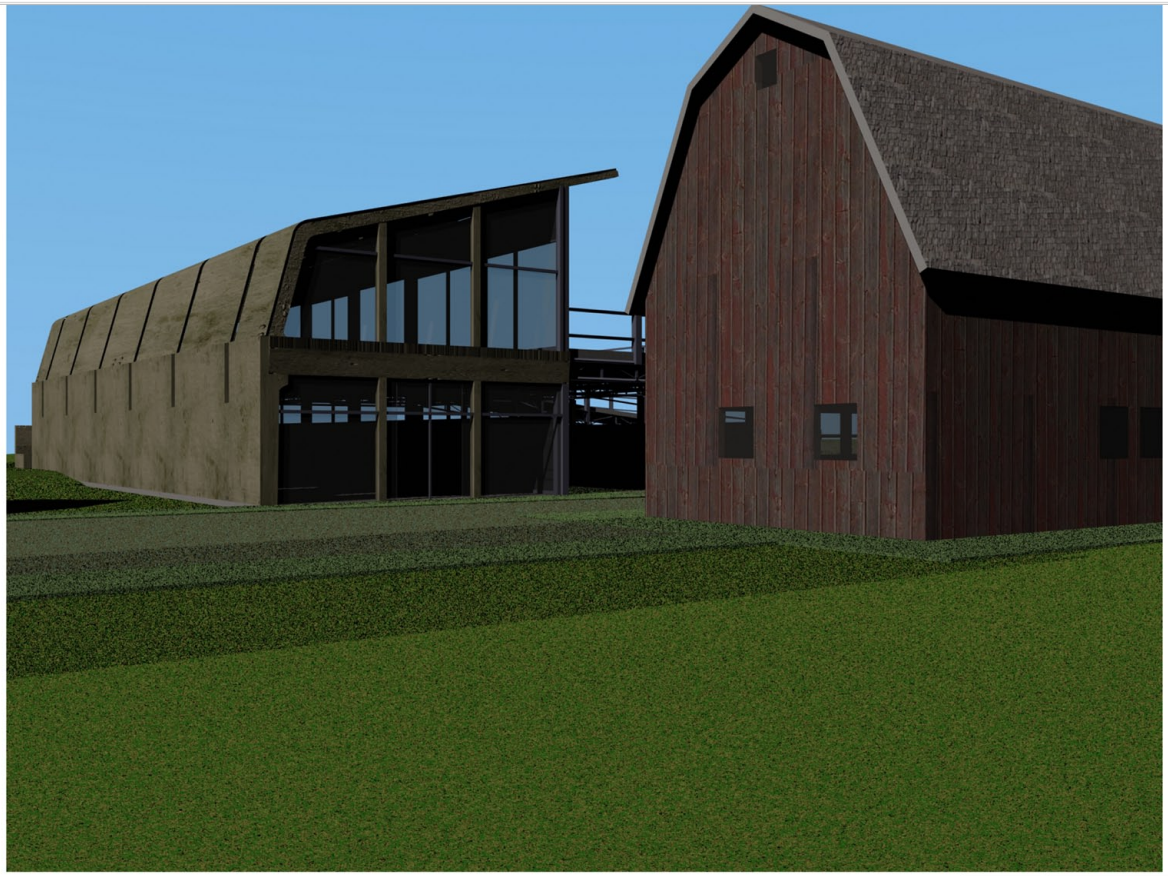




2nd Floor N

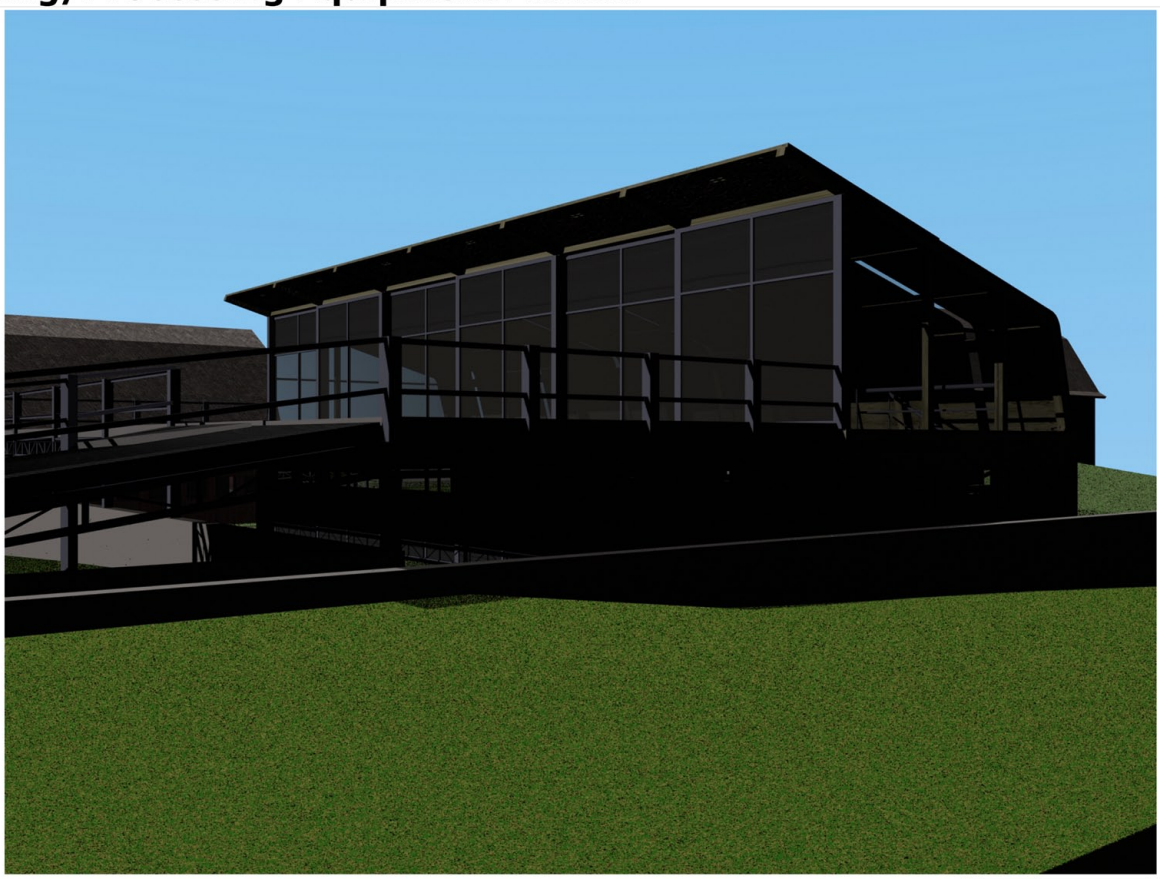
Harvesting/Processing Equipment Exhibit

First Floor Z



Southeast Elevation

Harvesting/Processing Equipment Exhibit



Northwest Elevation

Conclusion

This project attempted to communicate the historical, cultural, and scientific significance of the advancement of farm equipment to visitors through the successful integration of newly introduced farm equipment exhibition structures with existing nineteenth to early twentieth century barns on an abandoned dairy farm. It was intended that this juxtaposition of newer concrete, steel, and glass elements with older wood elements at similar scales amongst a sea of native prairie grasses in a geographic that is becoming increasingly suburbanized would allow for the past rural heritage to be honored and re-appreciated.

It is believed that, in general, this project successfully integrated the new with the old, especially in the arrangement of the entire campus and the use of materials. If someone were to actually visit this museum, they could conceivably gain a good understanding of the historical, cultural, and scientific significance of the advancement of farm equipment. However, there is still much about this project that could be developed further. For instance, there was a programmatic lack of amenities where visitors spending the day at the museum could sit and eat. The exhibition structures were too nearly identical and needed to be differentiated. There was also no development in the design of the individual exhibits themselves, which would have to be integrated with the overall design of the exhibition structure.

An option that would successfully resolve the lack of amenities for visitors to sit and eat would be to place outdoor seating in the center of the courtyard with access to the seating from the existing covered driveway of the balloon framed barn. This would further develop the courtyard and be the premiere space where visitors can experience new exhibition structures to the east and west with old existing barns to the north and south while dining amongst the open expanse of native grasses in the courtyard.

Implementing these ideas to attempt to resolve these issues would bring the project closer to completion and would probably make the project a stronger solution to the thesis problem. Because this thesis topic explored topics that were of personal interest and avoided issues that were not, the exploration of this thesis was highly beneficial and thoroughly enjoyed.

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