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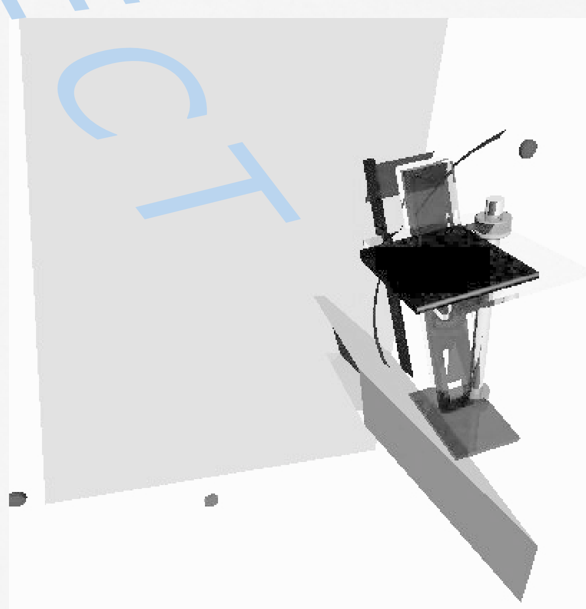
TECTURE: A NONLINEAR RETROSPECT



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TECTURE: A Nonlinear Retrospect

Thesis submitted to the faculty of the ***Virginia Polytechnic Institute & State University*** *in partial fulfillment of the requirements for the degree of* ***Master of Science in Architecture, Concentration in Industrial Design.***

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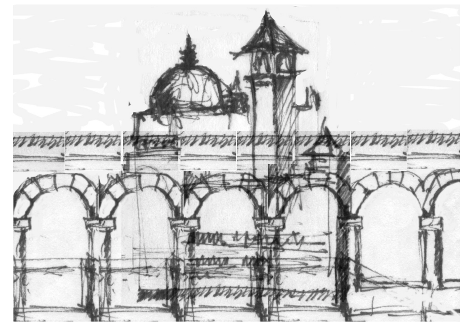
Figure #1
(double helix of the DNA strand)



Sketch of colonnade at the Flagger Hotel at St. Augustine, FL

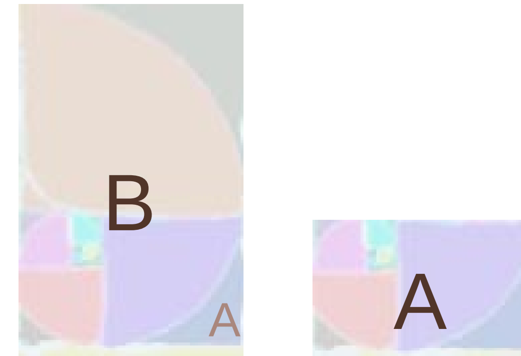
Preface

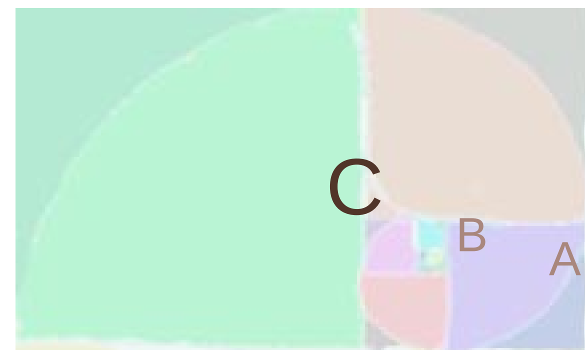
Perhaps certain formulas and rhythmic processes can be determined as a design methodology. Repetition and sequencing gives order to things in nature as well as artificially created objects and environments. A DNA strand *(Figure #1)*which is represented by a sequence of spiral matrix (double helix) is both linear and cyclical in composition. This state of order is embodied within the cells of plants, animals and all living organisms. Because of modern advances, this sequencing can now be studied as well as adjusted. In the case of architecture, colonnade is utilized as a progression that lends structure and formality. A column by itself leads the eye from grade level into the rest of the construct, forming a composition. This type of order has been identified with the classical language of architectural design.

A system is comprised of number of parts and counterparts as it relates to the entirety. It begins on a larger scope, then branches off into a segmented and more finite level. It is not the purpose of this paper to insist that there is only one direction in design development. Rather, it is to give evidence to the possibility of a methodology which exists on a transparent level. Not only can this be useful in cognitive perception, but also in the process of developing a universal language as it applies to design. Inherent in most designs are several developmental methodologies, some better known as the process. Second is the components of the design process. Finally, these components are utilized effectively in bring forth a conclusive whole in a finished project.

Professor Siegfried Masser informs us of the shortcomings of developing a theoretical construct within the many facets of the design discipline.[1] Overall design discipline thrives on its interdependent parts. He believes that theoretical construct could help in some situations and be a detriment in the creative process in other cases. As we know, the act of making (*teckton*) is also part of a process. In making a piece of furniture one can resolve functional issues in the process of constructing. In developing a set of completed preliminary design documents and schematics, one is resolving design problems in the process of making a building. Even in the case of constructing a graphic layout, one is exercising their abilities in making a composition.

In this paper, I am laying out the materials similar to the chronological order in which this study of design in architecture has progressed. A Pedagogical ramification could be to find a common thread in the methodologies and applications. Whether be it a cyclical method or a hierarchical method, there is a level of composition in all facets of design.





Illustrative of the proportional harmonies of the Golden Section.

Introduction

In the Golden Section there are proportional harmonies in nature, art and architecture.[2] In this concept, series of reciprocal proportions are playing against each other to form an entirety in the case where A is to B, as A and B is to C, and the entirety, A/B is to C as an equivalent to its independent counterparts. This reciprocal continues on in a cyclical manner.

Although a nonlinear perspective could be explained in many different ways, the purpose of this paper is to represent it in one way, the Hierarchy of Progression. It enhances the progress to move from one idea to another. In the developmental process of designing an object, environment, or even abstract composition, the designer can utilize this form of study to better understand its context. This could be identified as a cyclical progression in designing, studying, or just observing a point of view. When we study Le Corbusier's works,[3] the five principles that is prevalent throughout his structures are: *Pilotis, Roof Terrace, Free Plan, Fenetre en Longueur, and Free Facade* are cyclical in nature. One element corresponds to the other forming a complete whole.

Some of these functional methodologies are simply to enhance the level of work in progress. They also give a deeper meaning of what is being constructed or what already has been composed. In most cases this keeps the longevity of the project on a universal level. It puts qualitative dimensions to spiritless objects, and constructs.

This is a note on how a methodology of organizing tasks for a design studio was developed. The word architecture is composed of the prefix "arch" and suffix "tecture." This term "TECTURE" was devised as a name for a design studio in Chicago in 1989. It became a strategy in conducting a professional practice within the diverse design field. However, it had potential to go beyond the capability of a design studio into a platform for theoretical design studies. Areas of visual communication and graphics can be described as visualTECTURE. Industrial design applications as producTECTURE. Exhibitions and environmental installations fit under the description of enviroTECTURE. It is an attempt to work with a universal mode of applicable design strategy.

Premise

The nature of this hierarchical progression in design can be described as a triadic composition, where this composition has a relationship between one component to the next as a simultaneous progression. The first component plays a major role to the intermediate component, and the intermediate one plays a role to the last component, and finally the last component plays a major role to the first forming the triad. This can be applied into an operational mode of making or designing something. This tool for design studies helps to observe compositions, functional applications, and theoretical constructs. One example is on the structural level. It is critical to utilize systems and subsystems as they relate to the entire project.

Figure #2 (BRAUN water kettle)

Similar to the Golden Section or the Pythagorean Theory, there is a simple relationship between the initial to its counterpart. If A in this case is the dominant element, and B is the subdominant, and C the subordinate, the entirety has a balance to its counterparts. If observed carefully, each section -- A, B or C itself — will embody the three levels within each. This same way of thinking can apply to other objects as well. In studying a household product designed and produced by BRAUN™, we can observe the effectiveness and ease of use due to this progression. This water kettle *(Figure #2)* casing is made of white ABS plastic body. Durable textured handle design with control buttons. Base is a separate piece with heating elements.

In size and scale the body is the dominant component, the handle is subdominant component, and the base is subordinate component. However in function, the handle has a stronger design allowing it to be directly approachable and button controls encased. Base is the active heating element as an attached component. The body is a (cylindrical cone shaped) volumetric container. Within the exposed side of the body itself there are three components. Water level marker is graphically visible, power "on" light colored lens, and the company logo. The language of semantics is not only for function, but also to address the issues of the end-user's cognitive needs.

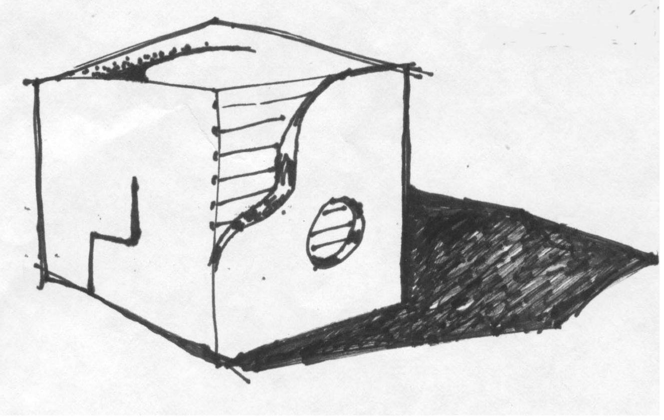
In human cognition, there are the instinctive, intellectual and the intuitive levels. The functions of everyday needs such as eating, moving about, and necessary motor related skills are sufficed by the instinctive level. The ability to make rational decision is completed by the intellectual mode. The Intuitive is the discretion made by the individual's call between the instinctive and the intellect.

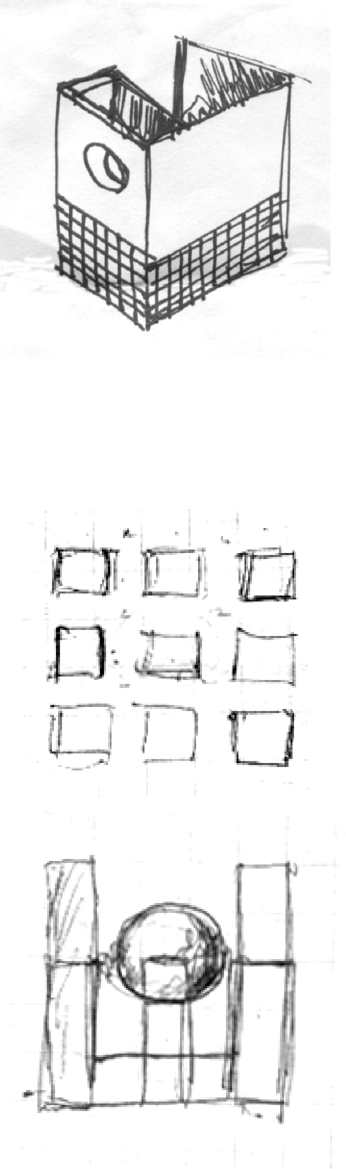
Back to design... ...We can see how this triadic relationship can apply to observing objects or architecture. This can also apply to structural elements within a design construct. If one were to draw schematics or documents, one would notice the thickness of lines. There are strong dark lines representing dominant elements (such as steel beams), medium line thickness for subsystems and active components, and lighter lines represent cladding or dimensions. This applies to detailed illustratives as well. There is a dominant element, a secondary substructure, and completion of attachments.

This body of work represents Components of Design, A Systems Approach, and an Environmental Installation. Components as made objects are discussed as developmental progression. Applicable or acquired components fall under the category of derivative context. Ongoing study in Environmental Design and Sustainability application is used in a building systems project. The Environmental Installation is used to describe an exhibition structure.

I. Components of Hierarchies and Adaptation

In order to achieve a well thought out composition, it becomes critical to understand what the components comprising it are. Components of the design process discussed in this paper are titled “Developmental Progression” and “Adaptive Context.” The ultimate goal is to design for an environmental installation. Prior to directly addressing the criteria of an environmental installation, it is important to understand the diverse types of exploration which exist in developing some preliminary concepts. By executing many different directions of models, ideas, and sketches, there is a larger selection of concepts to work with. This includes tangible issues as well as abstract issues.

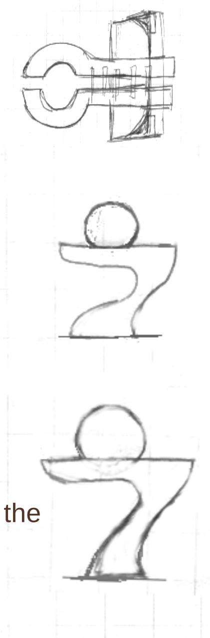




Sketches of cube model in relationship to cylindrical object.

Developmental Progression

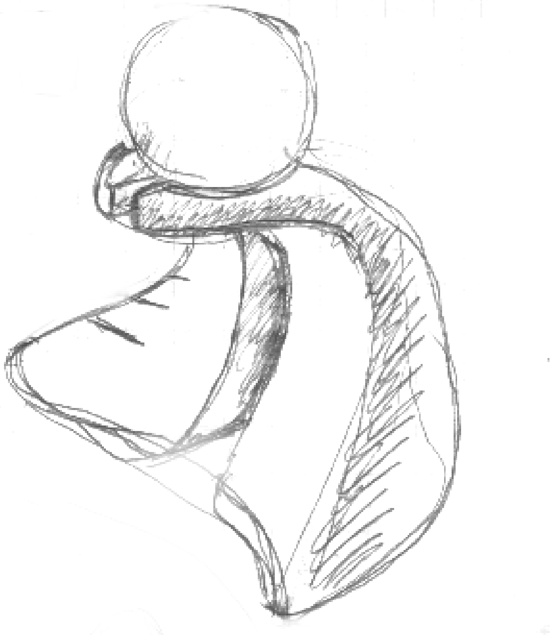
This progression is a problem solving method done though developing preliminary concepts. A finalized direction is achieved through developing repetitive ideas on the same theme. It is an augmented process where one concept sometimes leads to another or just a new direction of development altogether. If a direction is suitable to expand on, then the focus becomes that particular realm of thought. Design strategies are put into affect for some conclusive results. This augmented process is evident in the sketches shown above. Example of a finalized direction is described in the section of design research titled “Extensions of Body and Mind.”

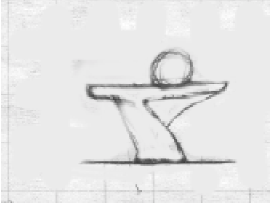


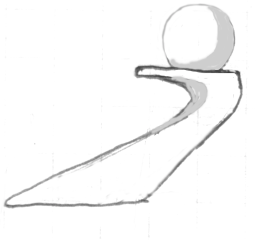
Sketches of cylindrical object within the realm of a 10”x 10” volume.

Augmented Process

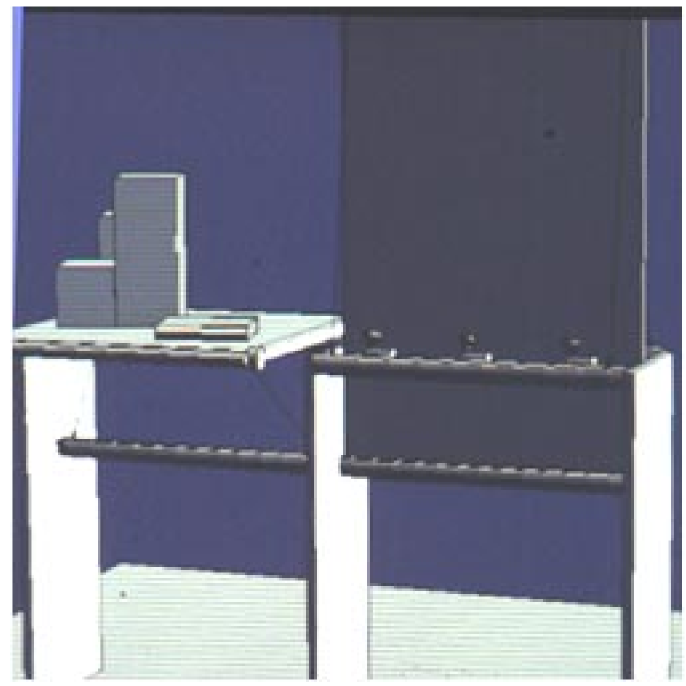
A made object has a relationship to its counterparts. In working with a 10” x10” cube as the volumetric parameter, the central focus of the object has a variety of determinants. When going from a tangible geometry to a more soluble composition, maintaining the parameter is the design criteria. Sketches show a larger area of focal point, a secondary focal point, and a fading away type of focal point. Also presented is the triadic relationship of a dominant mass below, a secondary stem-type extension to hold the spherical object, and the spherical object itself.







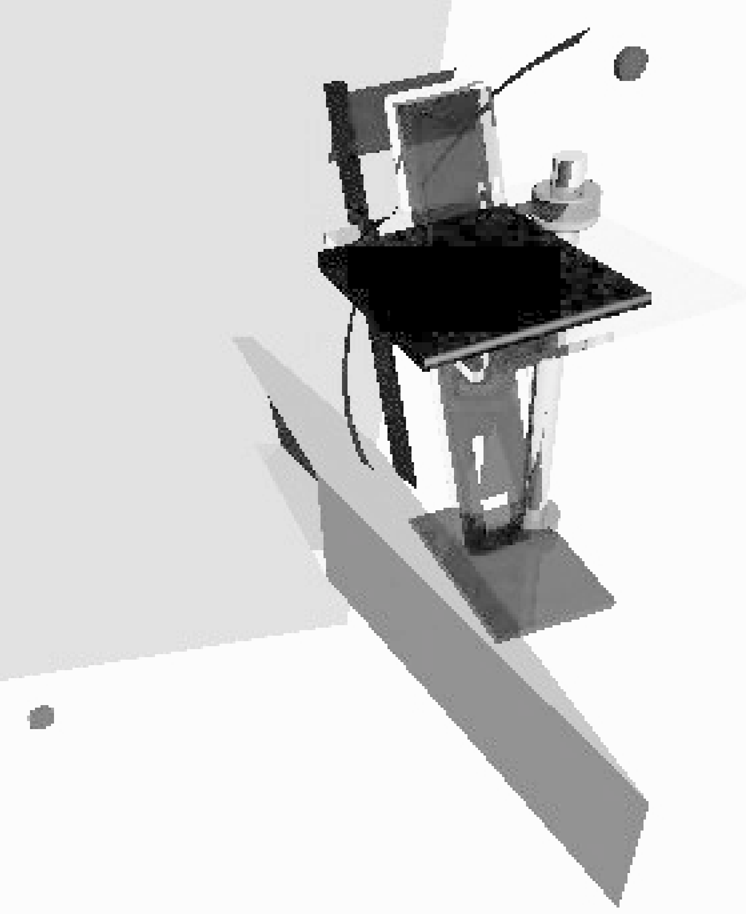
In the previous case, sketches provided certain levels of results in repeating one idea which lead to another. Repetition alone is not the augmented process. It is in the exploration during “making of things” which results in the learning process. This is done on multidimensional levels using different mediums and materials. Working with actual three-dimensional models extends the exploration process further. A series of designed and built stands were developed as foundation material to understand form, planes and structure. Actual wooden construction and computer models helped in the process.

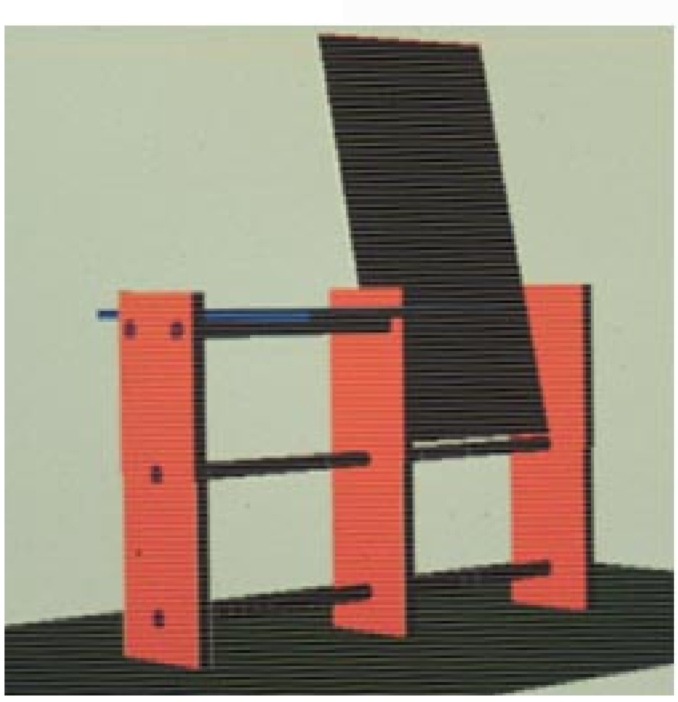


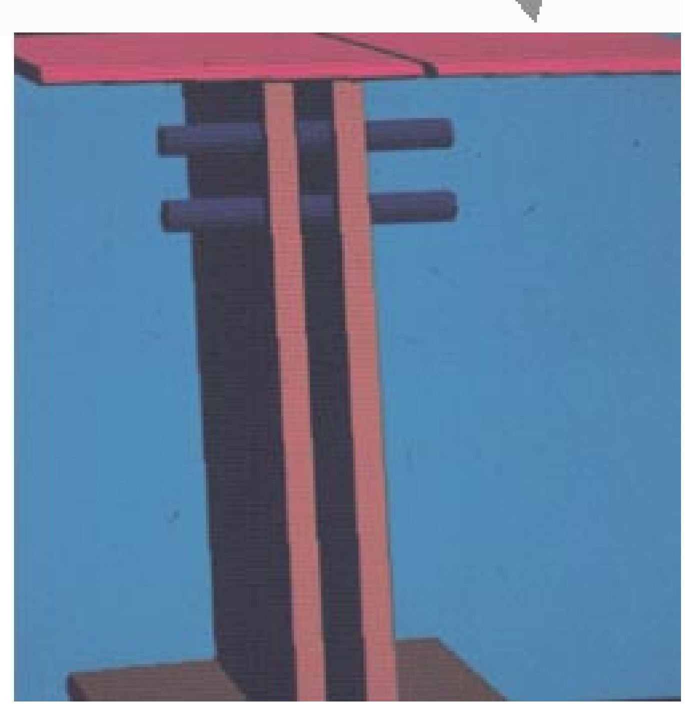
Computer models of credenzas and stands as study in 3 dimensional forms.

Wooden model of credenza (stand) form study.

The term “producTECTURE” was coined to adapt the design methodology to industrial design applications. Furniture, or stands in this case, embodies the hierarchical level of development. In the wooden credenza, the top surfaces are visually dominant, angular support is subdominant, and the base is the subordinate. It is in reverse for functional priority. This triadic relationship is prevalent throughout all of the stands and displays presented.





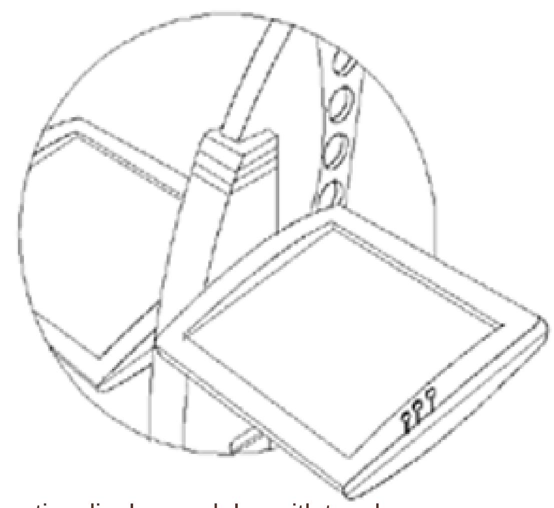


Extensions of Body and Mind:
(Interactive display study models)

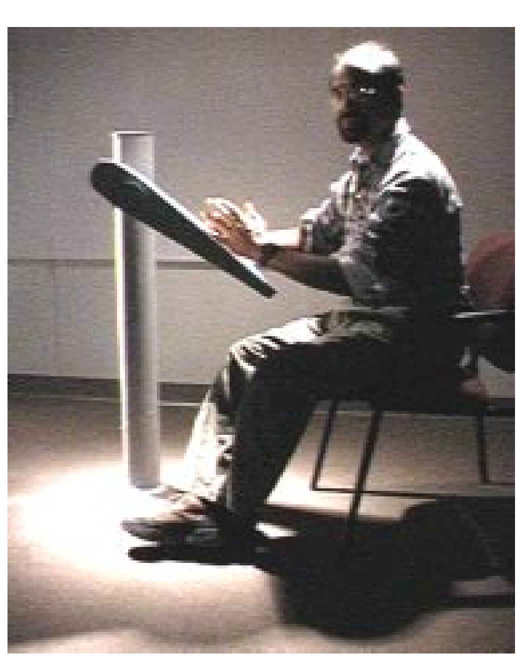
This study includes three models that are to be utilized in museums or other exhibition environments. Display modules were designed for interactive applications to support exhibited material. Embodying state of the art flat screen technology, it has the potential to use touch-screen display. Amongst the three designs, each has a different purpose for the same set of functional criteria. Applications include permanent installation requirements, temporary exhibit requirements, and in-between level exhibits. This application is directed towards use in conjunction with museums, corporate lobbies, and trade environments. This could be used in relation to education where its information access could be applied in libraries, institutions, and distance learning applications. It could be used in super information highways, government and public applications or where ever information feed is necessary.

In following the development of video screen technology itself, we can see how it has gone from a large box to a thin flat screen panel. Its integration to hardware is becoming widespread as seen in the personal computer environments. It is evident that flat-screen technology is developing at the same rate as touch-screen technology. This will allow for keyboard-free access to information.

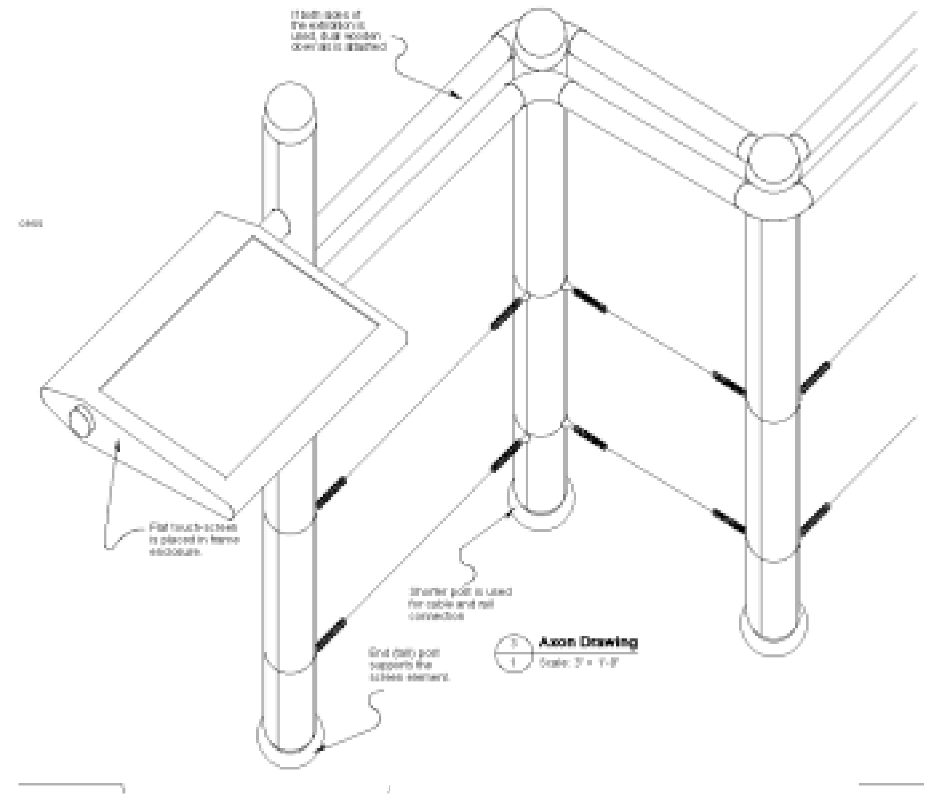
The difference between Human Factors and Ergonomics Studies is that the first works with proportions and the second with limitations and extension of human dimensions. This section is an attempt to go beyond human dimensions and extensions of body parts to the object being used. Study conducted for these interactive display modules describe how to design with human cognition as the factor. If there is a way to design a display for wheel chair accessibility, standing use, and sitting use, this one design meets multiple sets of criteria. This is not the same as all in one design. It is the process of understanding the needs of the public use environment. This type of research allows for better designed displays which do not stay abandoned in a corner of a building by themselves.



Computer models of interactive display modules with touch screen display screens.



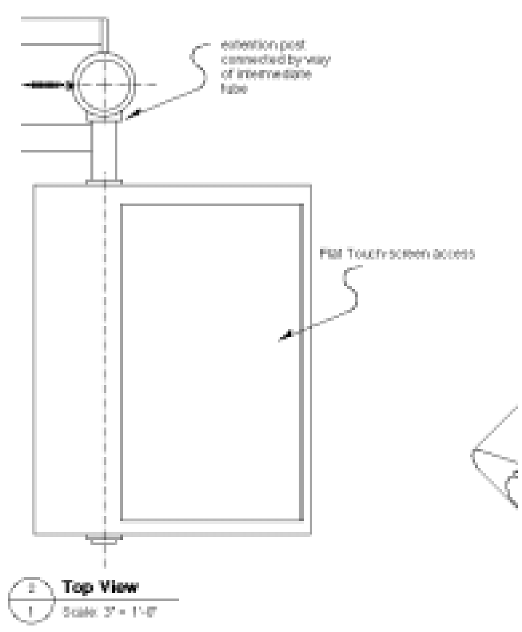
Human factor mock up models for display access.

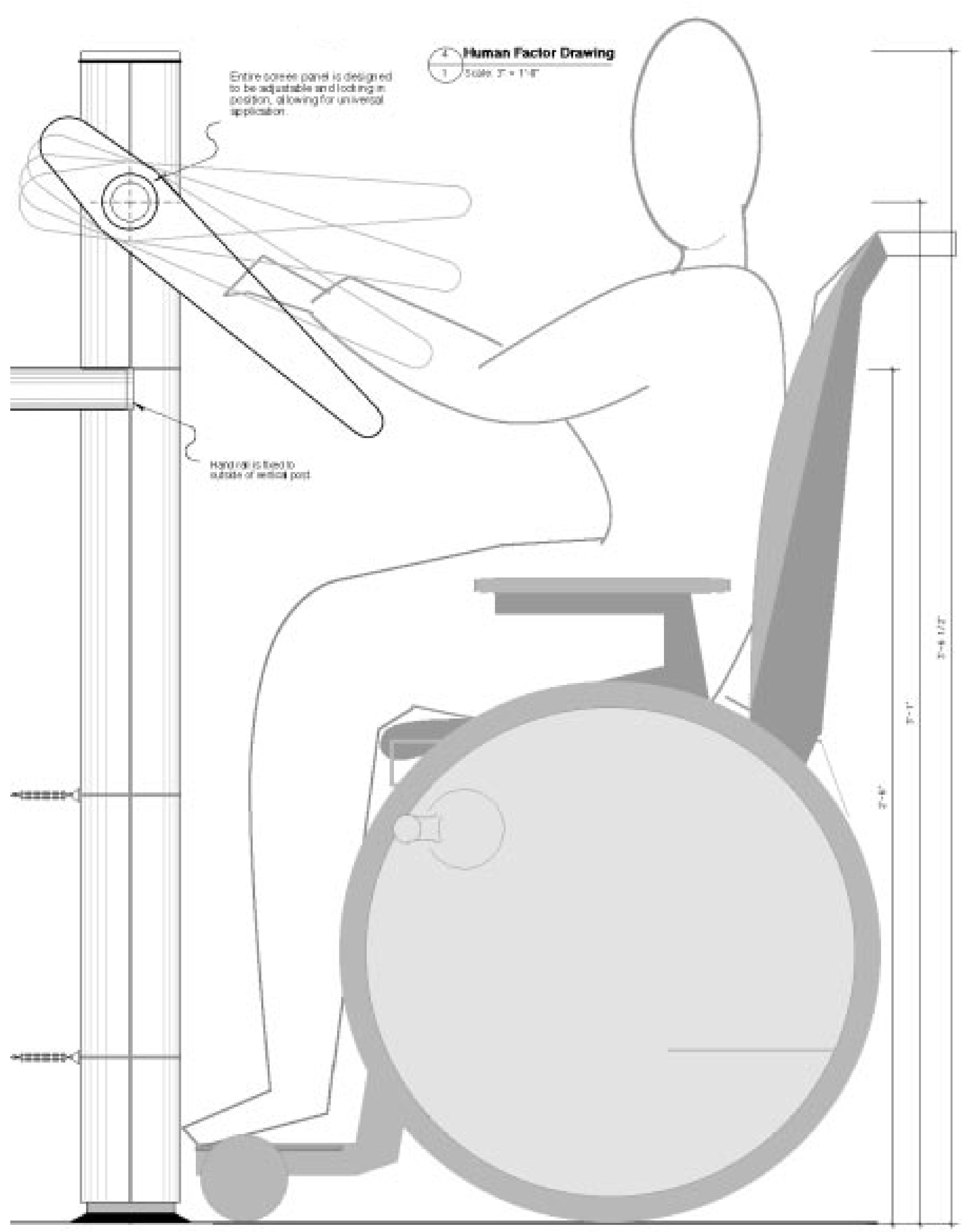


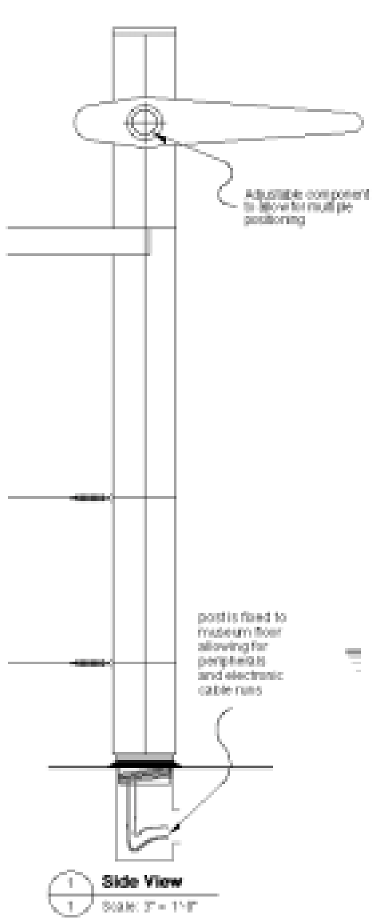
Post & Rail Concept:

(Interactive display module 1- Networked System Configuration)

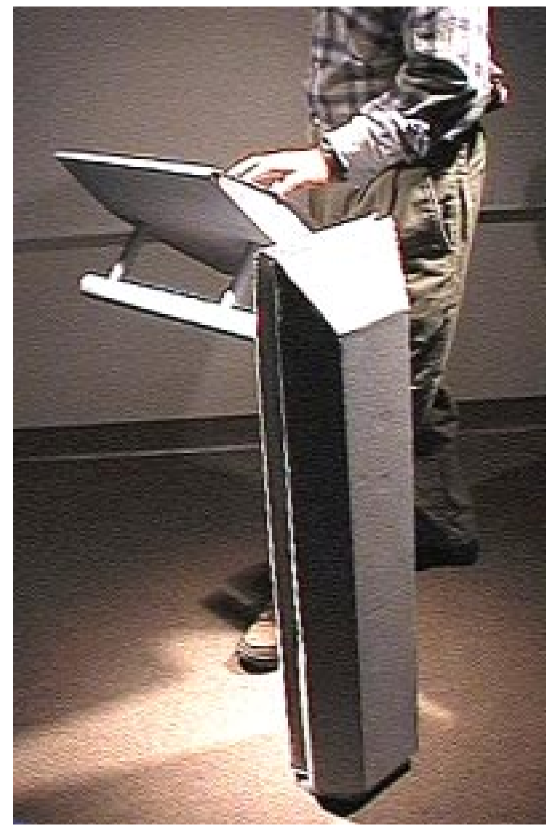
A Flat screen unit extends from a fixed post. This standard configuration allows for versatile use from one location. Post installation is fixed into the floor of the museum environment. This can allow for connections to peripherals and electronic cable runs. In case this post unit has to be removed, a floor encloser can fill the hole. A metal plate with a gasket-type seal can be flush mounted to the floor, allowing for open use of the exhibition floor again. Placement of the feed locations into the architecture has to be strategical. As in the case of the exhibition environment, it plays a supportive role for the object or environment on display. The post and rail configuration can also be used as a directory for specific location or material finding. Its universal use and application is as adaptable as the information it conveys.







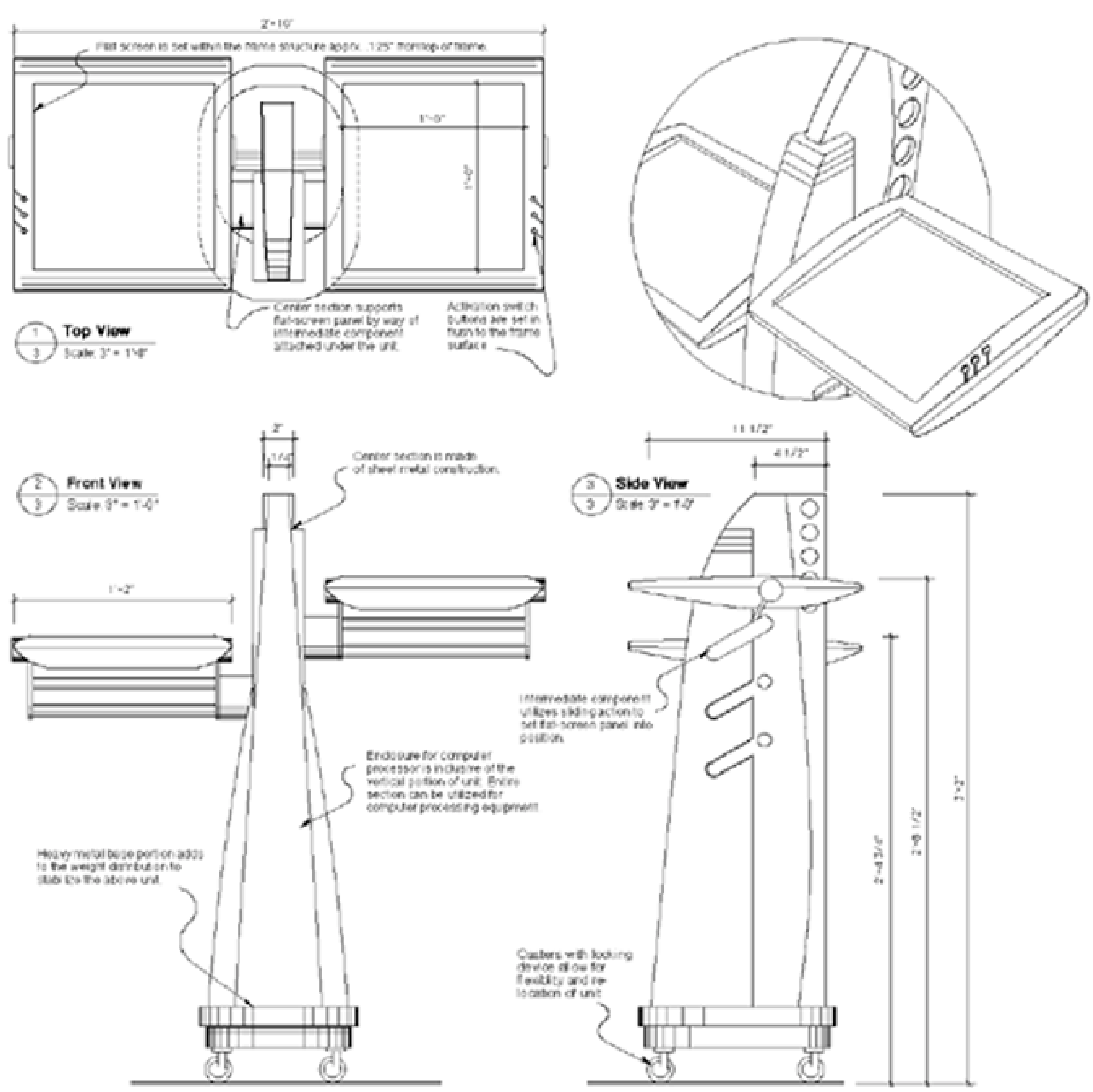
Attachable Unit Concept: (Interactive display module 2- Interdependent System)
This interdependent configuration concept allows for the module to move freely within the exhibition environment. However the unit can be networked by attaching hardware by way of peripheral connections on floor mount. The entire unit can easily be removed according to exhibition design planning and layout.



Single Unit Concept: (Interactive display module 3 -Independent Configuration)

This freestanding unit allows for a display to be placed at any location. Since it includes casters within the base portion, it can travel as a caddy to be placed where appropriate, and wheels lock for stability. Connecting peripherals and cable run will attach by use of extension cords to the units fixed location. The electronic feed will be within proximity of the exhibit.

Critical hardware design issues would have to correspond to recently developed chip and circuit board technology. The processor related components would be encased within the body of the unit. If a large networking system processor is used, an internal processor for this unit is not necessary. This design allows for universal use of display module. It can be used for one or more exhibitions at the same time.



Derivative Context

Ethical Context

It has become imperative that architects and designers take an active role in issues of global and environmental concerns. Working with cyclical methodologies is perhaps more effective then linear thinking. Taking a position or establishing an understanding for sustainable condition early in the design process allows for a cohesive end result. Global warming is no longer a far away myth.

In architecture and design, there are many focal points which complete the curriculum. Working with structure, form, systems, technology and history helps develop a well rounded architect. However we have become a more complex society since we have arrived into the post-industrial era. We have not even begun to address issues of societal and environmental concerns in depth. Similar to the study of history in Architecture, integrating Environmental Studies (in sustainability) will complete the architect/designer's development, giving a direction for theoretical and applied construct. Questions such as making and not making, reasons for using durable and long lasting materials, and subscribing to environmentally safe materials will make the difference in a well developed design. Not only does this add quality to the architects background, it helps the larger issue of global and environmental concerns. Prior to making complex regulations and policies, which is around the corner, it helps to become innately responsible on individual level.

This global warming issue has become a larger concern than initially predicted. Although life support systems are not immediately threatened, there are signs of major environmental change caused by carbon dioxide and other greenhouse gasses that is depleting our air quality. This will impact the global climate change, which affects life support systems on incremental levels. As stated in the climate summit in Kyoto, industrialized countries agreed, at least on paper, to reduce the amount of carbon dioxide released into the atmosphere. *"Scientists believe that we can only afford to release limited amount of carbon into the atmosphere, otherwise, we pass the "safe" limits of climate change."* [4] The United States itself has agreed on a reduction rate of 7% under these negotiations. Some European countries have a CO^2 regulatory plan. Their budgets are tied in with the CO^2. Apparently GCC (Global Climate Coalition) is in opposition with the Kyoto Conference and The United States legal participation in this agreement. Dragging our feet in making immediate change will have repercussions, politically as well as environmentally. Apparently the climate change is occurring so fast that ecosystems are not able to adapt. To keep the temperature from increasing at the rate of 1° C limit is calculated at a range of 112.5 to 337.5 billion ton of carbons over the next 100 years. Industries produce four times this amount of carbon. At the rate we are going, we will be reaching this within 40 years.

This is why it becomes pertinent that we reduce burning fossil fuels. Fossil fuel groups are afraid that in the process of reducing the carbon dioxide emissions, we will phase out the fossil fuel consumption altogether. Policy analysis written by fossilfuel organizations claim that fossil fuel is a sustainable and conventional form of energy. Their position is that they can burn oil, gas, and coal in an environmentally acceptable manner. They believe that it is abundant and they plan to improve their technologies in bringing their capital investments to a larger percentile. They forgot one thing, the concern is not whether fossil fuel is abundant or scarce. It is the impact of automobile and energy burning use that sacrifices the climate conditions at an alarming rate.

This linear thinking of continuing to move forward, burning all the resources along the way has to be left behind as past way of living. A large percentage of the world does this without knowing what the consequences are. In cyclical thinking, we will know what has reusable value as well as long term value. This becomes a basis for involvement of theory in the design approach. This is where regulations and policies will take effect. It becomes valuable to be knowledgeable in applying sustainable designs with long-term goals in mind. Technical institutions develop the practical functional skills. Colleges and universities should embody the ethical and environmentally sustainable values in their students. Education has to reach beyond mechanical and technical systems and somehow relate it to the whole.

The triad here, is when the action taken on one level has a impact on the other two.[5] Environmental concerns are the responsibility of the Society (or Social Community). Just the same, this people community is dependent on the economy and its impact on living conditions. In completion of this cycle, economy can only be as healthy as the natural environment which produces these dependent resources. Charles and Ray Eams produced a film clip called the "Power of Ten," visual tool which illustrates scientific ratio of the cosmic existence.[6] This scale linking process which starts at the power of 1000KM where there is the region or biom. Power of 100KM is the landscape. At 10KM is the town. As it progresses to dwelling, then to the human individual, the tool, and into the atomic level. If everything is linked and has impact on other links as it changes, then the climate change will impact the environment and ultimately us the inhabitants.

(Above image was taken near Harrisburg, PA - region for coal mining transport.)

In the video "After the Warming," James Burke narrates by representing himself in a virtual time travel through a hologram transport.[7] Placed in the year 2050 he reviews the world in a historical context heading back to the year 100,000 BC. As the earth's orbital cycle changes tilting away from the sun in 40,000BC. The Ice age at 200,000, the natural greenhouse cycle occurence is predicted. When he reaches 1750AD, the weather allows for food surplus. Electricity is developed at 1885AD, Colonial expansion in the1900's. In the 20th Century consumer life-style and infinite resources leads to a carbon dioxide and methane emission, CFC's (chlorofluorocarbons), and deforestation trends taking place. There is a tendency for greenhouse gases to double and rise the global temperature average of 10°-15° F within the years 2030, 2050, or 2075. At least "50% reduction of CO^2 for the next 100 years is required to hold temperature rise to +8°F by 2100AD. Critical questions are... Can we stop burning fossil fuels? Can we reduce our garbage output? (i.e. Methane form rotting garbage and cows.) Can we stop use of industrial fertilizers? (Nitrous Oxide) And finally is there another way to address the need to use A/C, refrigerators, spray cans, and foam which release CFC's?

Another form of societal impact on our natural environment is how we are rapidly depleting the forests. We use more wood products in one year then what we can replant in producing new growth on long term basis. We need to stop unnecessary deforestation and rethink how we build and make for durable and long term use of quality products. This way we are not overwhelmingly deforesting for the wrong reasons.

Along with the above mentioned issues, necessary water access and human intervention are a concern as well. Oceans, waterways, and landfills are not a place to dispose of toxic waste. Air quality and ground water is affected when they are neglected.

This ecological system is affected by population overgrowth as well. "The world population doubles every 30 years." Along with this, consider that everyone requires the fundamental basics of life. Nonindustrialized or undeveloped countries that are growing in population are wanting the same lifestyle as the Industrialized countries. Food, water, shelter, public health, and other finite needs add to the exponential requirements and demands on global resources. Government regulations and polices on housing and economical stability can only become more complex. "The obvious consequence is one of the two alternatives: many will go without, or those resources will have to be divided more equitable among an increasing population." Everyone wants at least one television, radio w/ CD, computer and a pair of blue jeans. The consumer demands and standards of these developed countries have acquired will be in greater numbers. We in the United States must rethink our standards as a trend setter of post-industrial counties.

People living in rural conditions need independent ecosystems to support themselves, whereas people living in urban conditions work with one large power structure. There are pros and cons in both conditions. Electric energy required by a city dwelling is systematized into zones. Nodes of power generators and junction stations distribute needed energy. On the other hand, people living in rural conditions will require the energy to be drawn out to them. This could mean cumbersome maintenance, power loss, and other effects on the natural environment. However if the rural population decides to adapt to environmentally sound living conditions, they can optimize use. This means utilizing passive and active solar systems integrated into their living conditions. Water filtration systems, and refuse and ecological land use systems would give independent empowerment as well. Whereas people living in urban conditions migrate towards a multi-faceted populace area. Since early human civilization, people have migrated towards waterways and basins. Cities and towns have evolved from their need for natural resource basins, such as rivers, canals, and ocean. This is not only a social need to gather, but a sound ecological solution for an over populous area. If the air and water quality is well maintained, it is conducive to a cyclical environmentally safe condition. Maintaining this condition will be the economical progress. Along with all this, people will enjoy going to parks with trees, waterways with human activities. Museums, theaters, and public markets can flourish without violating its natural environment.

(Above images - population around the Baltimore harbor region and High-rise buildings of Denver, CO)

Derivative Context

Learning from Natural Forms

There are many patterns and geometries to be found within the natural environment. A leaf which has a major stem (access channel), leads to smaller channels. Within the surface there is a network of small lines forming fine little geometrical patterns. The edges become a mesh blending into rest of the leaf. This is just one example of how natural materials can be adaptive to design influence. Similar to the leaf, a spider web structure was studied and researched to find out if the ratio of structure can be simulated in silk type of materials for elasticity and durability. When we utilize biological influences to produce contemporary and efficient materials, the study is called Biomimetics.[8]

Order in the Natural Environment

In natural forms such as a tree barks, there seems to be an irregular surface. However when one looking closely at the entire surface, the there is a relationship between exterior surface and interior surface as a composition. There is an order found in nature which is not immediately visible. Acorns or flower buds growing in different sizes, where all have the same symmetrical pattern of growth. There is an order of seed compartments within the array of openings. Although pine tree growth seems symmetrical, the actual growth pattern of the needles are alternated. Whether there is a random or parallel patterns to natural elements, there is an order comprised within it.

Form Giving

Feathers are formed by way of interlocking follicles, as though if they were extruded from the central stem. Also when looking at a bone structure, there is a directional flow of fibers which compose the surface with cellular interior which gives it form and stability.

Architect Santiago Calatrava uses the natural studies to create an artificial environment. *(Figure #3)* The form giving details have been influenced by skeletal structures of birds, animals and the natural environment. Below is a bridge design in Kronprinzen, Berlin.

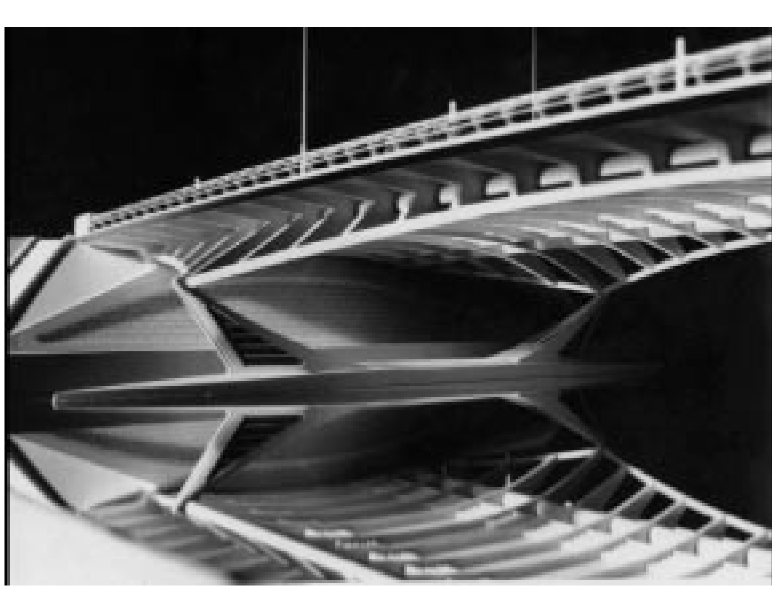


Figure #3 (Bridge model design by Architect Santiago Calatrava in Kronprinzen, Berlin)

Wind Turbine installation

Derivative Context

Tapping into the Renewable

Whether the objective is to design a "green building" or to consider implementing an environmentally sustainable installation, the purpose is to follow along the line of renewable resources. Predominant amount of the resource is already provided from the sun, wind and thermal conditioning. Passive systems take advantage of the heating and cooling needs of an built environment. Active systems are additional installations and investments added to the building. Other renewable considerations are water systems, environmentally sustainable material usage, and maintenance of all of the above. Other components which fall under the category of renewable resources include the following: natural ventilation issues, composting, water retianment (cisterns), recycled material use (wood and paper fibers, plastics, air rated concrete, and metals such as aluminum), and optimal use of landscape without violation to the land itself.

Glass atrium for passive solar applications.

Considerations for passive solar design systems utilize large open glass area. This is especially true for direct gain or greenhouse system where thermal storage mass is required. The mass absorbs the excess storage heat and releases it back into the building at night. The mass is also used for regulating extreme highs and lows in temperature. Indirect gain from the sun uses the walls, floors and other thermal mass elements as conductors within the building. This can be done if the building is strategically constructed to its relationship to the south facing sun. A maximum use of sun in an effective manner could take advantage of incorporating into building a greenhouse, sunporch, thermosiphoning air panel gain, fan-assisted air panel gain and a thermal storage wall (Trombe wall).[9]

Shading components with strategically constructed overhangs above windows make the difference of having warmth in winter and shaded cooled area in summer months based on the solar angle.

Active solar energy use takes advantage of heating water for interior use and providing electricity by way of photovoltaic systems. Both of these systems requires maintenance and need to be regulated by the end user. Heating water systems for providing warmth inside, for thermal installation within the concrete slab, or for just for domestic use requires an installation of south facing water line encasement to be pumped back to a regulated tanks area. Variety of systems exist to adapt to each particular need.

Photovoltaic systems require collector panel systems, storage (battery) packs, inverters, and regulating components. A series of sizers are used in determining the power load required for installation of the photovoltaic array. PV or Solar cells operate on the principle that electricity will flow between two different semiconductors. The exposed light between the conductors produces electricity from the cells.[10] The entire system is utilized by way of integrating the designed components into or outside of the building structure.

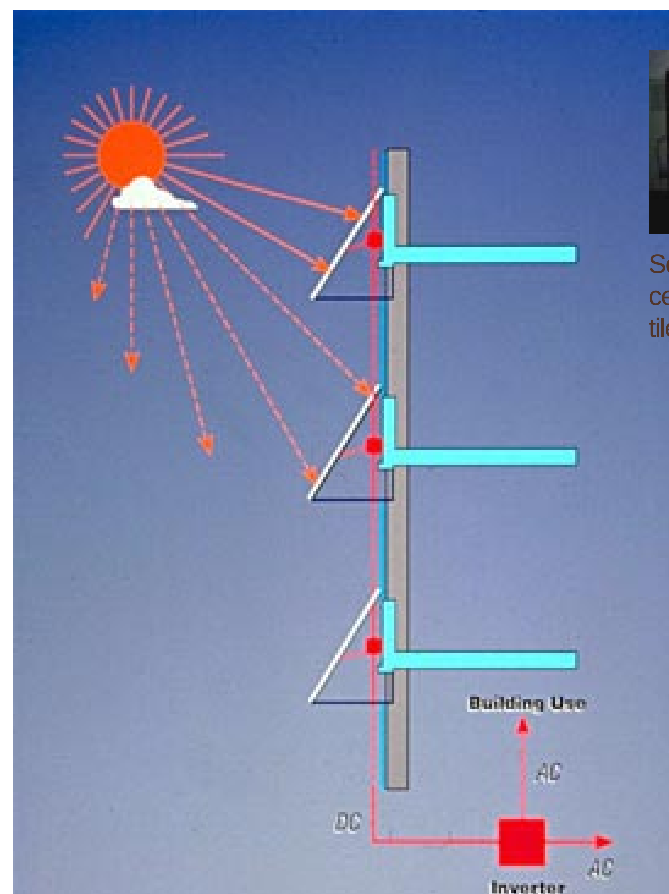
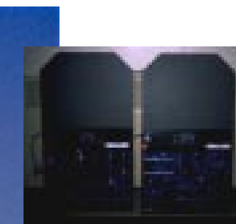
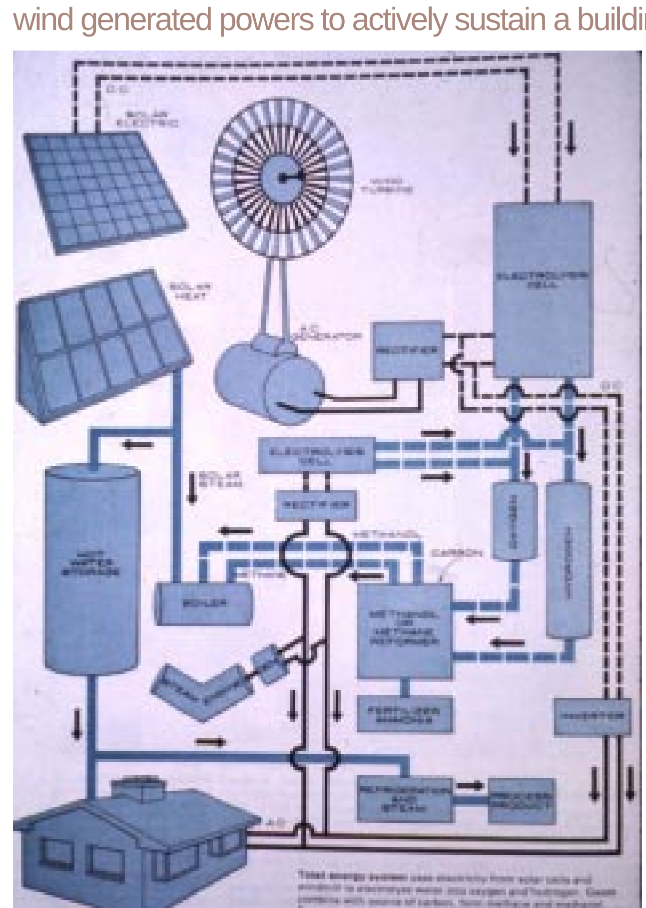


Figure #4 (Solar array collection system)



Solar collector cells on roofing tiles.

Wind turbines are used as required per the climate adaptation to its necessity. Meaning that if there is a greater wind pattern flow year round by coastal regions, then the power source gained is greater. Similar to solar array sizing, its important to study to wind patterns of the location it is being installed. Directional flow and controlling systems utilizing anemometers allows for optimal use when required. There are also hybrid systems which include solar and wind generated powers to actively sustain a building.



Figures #5 (includes all other images on this page) Hybrid applications of solar and wind turbine power generating systems.

II. A Systematic Approach

Knowing The Limits: (Project Environment)

When this project started, there was an request for a Eco-lodge type of building utilizing sustainable dwelling perimeters. In keeping with the design criteria, it was necessary for this project to explore other applications within the issues of sustainability. The question became whether it was feasible to introduce a permanent presence in an ever changing condition. Climate patterns change in accordance with seasons, months and decades. Perhaps global effects have a major role in this change as well.

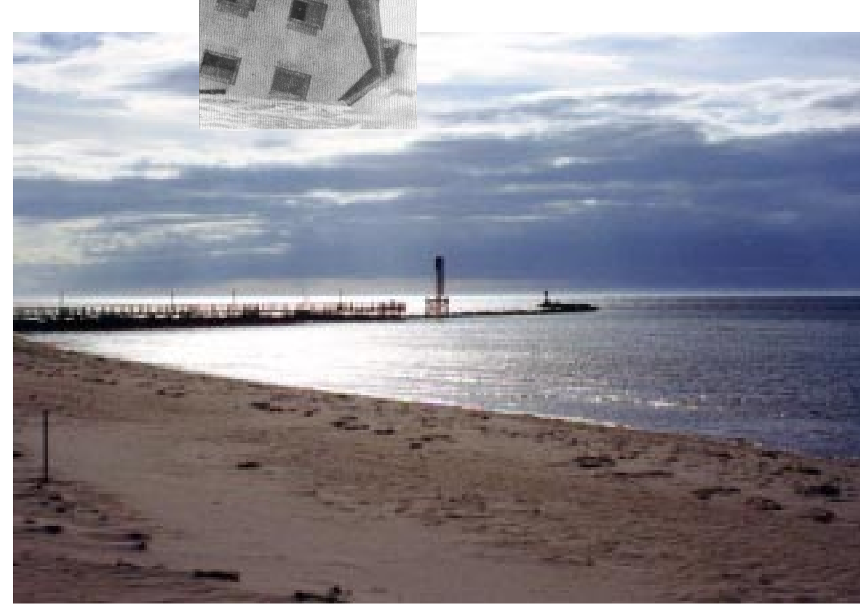
Throughout history, permanent structures allowed for a more substantive and stable construct. With even more drastic environmental conditions taking place within recent years, their impact is taking a toll on the land, buildings and dwelling. We must investigate alternative structures.

In the case of the Barrier Islands of Virginia, there is evidence of this type of constant change. Lifestyle is very rich in natural quality. People who reside in the area are very proud and protective of their environment. The Coast Guard Station in Cobb Island was an example of how protective and respectful the residents of the area are. Along with The Nature Conservancy groups, public and private contributions helped to save this from the hazards of the ever changing conditions. To avoid from sinking into the ocean, (Figure9) it was transported by loading it onto a barge and re-stabilizing it on an inland site. Now it sits on new stilts as its permanent residence at the bay of Oyster, Virginia. The function has also changed to be economically supportive of a Eco-Lodge for the people to come and visit within the context of Eco-tourism. This gives the residents their stewardship role to take care of their dwelling. Visitors can come and go for short retreats or for observing surrounding wildlife amongst the natural setting.

Building types are also changing. This is why it would be a good idea to have a building type which can address several needs. A universal perspective could be the answer. Perhaps introducing a building which is utilized for research and studies of the environment in which it is built. In this particular case studying the Barrier Islands of Virginia, this could include the possibility of extending temporary residence for the research group involved, a nonpermanent time of residence until the next group comes along.

Old Coast Guard Station within the Barrier Islands of Virginia- Proposed Building for new use (Eco-Tourist center)

Figures #6
(image of building falling into the coastal beach)



Eastern Shore of Virginia (Oyster Bay) Region

The proposal for this design is to build a temporary structure which can be transported on the barge to Parramore Island from the inland part of the Chesapeake Bay Peninsula. This structure has to be constructed in such a way that it can be built and dismantled as required. Since it is similar to a kit-of-parts building, its life span is based on the project's duration. This is ideal for a science or environmental research center where studies and courses can be offered on site. Depending on the research or grant types, different projects can go on in conjunction with each other or scheduled for a duration. The structure can be left standing for 5 to 7 years before it is dismantled and reconstructed again in another location.

GIS map & soil maps

Building parts can be designed in a way that all components required to construct this structure can travel on the same barge as well. This includes building parts, lightweight cranes, utility machines with exchangeable parts to adapt to its function during its construction. These machines may remain docked or assist in the autonomous dwelling duration as supportive objects.

In this particular location the barge can depart from the Wachapareagu area dock and travel through Bradford Bay and Horseshoe inlet to Parramore Island. This way the barge can pass through the clear channels of the marsh area, clearing any obstacles. The nonpermanent foundation footers can be set in to a stable grade level at the northeast location of Parramore island. Soil studies show the silt and sandy marsh conditions are not a threat at the foothill (landing) region of Italian Hill.

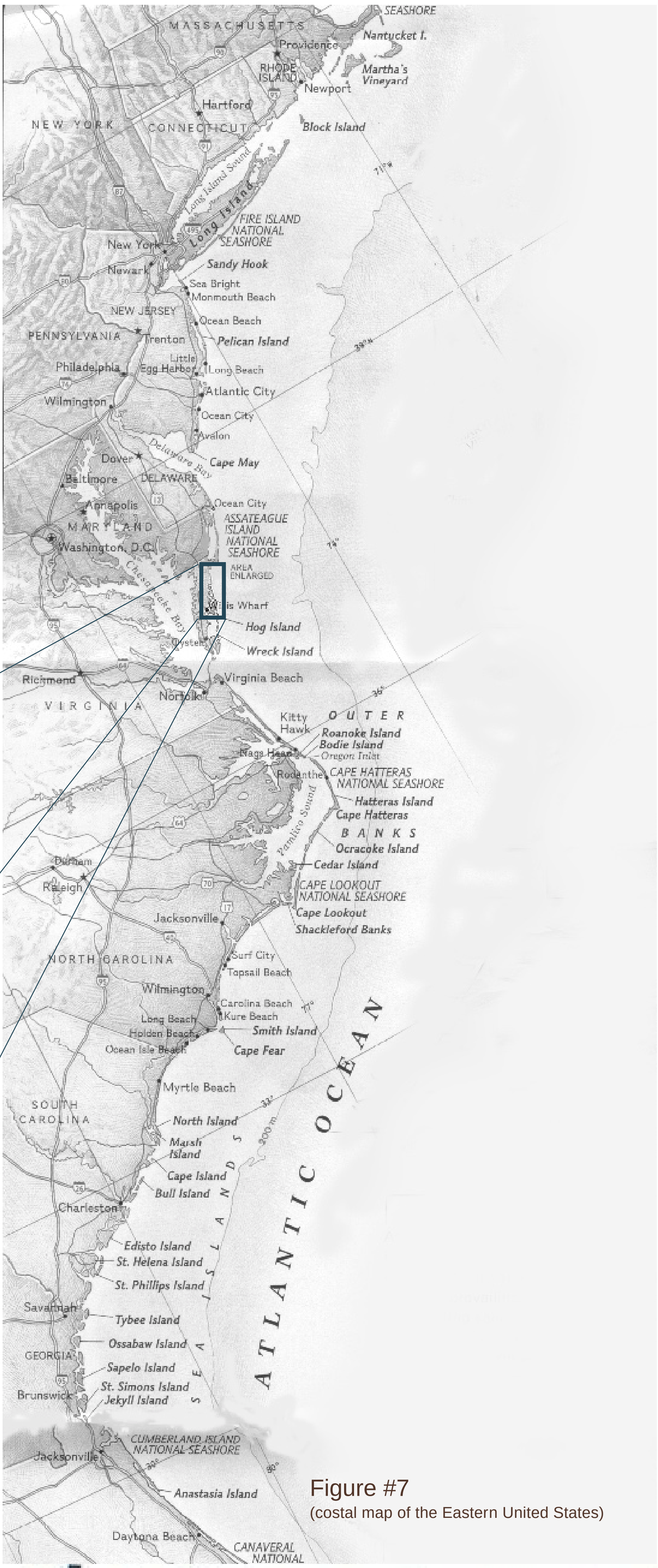
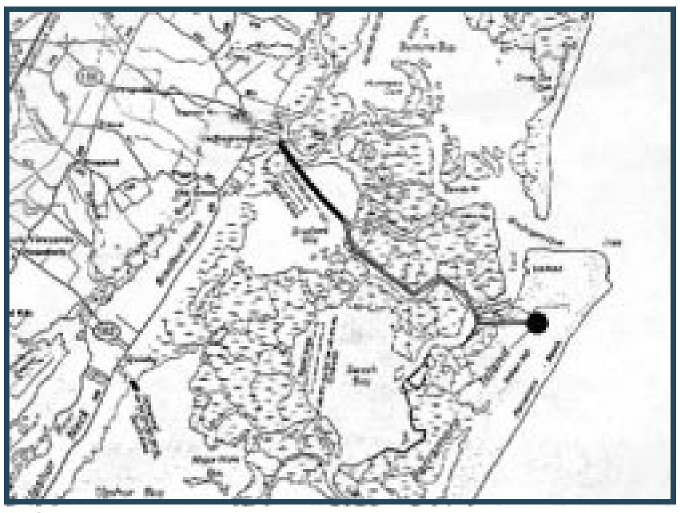


Figure #7
(costal map of the Eastern United States)



Figures #8
(Includes the above GIS maps and soil map)

What is Building with Parts?
Systems Model (Project description)

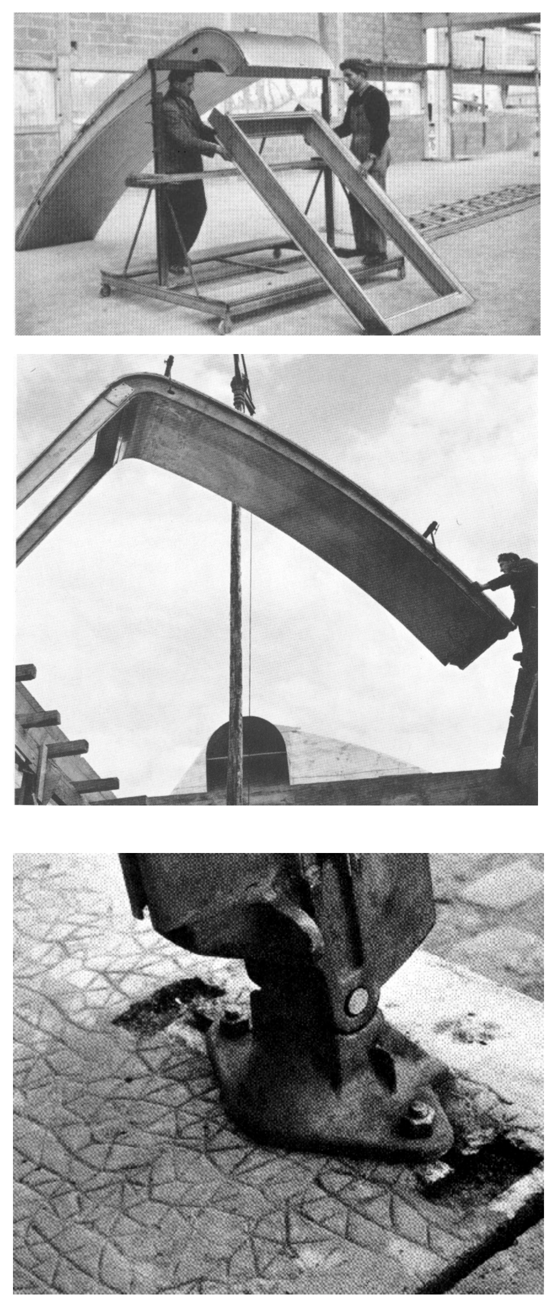
In investigating what is a sustainable condition in building design, there were many conclusive responses. This was based on the levels of applications for residential, public use, and research use. A green building could be all encompassing of environmental issues and therefore only use materials which are nonabrasive to the environment. Sure enough, almost every fabricated material has a component with a secondary by-product. Or perhaps even utilized materials in development have had some effect, as in the use of photovoltaic systems which utilize batteries to store energy resources. The cells within the battery have an approximate life-span of 30 to 35 years. Where as some nuclear power plants have a life span of 30 to 35 years before they are obsolete as well. The objective is not to say there is a comparison. Perhaps we need to be finding ways to utilize renewable energy which is efficiently produced. Using photovoltaics or wind generated energy sources help to improve quality of dwelling without continuously affecting our natural environment and depleting our nonrenewable resources. Using hybrid resources of conventional and renewable systems should be investigated.

Since there are many schools of thought in developing a sustainable design, all are trying to prove their feasibility of utilizing renewable resources. What if we borrowed permanent components and materials in conjunction with Eco-development building components as subsidiary parts to the whole? Taking correct measures will assure long-term solutions even if they are temporary constructs.

As in the case of nonpermanent structures, experimentation has been going on for several years. French architect Jean Prouve has investigated this process of putting factory buildings together as parts fabricated in increments since the 1950's.[11] Although the parts were fabricated (Figures #10) utilizing industrial components, the purpose was not to re-industrialize new factories. It was to find custom applications for individual custom needs. He would produce a roofing structure with same multiple parts of the same piece for that particular project. Perhaps this type of development might be a feasible direction for a sustainable dwelling condition.

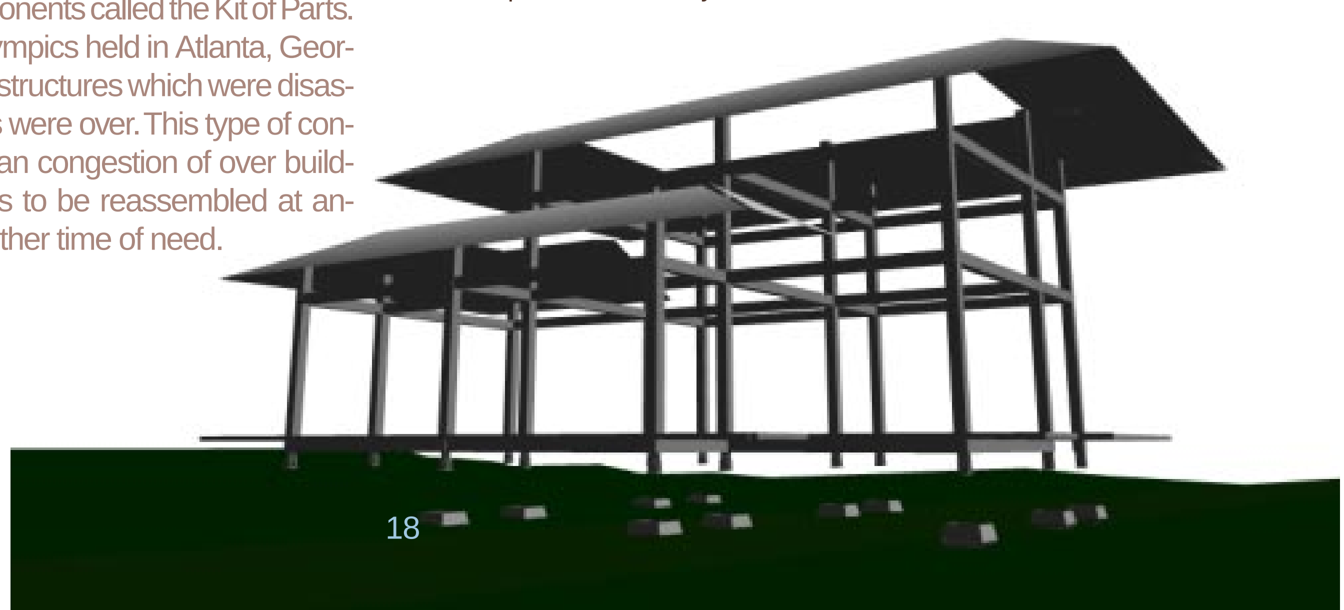
Building in incremental portions is presently being utilized by the U.S. Postal Service in designing a more efficient structure in components called the Kit of Parts. Also the International Olympics held in Atlanta, Georgia had many temporary structures which were disassembled once the events were over. This type of construct decreases the urban congestion of over building. It allows for buildings to be reassembled at another location or at a another time of need.

Basic frame structure for system model.



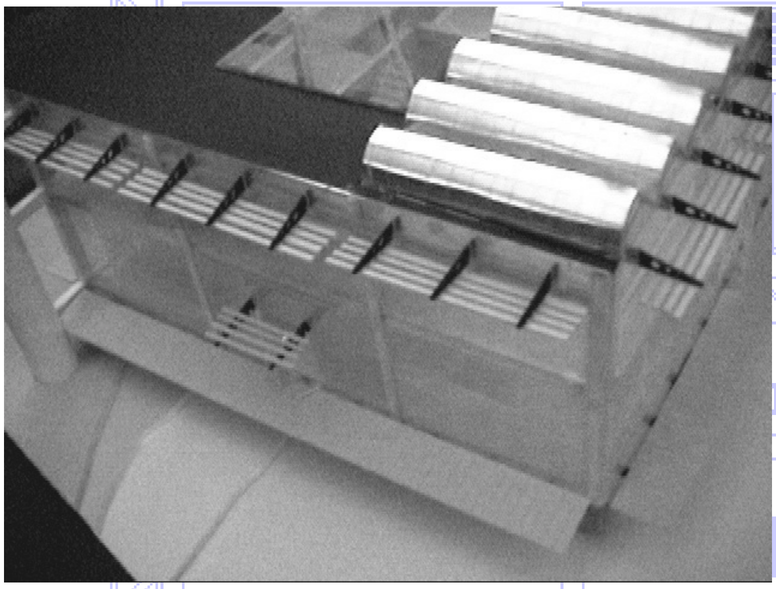
Figures #9
(Precedence studies of Architect Jean Prouve's fabricated building parts)

Computer model of system frame and structure.

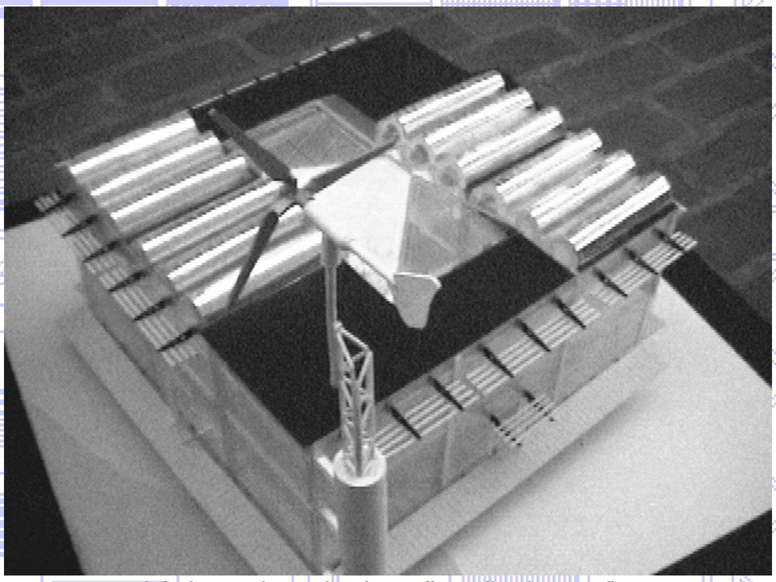


The Language of Systems

Building model study utilizing systematic approach.

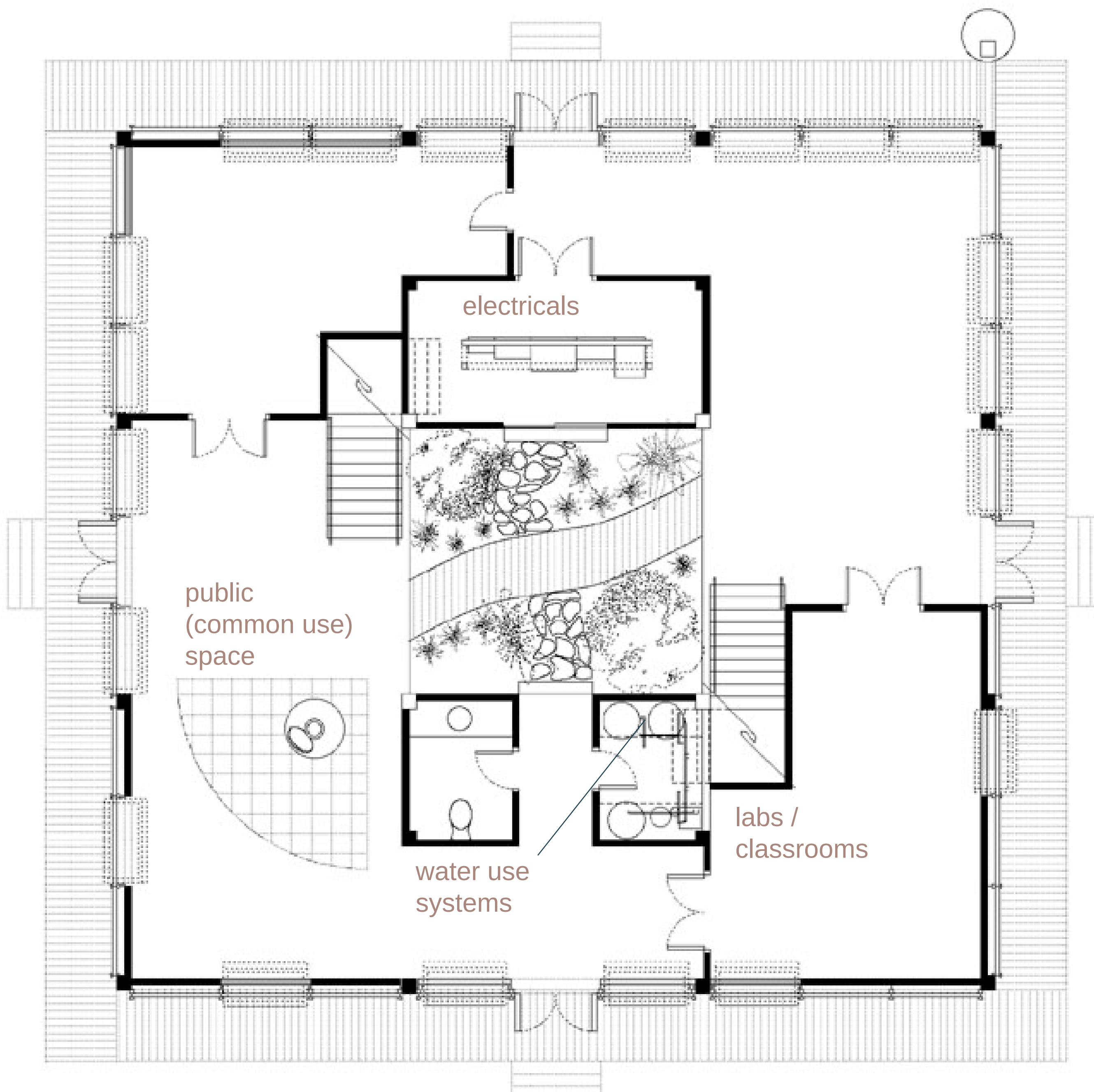


Model made from computer drawing. Surfaces were cut on the cad router for application onto the frame of physical model.



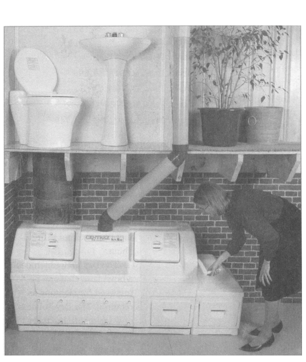
Model shows tin and solar cell application roofing structure. It also shows the wind turbine application for a research building.

Model shows external walk decking and light filter glazing of open window systems.

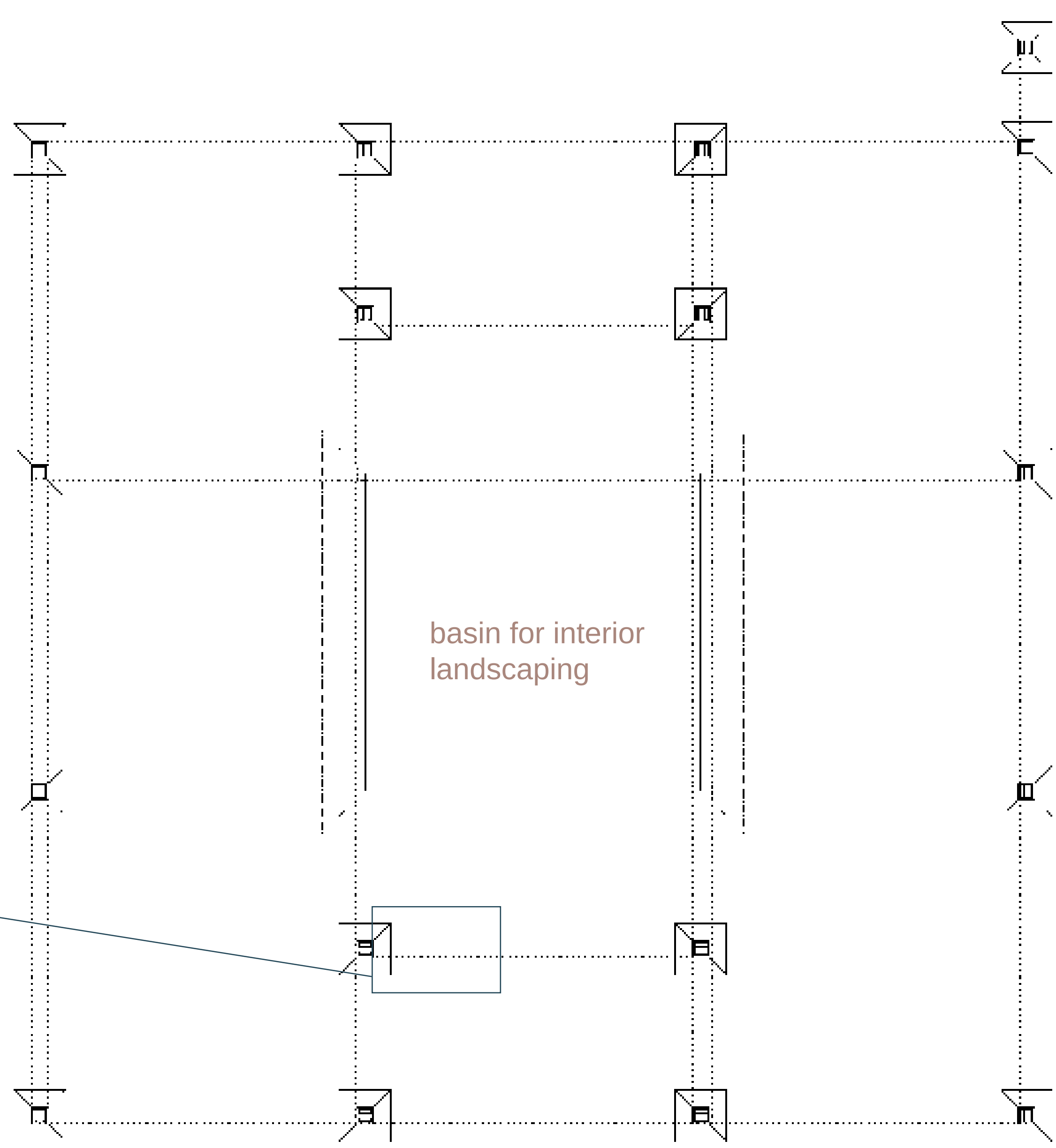


FIRST FLOOR PLAN

(Figure #10)

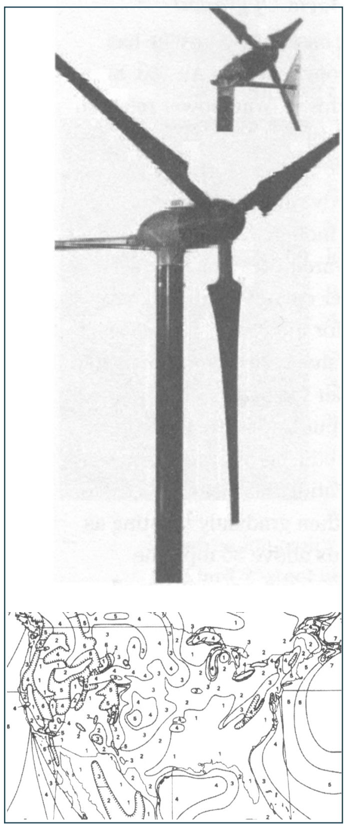


compost below
bathroom chase

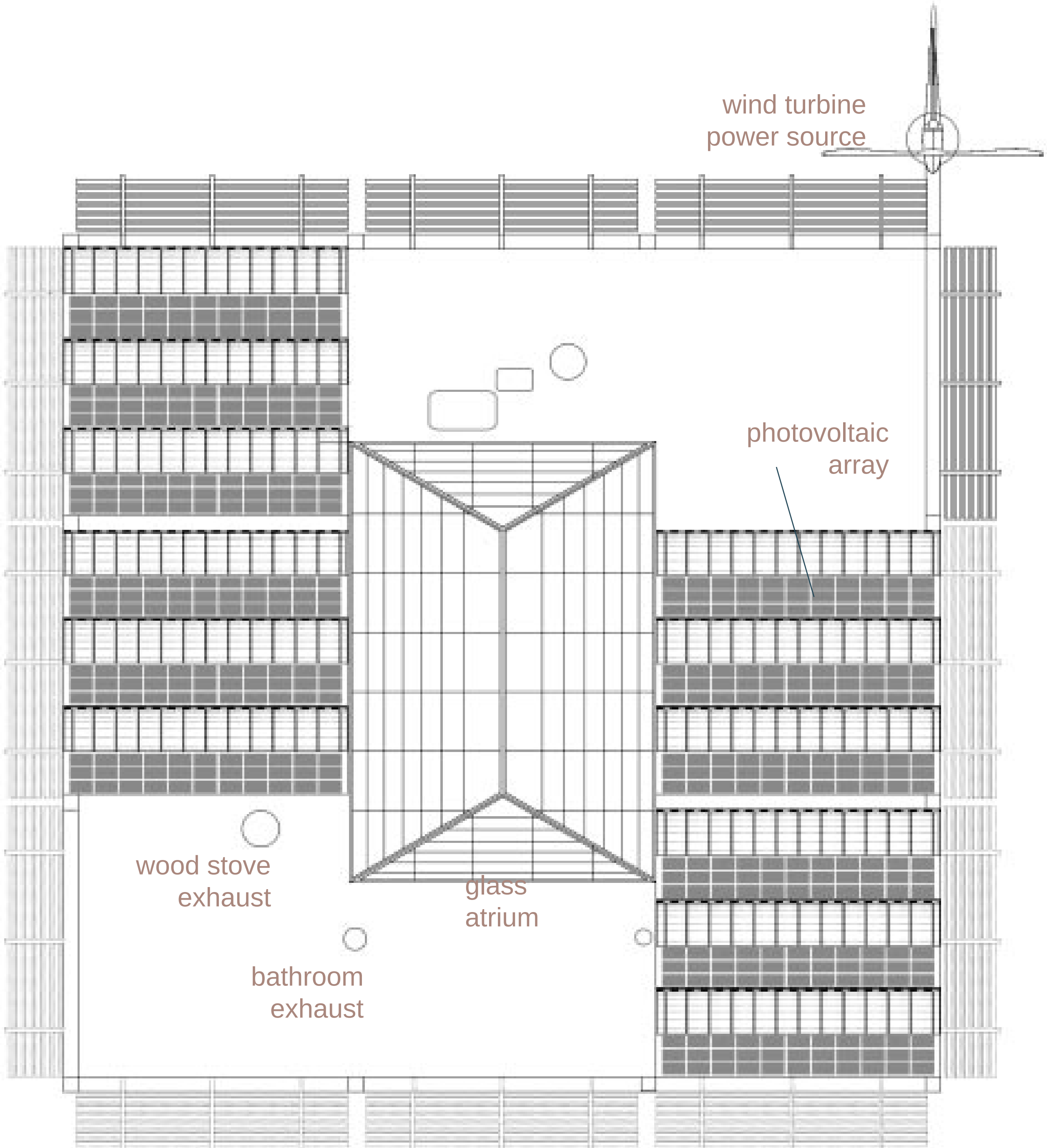


FOUNDATION (footer network layout)

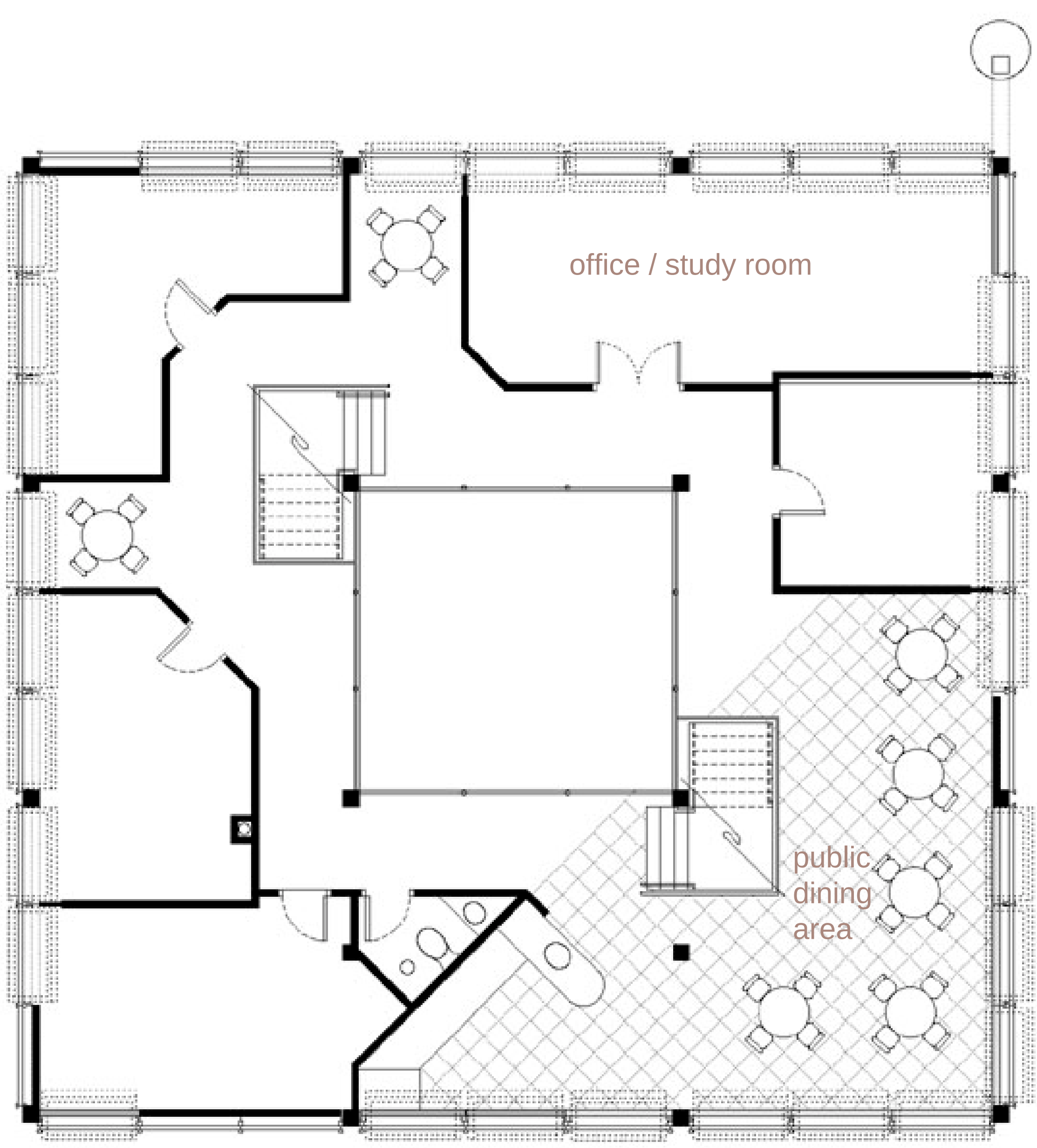
(Figures #11)



wind turbine
power source

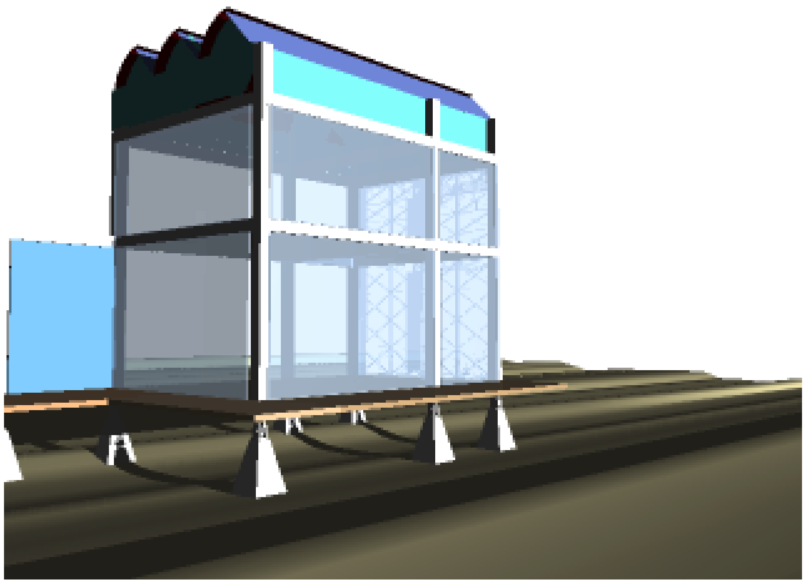


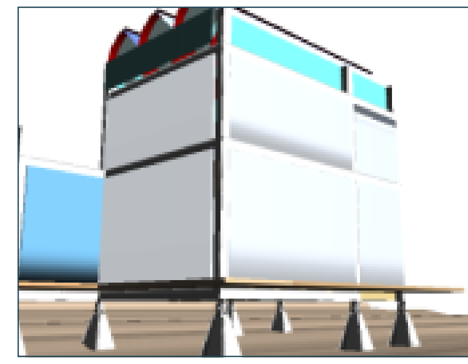
TOP VIEW (Roof Layout)

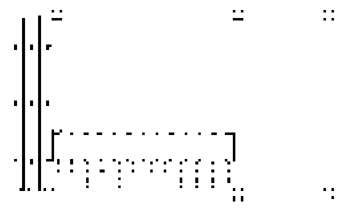


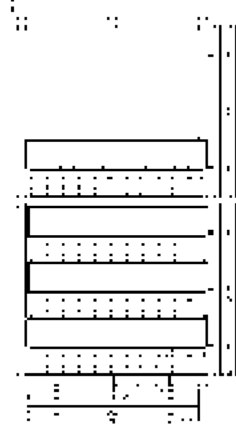
SECOND FLOOR PLAN

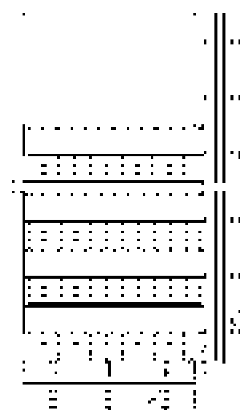
Concept model for research community in the area of environmental design and sustainability study

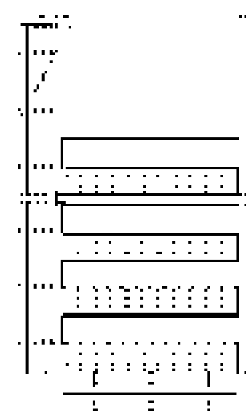


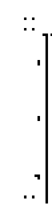


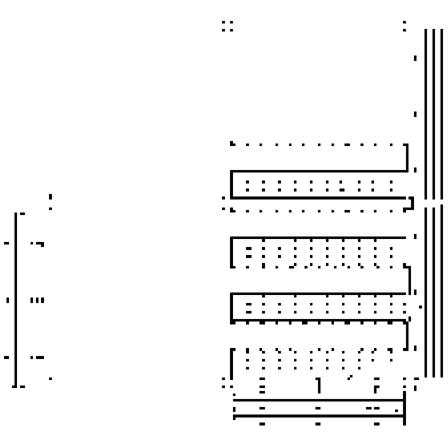


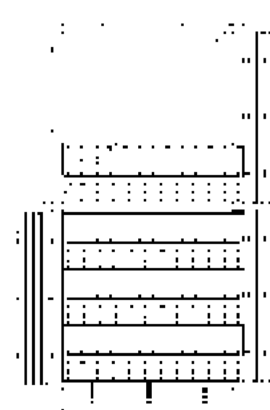


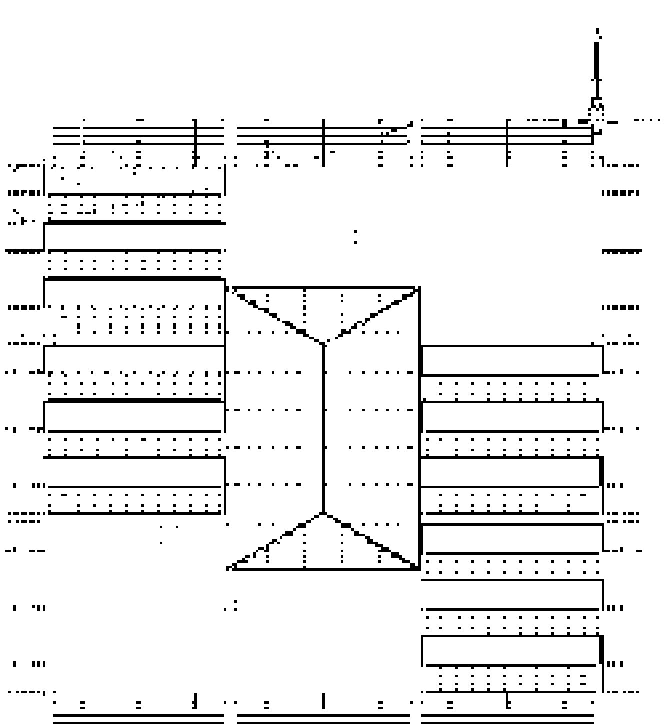


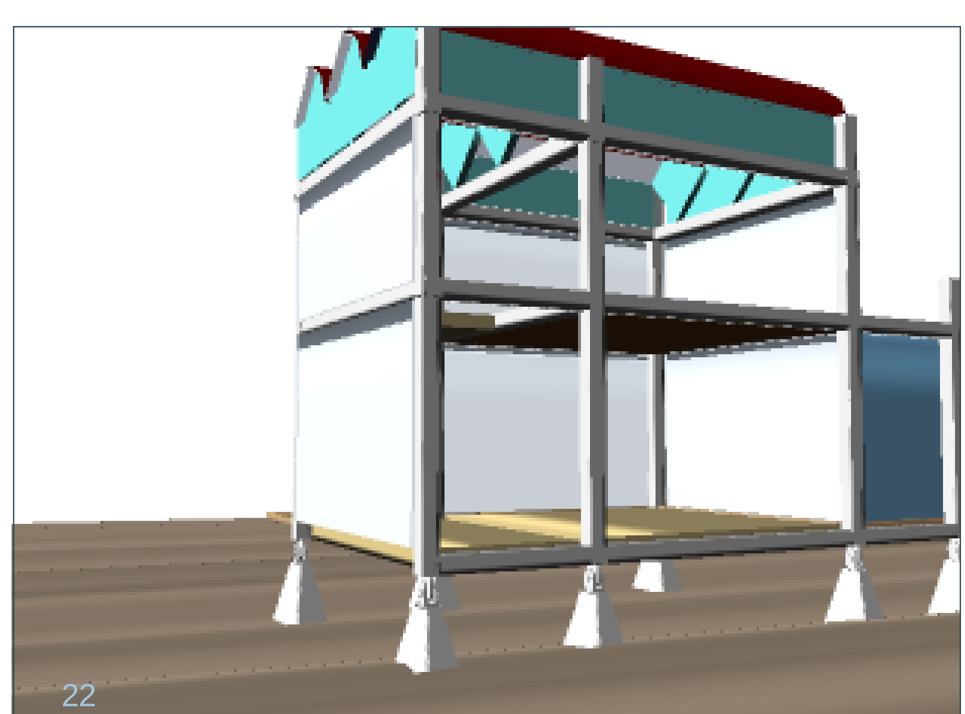


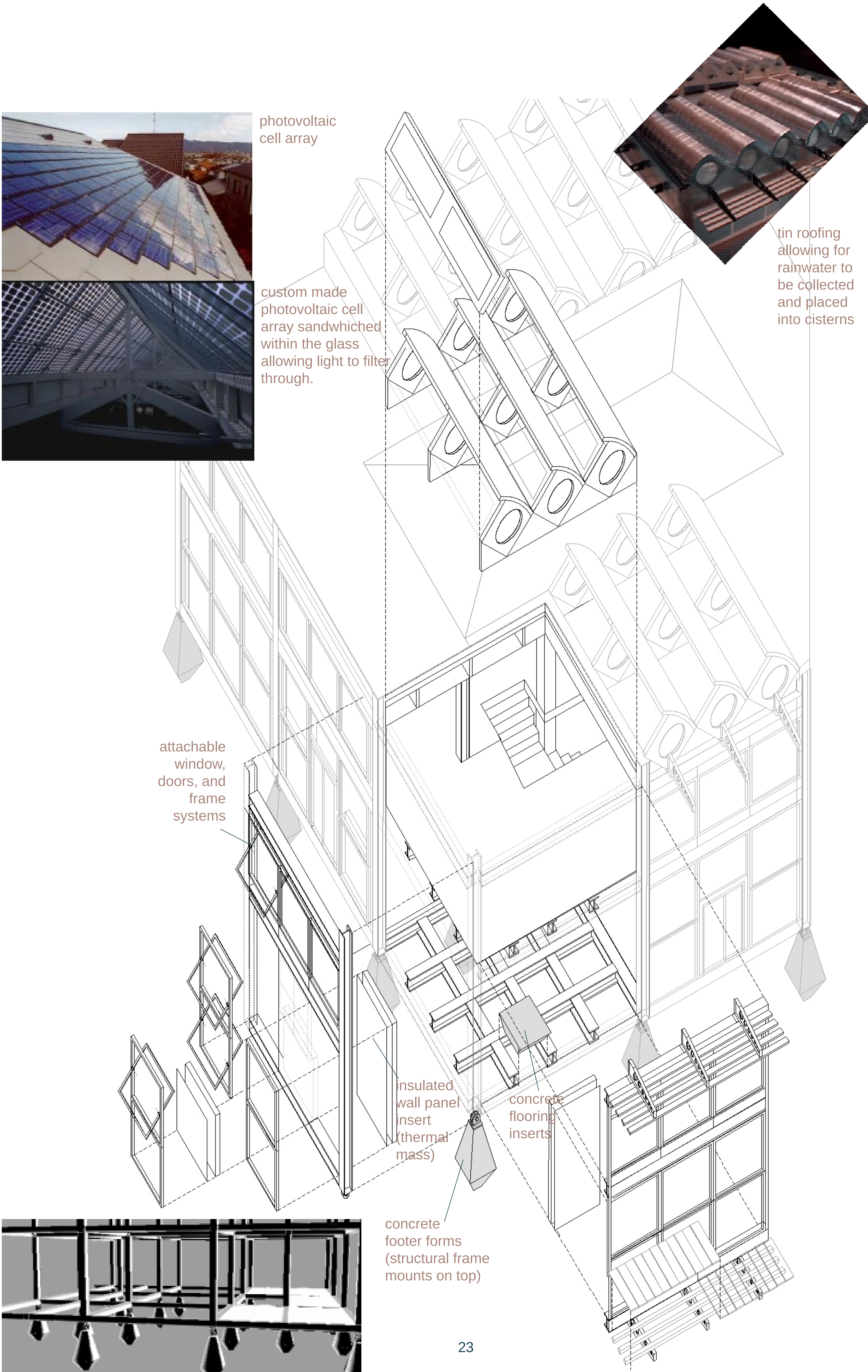











photovoltaic
cell array
custom made
photovoltaic cell
array sandwhiched
within the glass
allowing light to filter
through.
tin roofing
allowing for
rainwater to
be collected
and placed
into cisterns
attachable
window,
doors, and
frame
systems
insulated
wall panel
insert
(thermal
mass)
concrete
flooring
inserts
concrete
footer forms
(structural frame
mounts on top)

III. Environmental Installation Models

The following three models include applications of the modular installation in three separate conditions. Model one represents beach side conditions for temporary applications. Model two represents modular installation in silt and sandy conditions. Model three represents installation in solid rock and soil conditions.

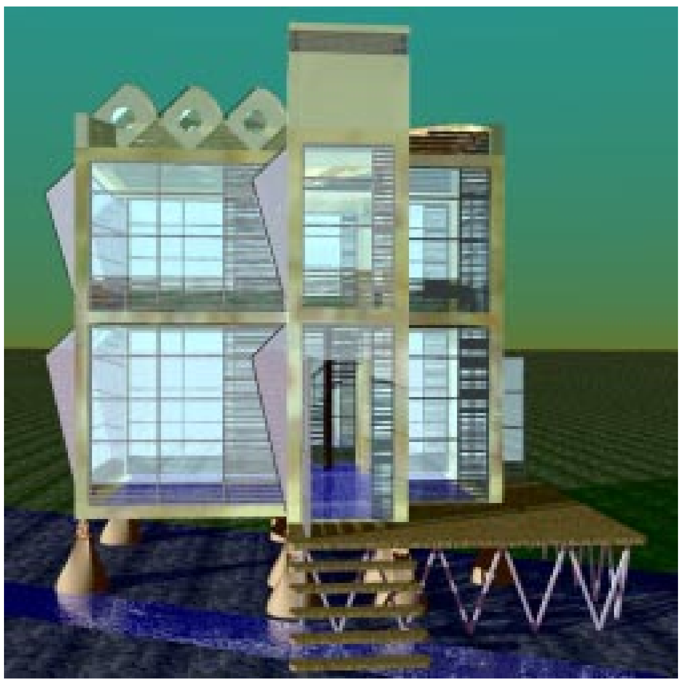
Model 1 (direct gain model)

Light weight thermal barrier wall panels are placed between exterior glass and interior. This regulates the inside from overheating during daytime and releases the warmth during night time. South facing sun angle absorb the intense heat and retains it within the wall mass. These thermal wall panels will have a reflective film between the glass and the beaded panels for ultra violet light protection. There is also a metal canopy over the front entrance blocking any direct sun to over heat the lower level as well.

Model 1

Model 2 (indirect gain model)

Similar to the light weight thermal panels on model 1, these panels are placed between a larger volume of space between the windows and the interior. These panels can also be removed and placed in position as necessary. Introduced, is are tubes of water and air vents within the lower portion of these bay windows. This allows for better heated air and cool air exchange. Bernoulli affect towers on sides draw the warm air from the building if too hot inside the building. The top angular panels could be opaque or clear glass to have solar cells embedded in them.



Model 2

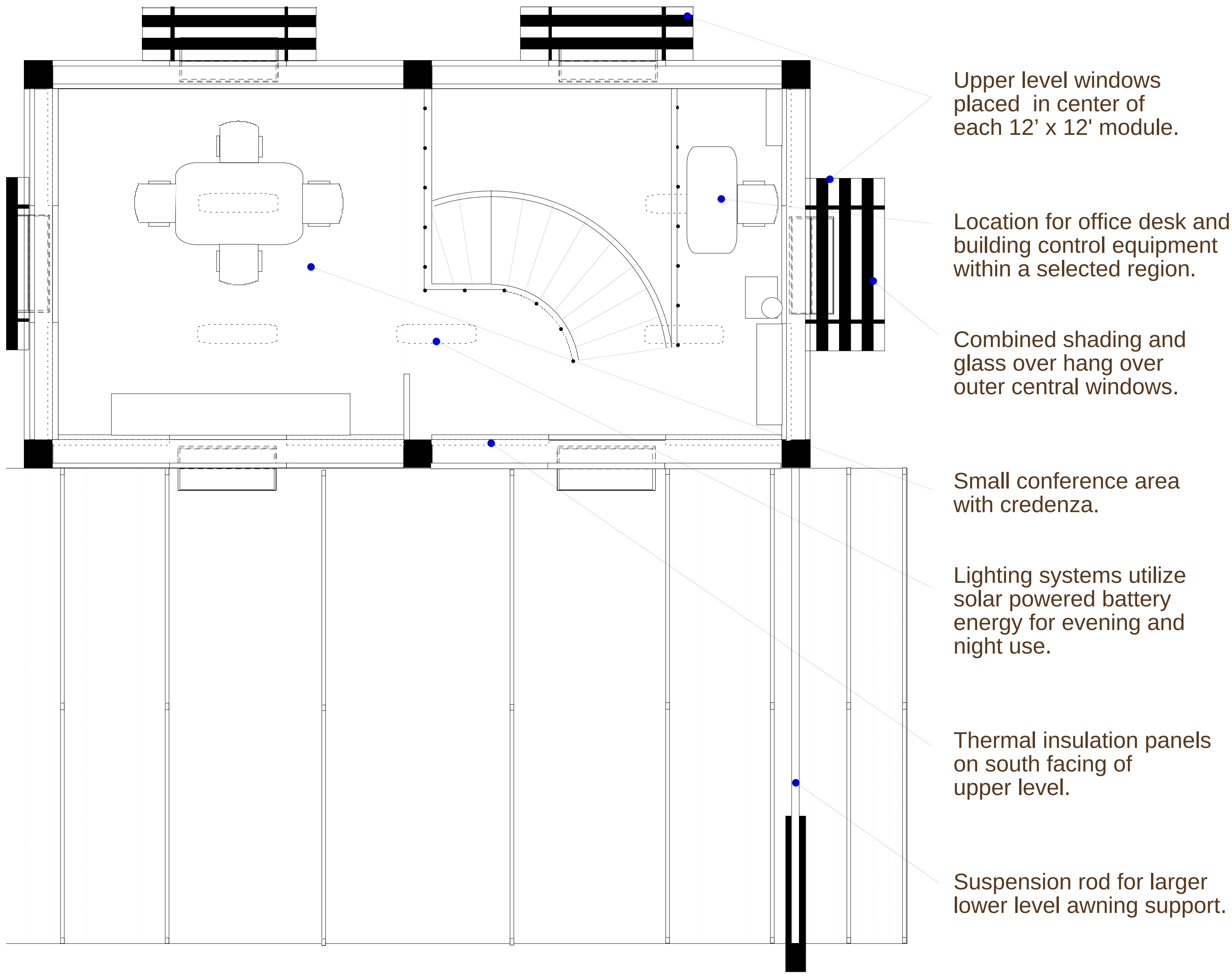
Model 3 (Using exterior light filtration systems)

This model introduces a less intense materials. It could utilize hardwoods or aluminum frames. The exterior of glazing introduces a series of light filer systems by use of louvers set in consecutive order to filter the solar rays.

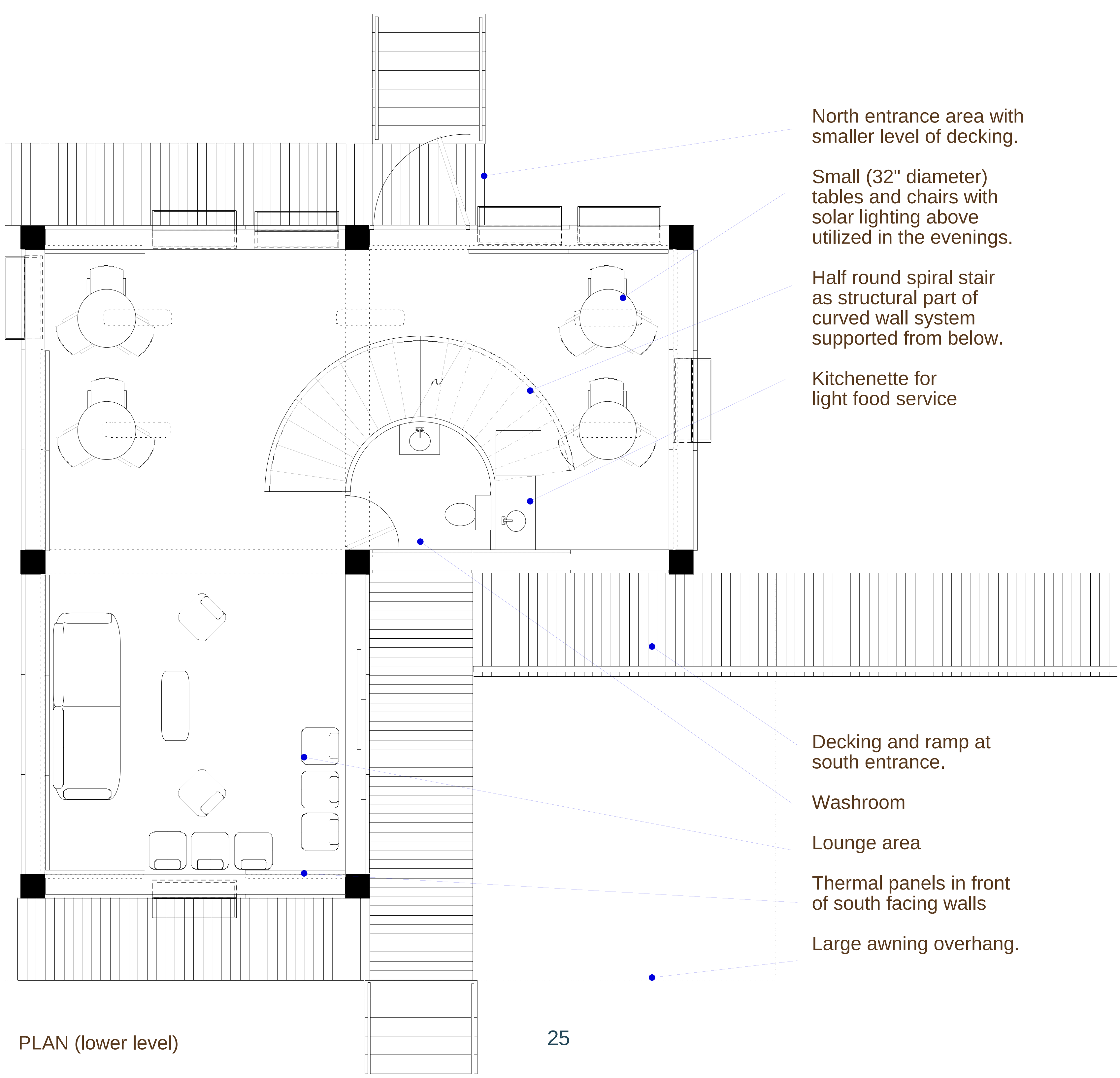
Model 3

All systems utilize same type of base structure with different footer applications for different terrain requirements. They all use the same roof truss system with solar cell application facing south.

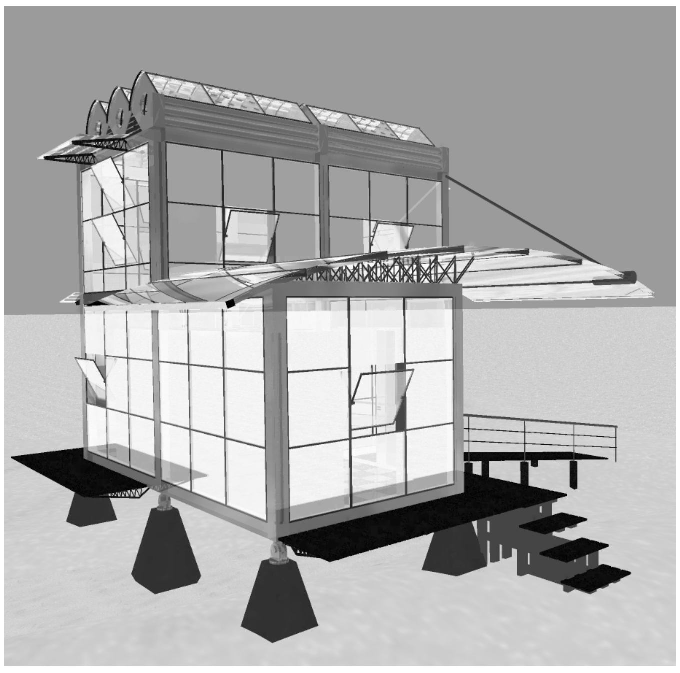
Model 1 (Modular system utilized for sandy beach conditions.)



PLAN (upper level) each open module is 12' x12'

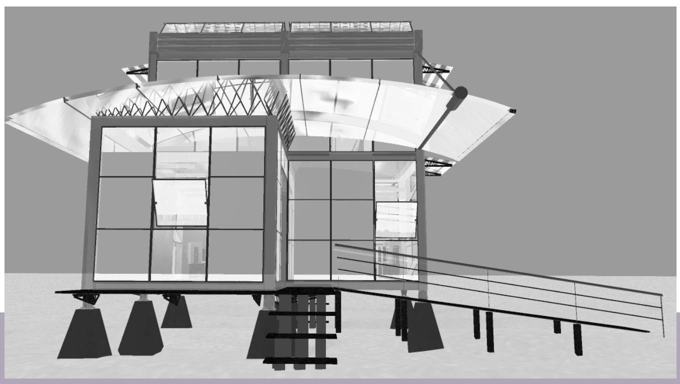


PLAN (lower level)



Model 1 (Exterior Views) Modular building used in beach side conditions

South facing view - illustrative shows south entrance and awning.



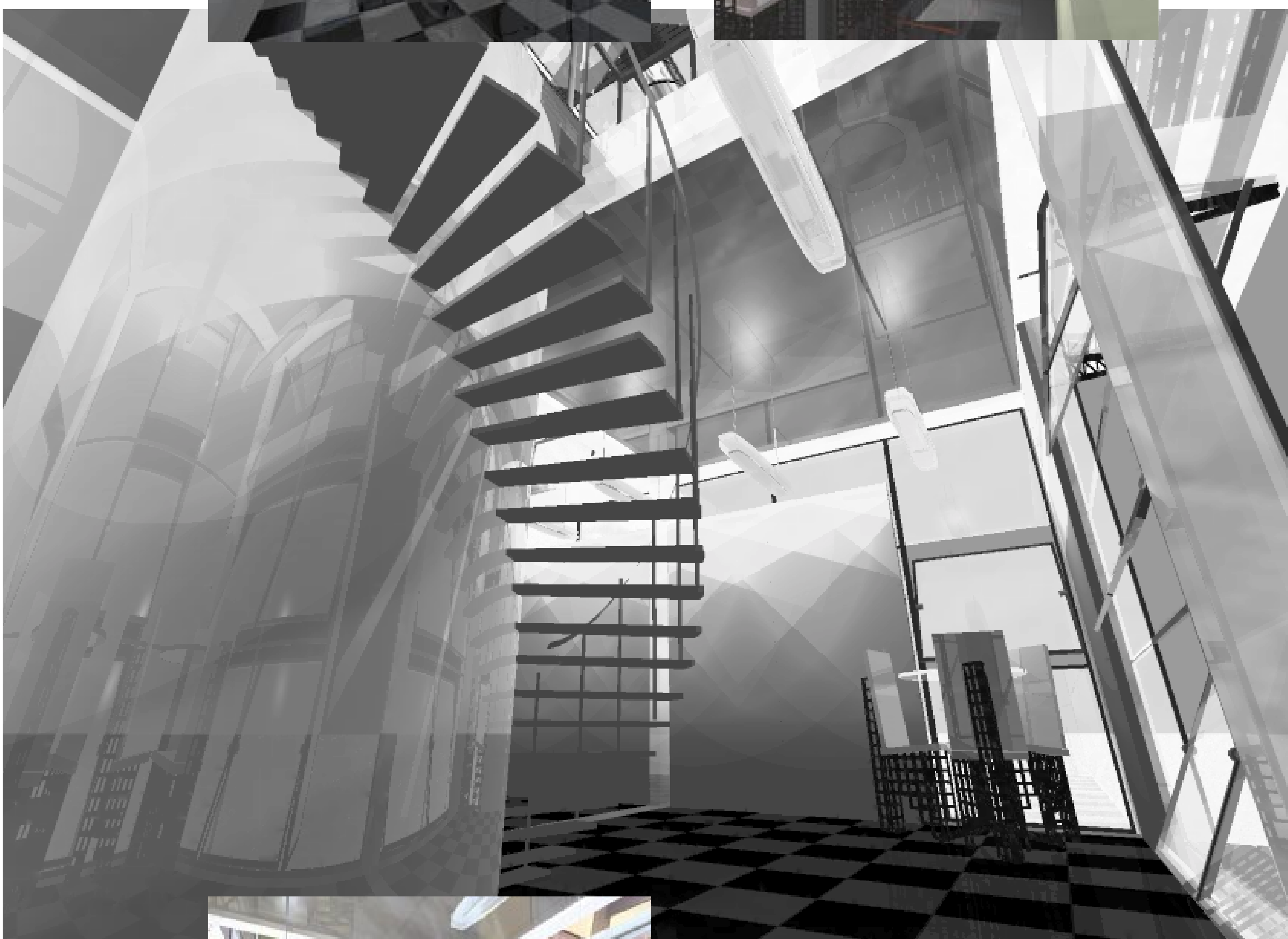
South facing view - shows ramp accessibility and front entrance.

South East facing view - level above awning and south entrance.

North facing view - shows stairs with decking components.

Model 1 (Interior Views) Modular building used in beach side conditions

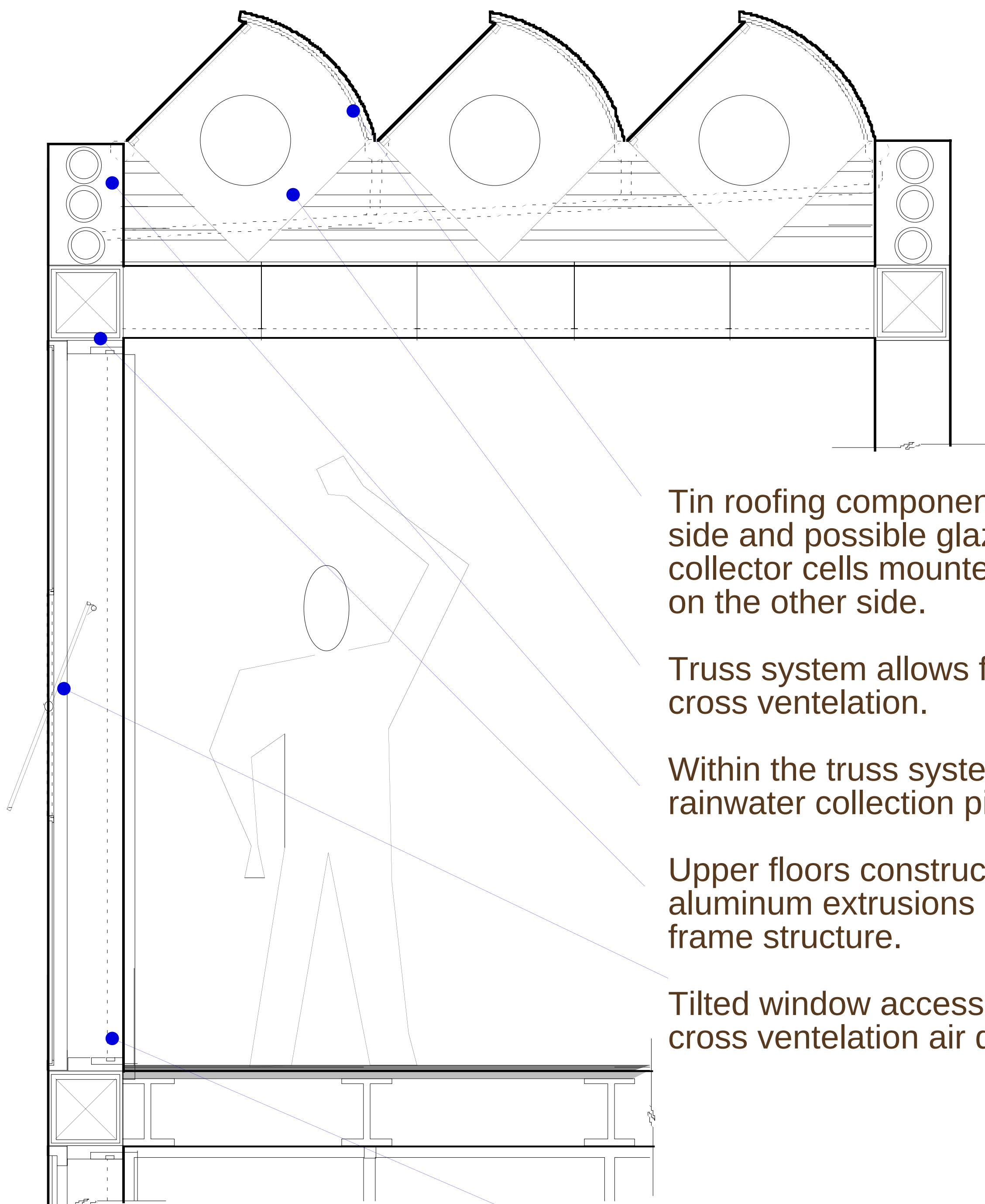
Upper level Conference Area



Lower level half-round stairs and lounge area(Thermal mass panels in front of widow glazing.)

Lower level, south entrance and lounge area

Upper level, office desk area looking out onto thermal wall and conference area.



Tin roofing component on one side and possible glazing or solar collector cells mounted onto glass on the other side.

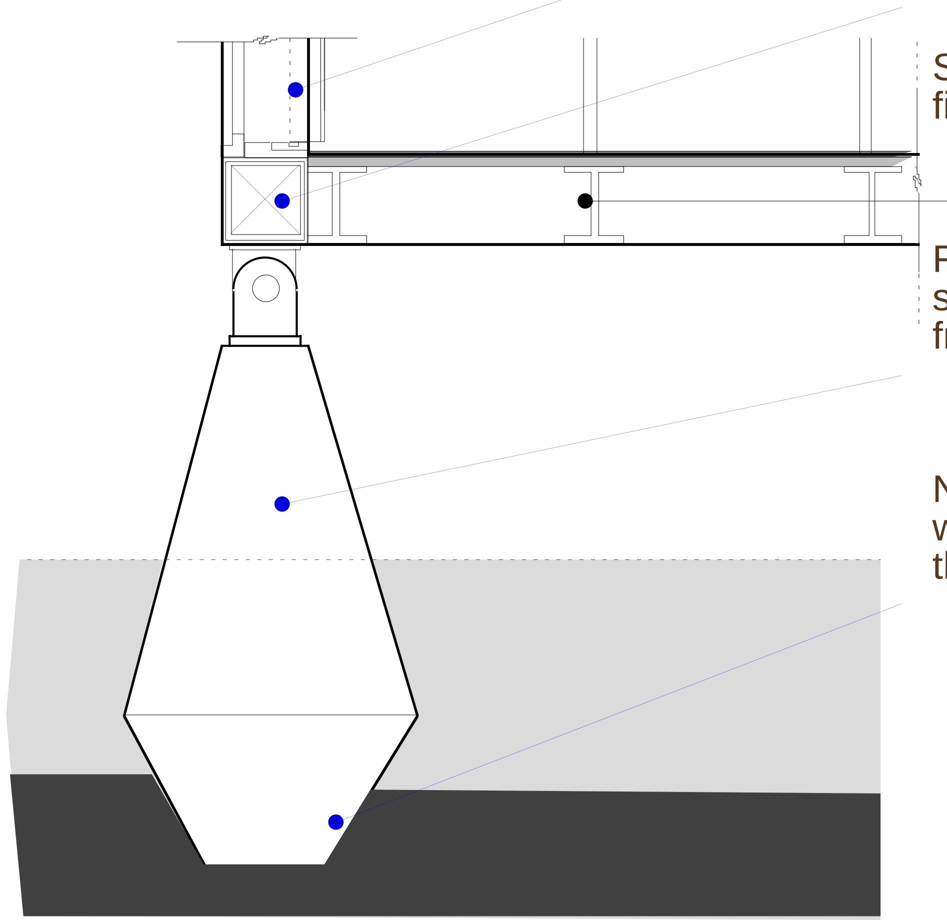
Truss system allows for open cross ventelation.

Within the truss system are located rainwater collection piping networks.

Upper floors constructed of recycled aluminum extrusions and light weight frame structure.

Tilted window access for utilizing cross ventelation air quality.

Thermal insulated panels set on track system for removal and ease of mobility during over heated southern exposure to sun.



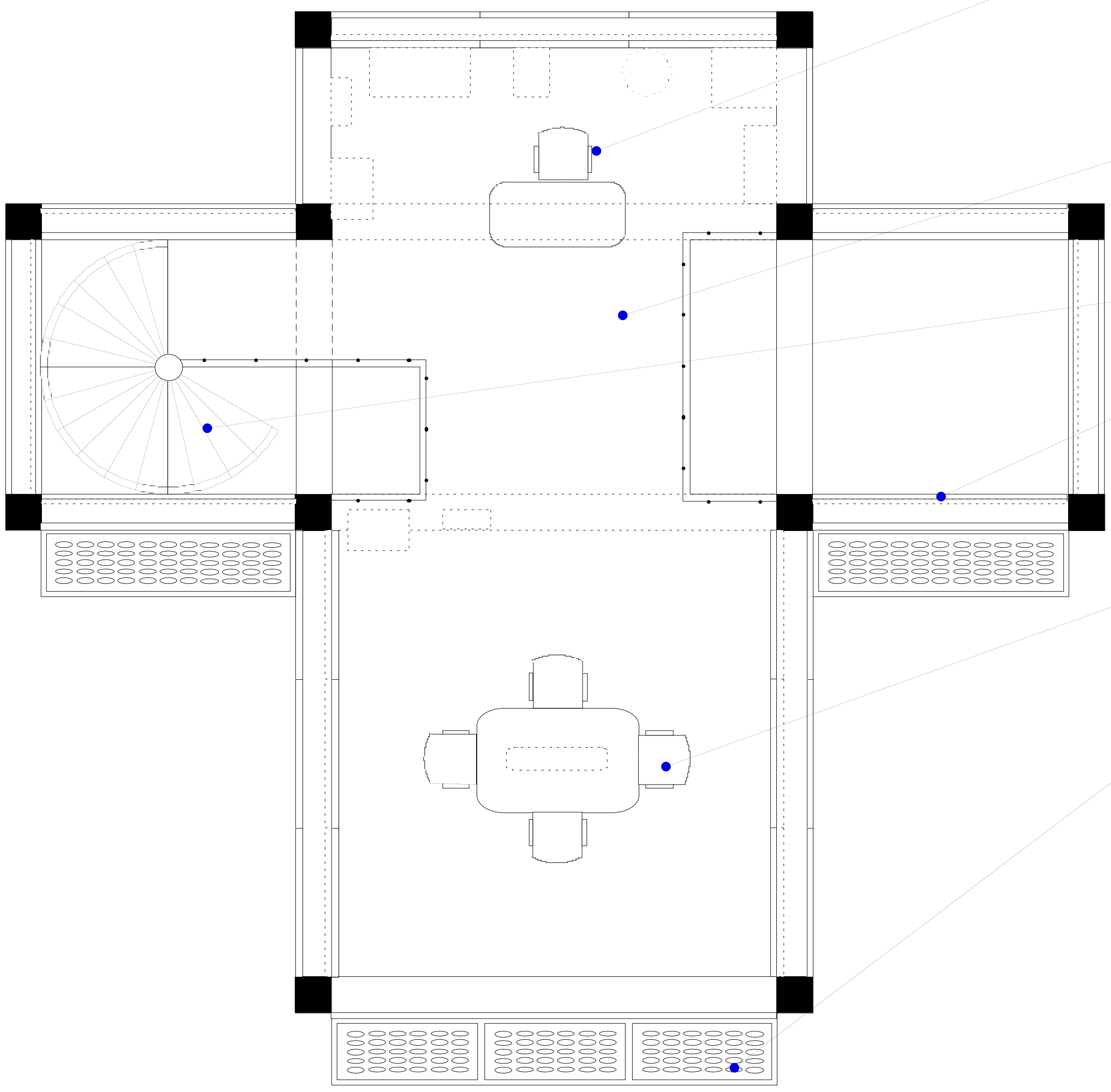
Lower level frame system utilizes recycled steel tubing for stable decking construction.

Secondary decking utilizes fiberglass "I" beams.

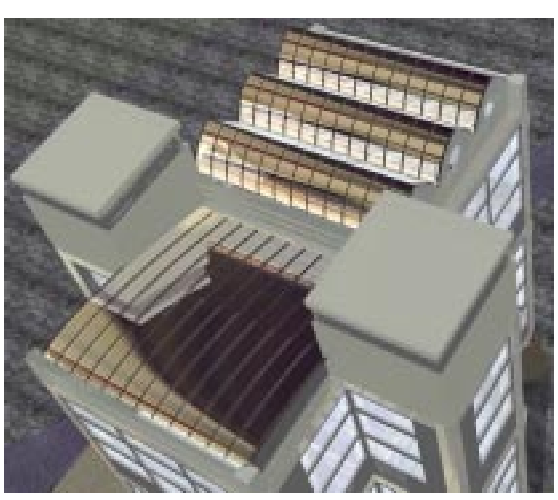
Footer portion is connected by socket & pin joint to the overall frame structure.

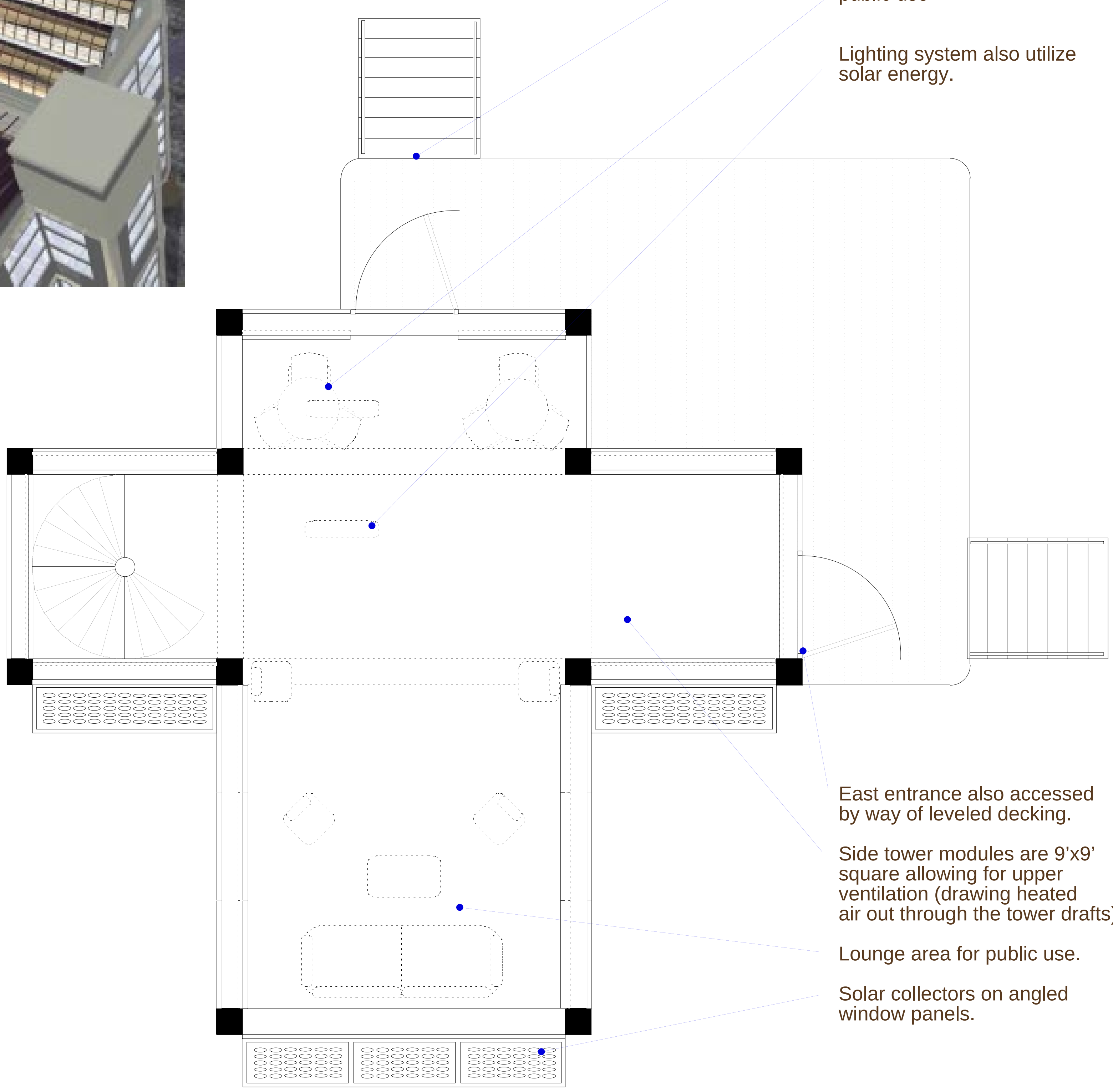
Note concrete footer is resting within solid soil portion and not the silt and sand condition

Model 2 (Modular system utilized for sand, silt and wet conditions)



PLAN (upper level) each open module is 12' x12'

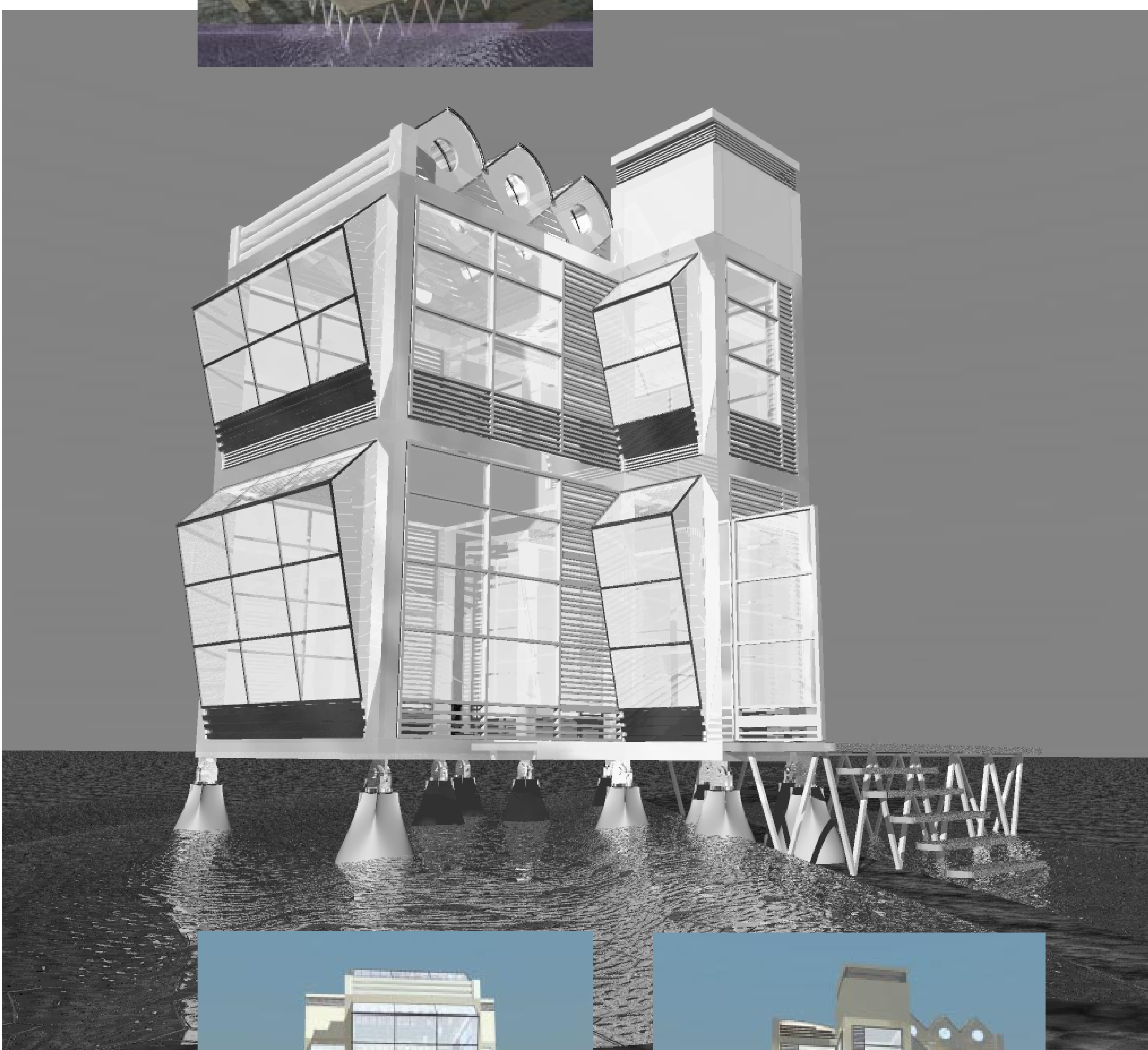




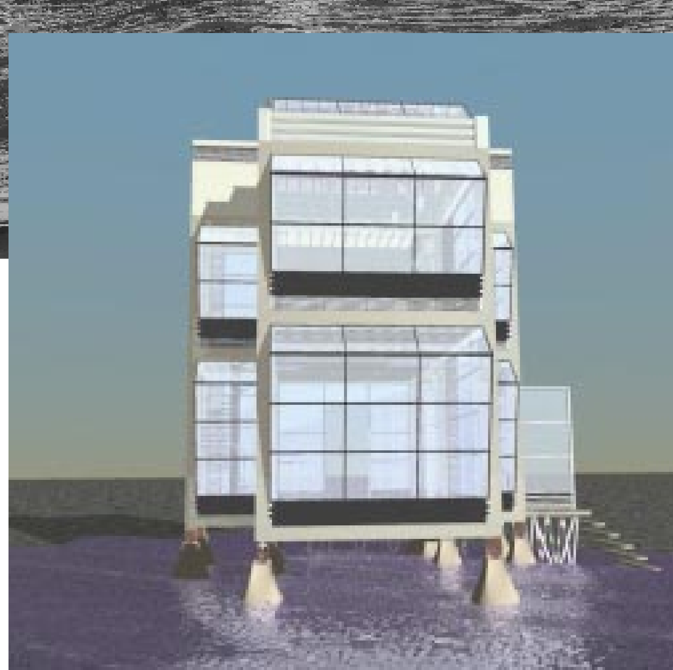
PLAN (lower level)
each open module is 12' x12'

Model 2 (Exterior Views) Modular building used in beach side conditions

North East facing view - shows water line coming into the shore region and north east entrance.



South East facing view - shows the Bernoulli ventilation towers and entrance

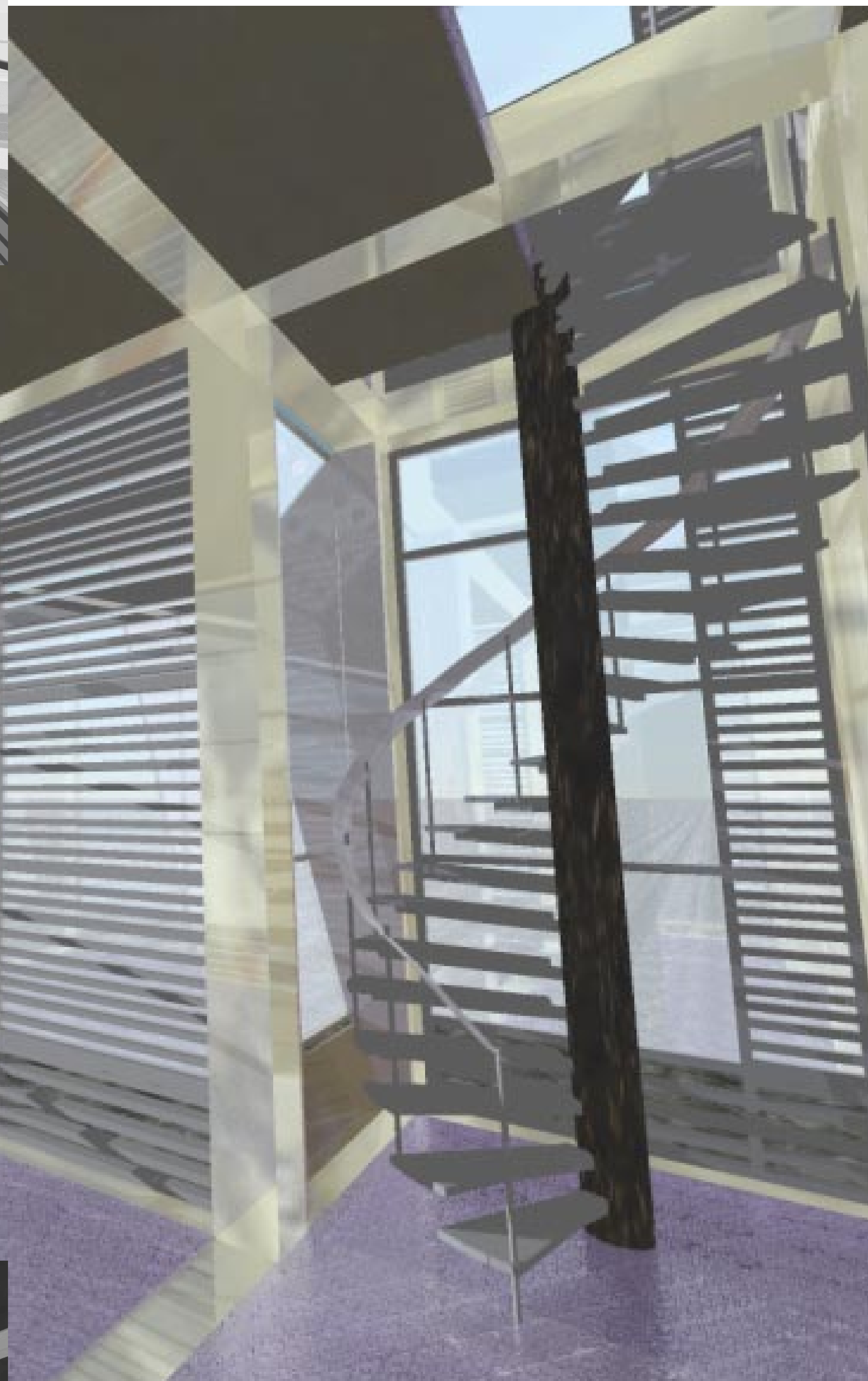


South facing view - shows solar collector bay windows and cross ventilations access below.

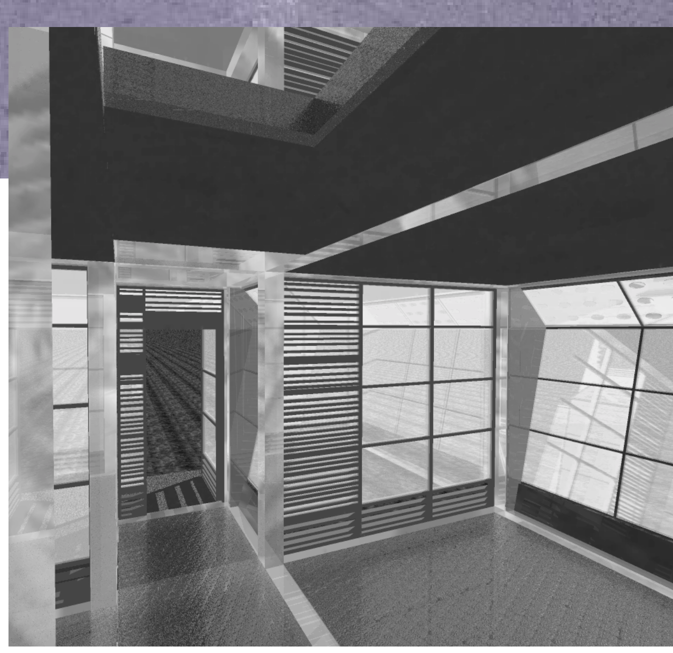
West facing view - shows the Bernoulli ventilation towers and door access opened to the North.

Model 2 (Interior Views) Modular system utilized for sand, silt and wet conditions

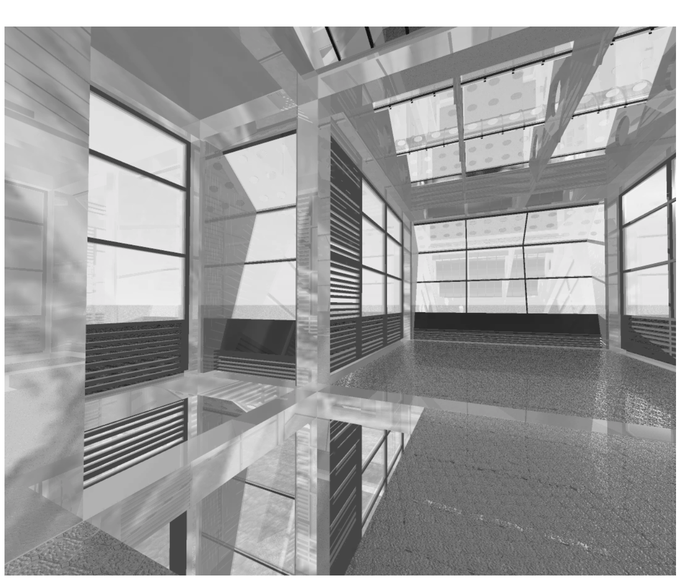
North entrance door way coming into the building.



Spiral stair within the lower level Bernoulli tower region.

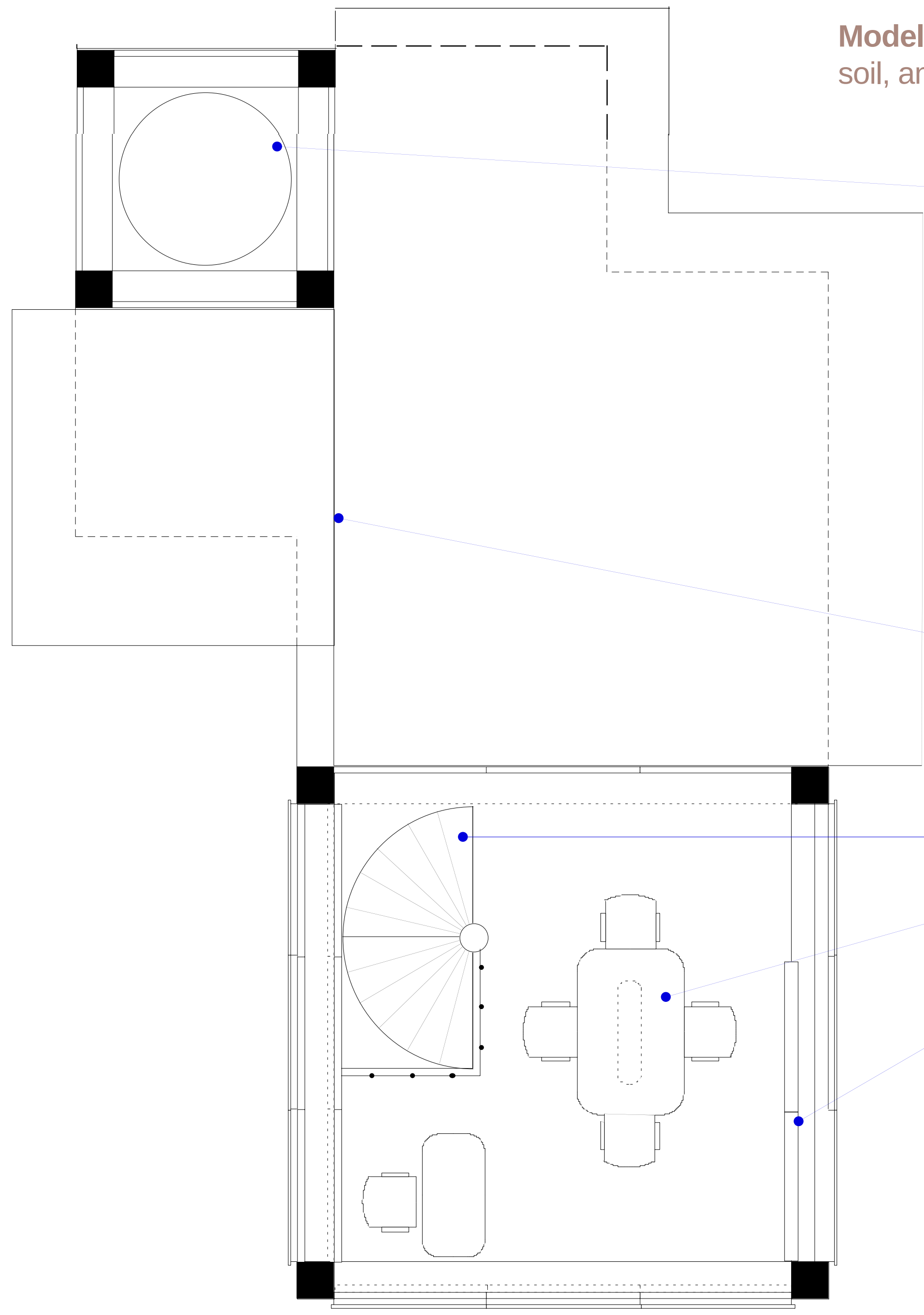


East entrance coming into the building on lower level.



Upper level cross ventilation from below to the upper level along the Bernoulli tower updraft region.

Model 3 (Modular system utilized for solid rock, soil, and grassy condition)



Rainwater cistern collector in rear of building. Sloped roofs have a pitch inward bringing the water drainage to the lower portion of the cistern. Filtered rain water is also collected from above the cistern tank. Water pressure for below is grater when the cistern sits slightly above the building.

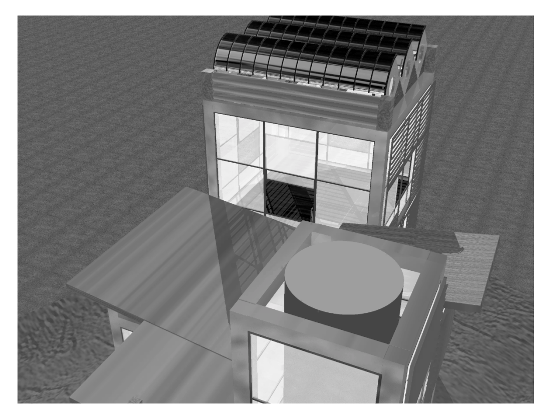
Roof slope to the center for drainage of rainwater collection.

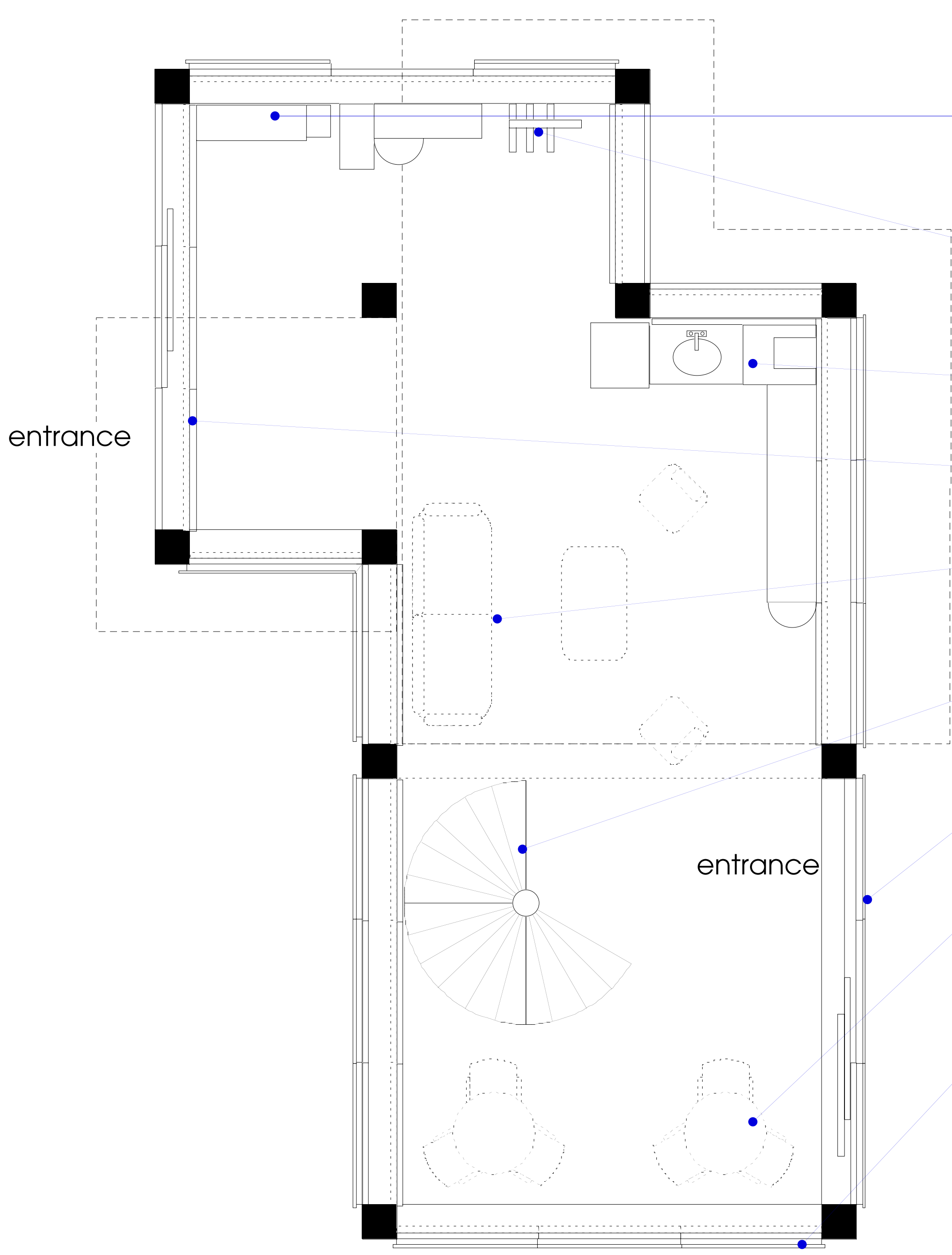
Access to upper level by spiral stairs.

Upper level contains the private conference and small office desk.

Possible use of sliding thermal panels to be utilized in necessary locations.

PLAN (upper level) one 12' x12' module





Below rainwater cistern collector tank is the water controlling system modules

Other reusable energy controlling systems along side.

Kitchenette region

West entrance access

Lounge area

Spiral stair access to upper level

East entrance access

Table and seating area

South facing window panels include light filtration systems made of slated louver type blinds on the outside of building. This controls the extreme direct gain solar rays.

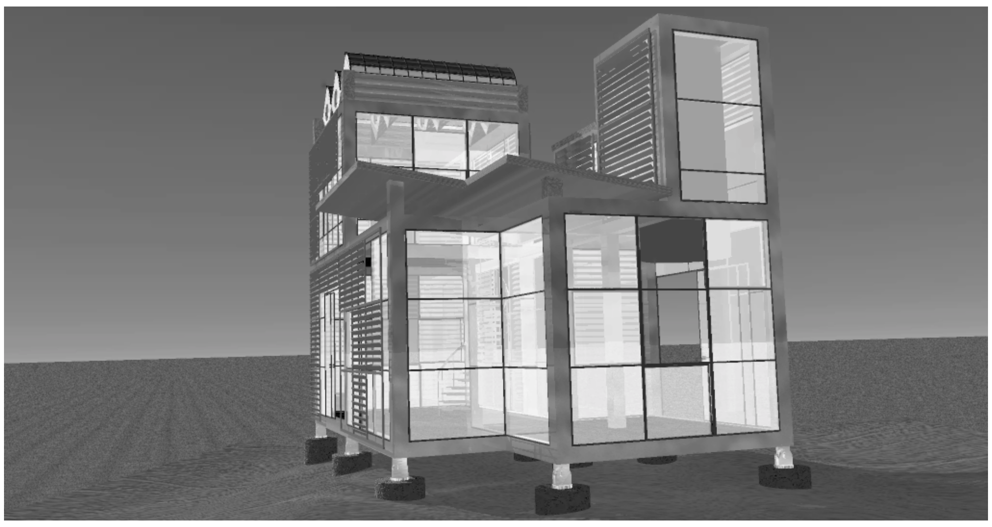
PLAN (upper level) 12' x12' modules interconnecting

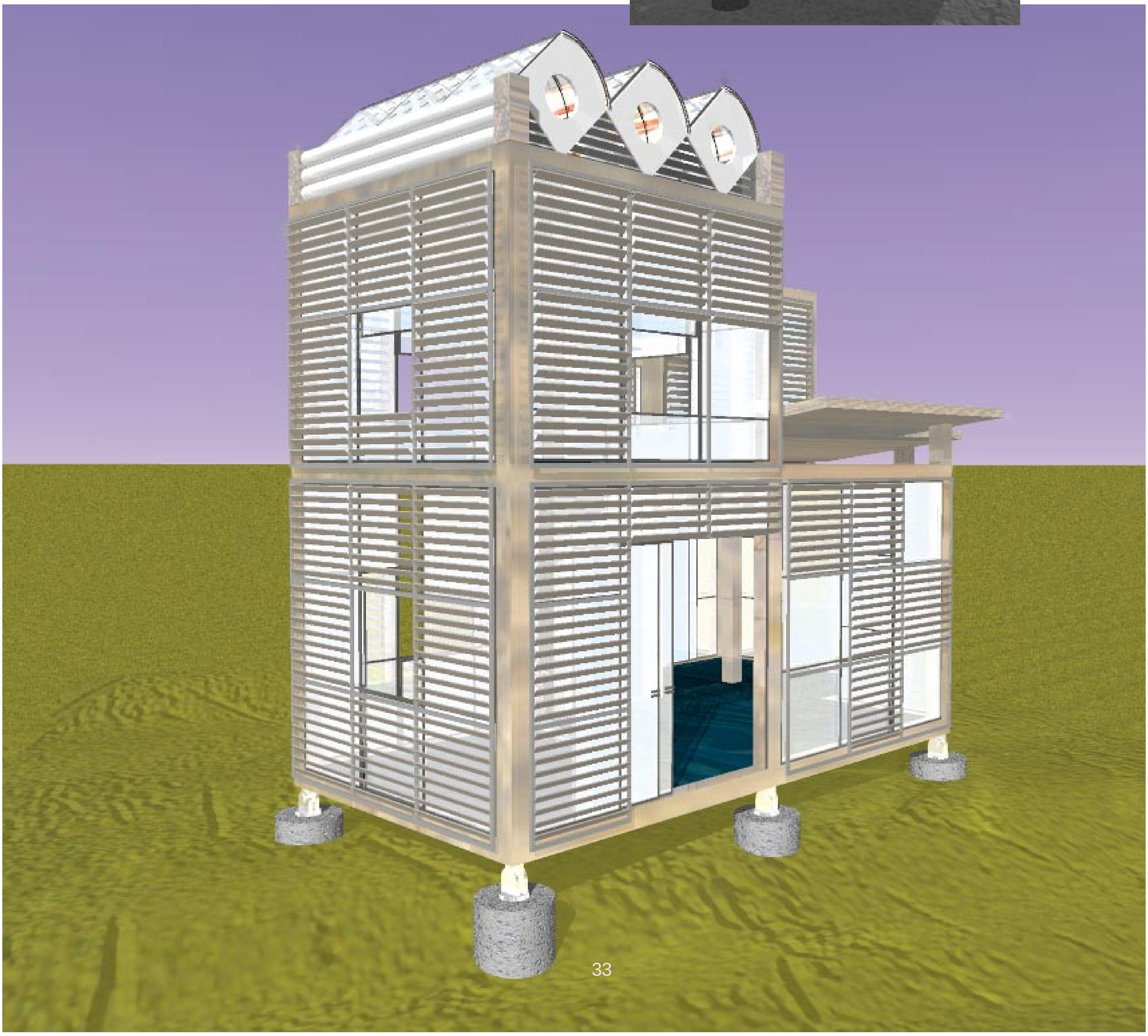
Model 3 (Exterior Views) Modular system utilized for solid rock, soil, and grassy condition.

South west view shows the frame with louver light filteration system built outside the systems frame. Sliding opening windows in center.

Rainwater collection storage cistern shown on north and northwest view.

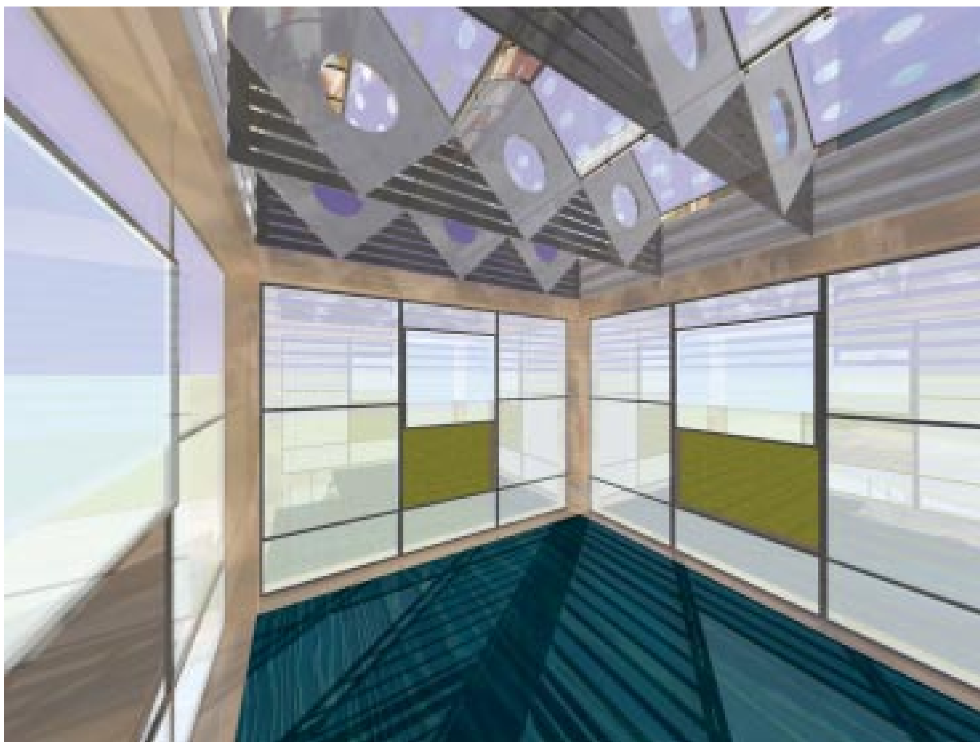
South east and main entrance shown below (color image)



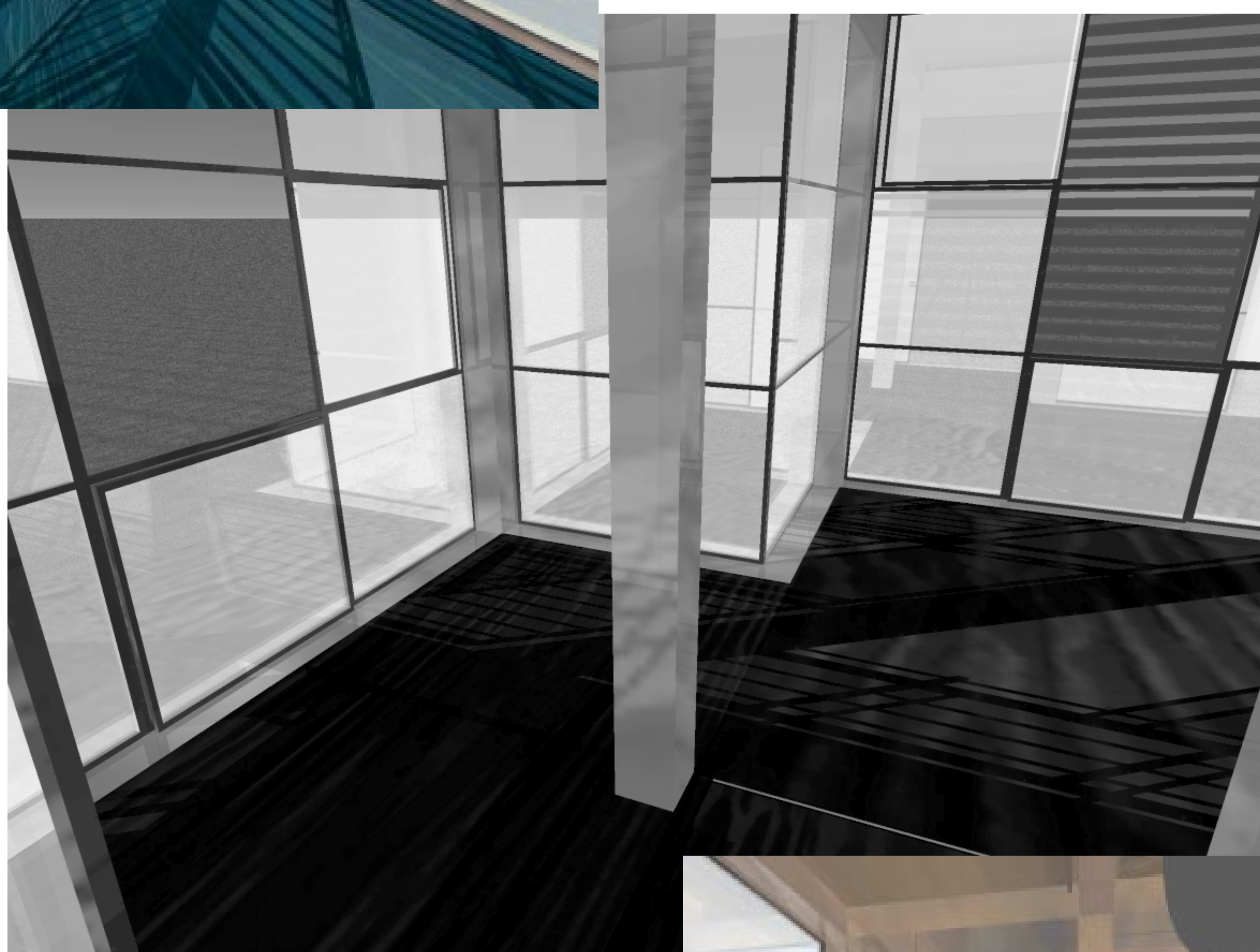


Model 3 (Interior Views) Modular system utilized for solid rock, soil, and grassy condition.

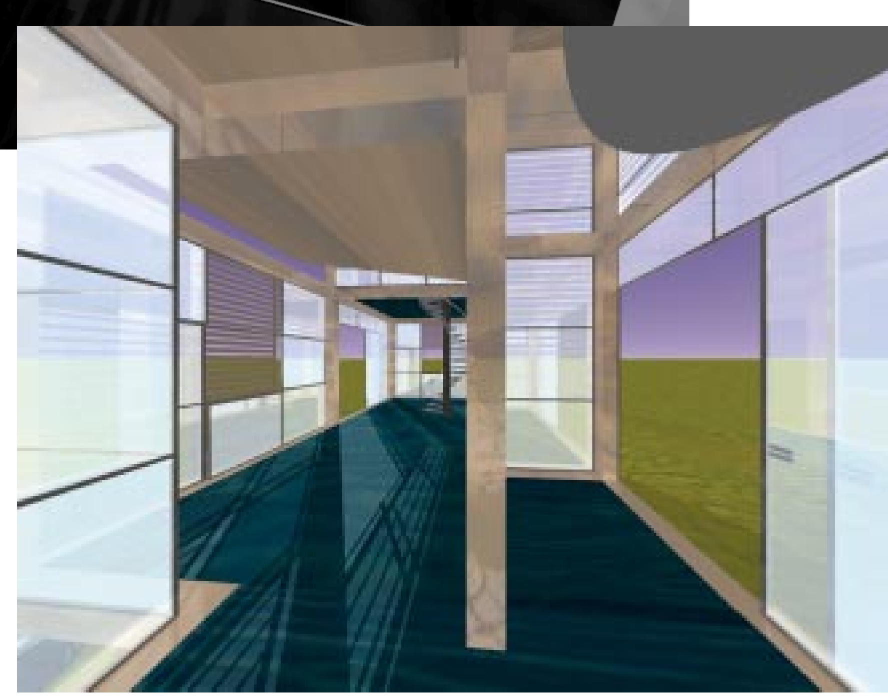
Interior upper level shows solar collector cells attached to roofing truss system. This view also shows the sliding windows and frame structure of upper level.



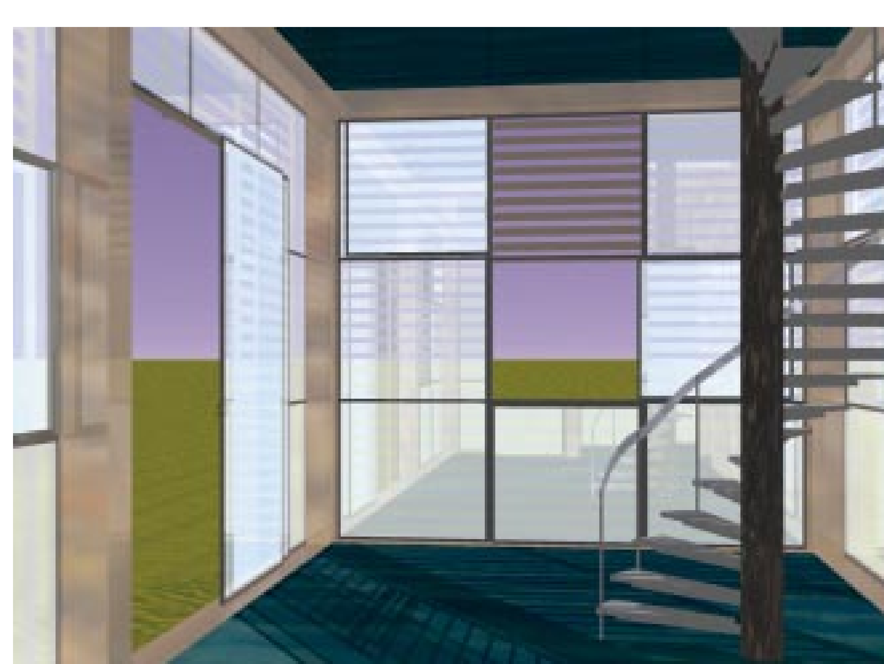
Lower level west entrance will allow for this view and accessibility to the kitchenette area.



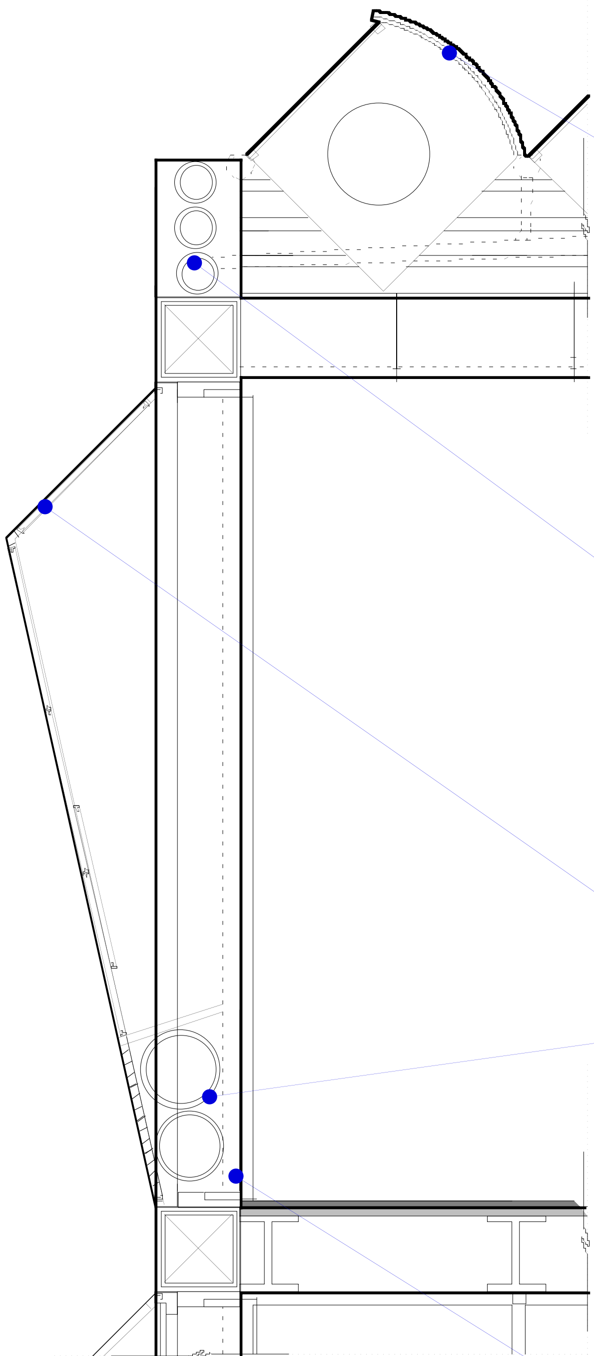
Lower level North west entrance



Lower level South east entrance and spiral stairs to upper level.

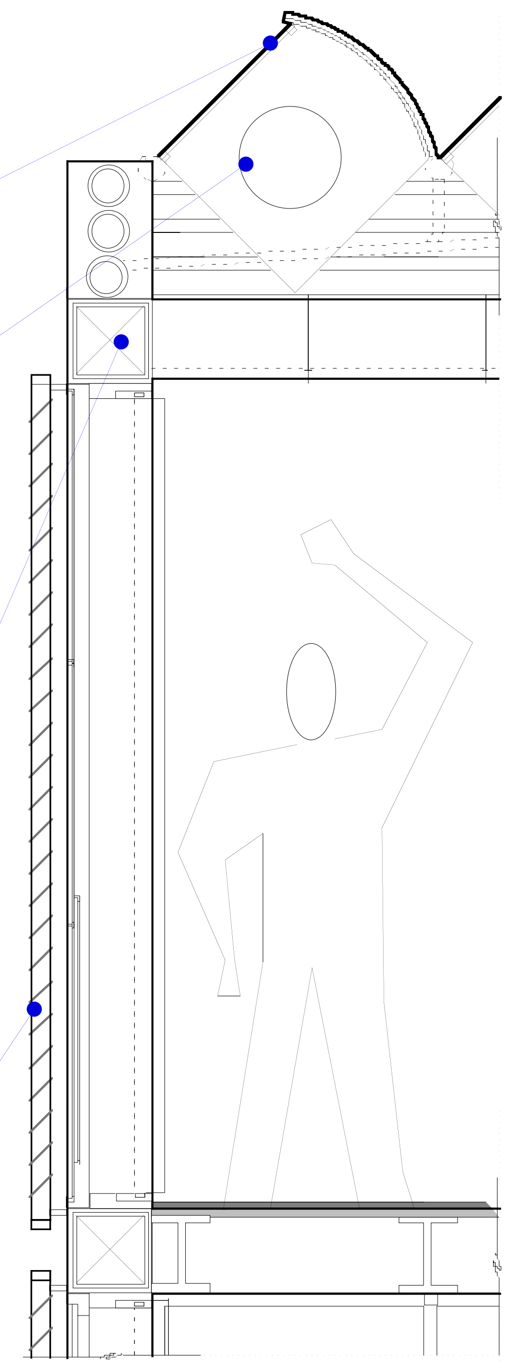


Model 2 Building Frame and Footer Sections



SECTION (Model 2 upper level)

Model 3 Building Frame and Footer Sections



SECTION (Model3 upper level)

Tin roofing component on one side and possible glazing or solar collector cells mounted onto glass on the other side.

Truss system allows for open cross ventilation.

Within the truss system are located rainwater collection piping networks.

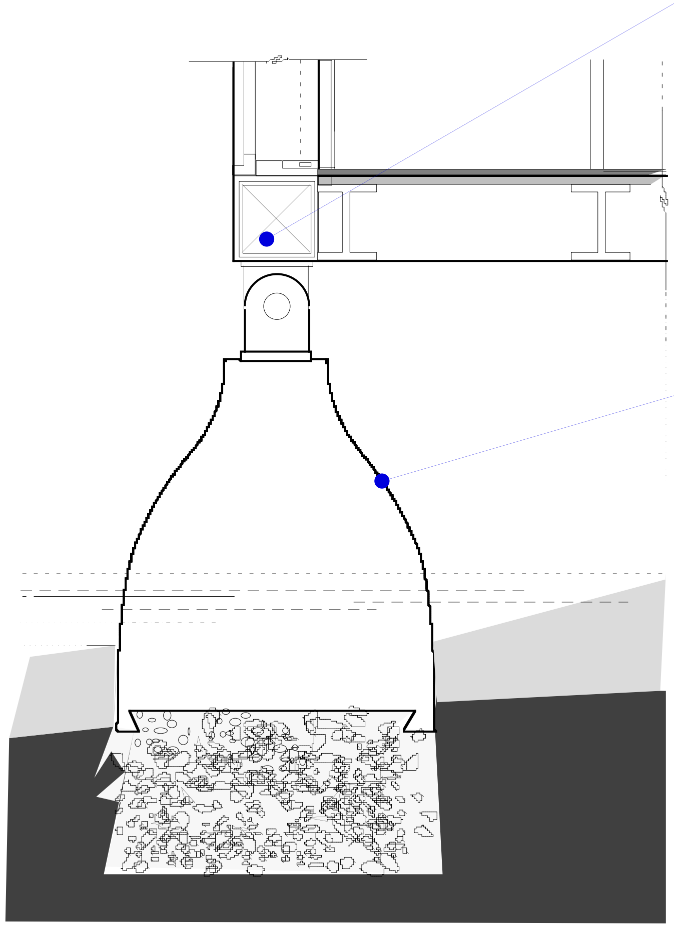
Upper system constructed of recycled aluminum extrusions and light weight frame structure.

Upper portion of window utilizes solar cell collectors

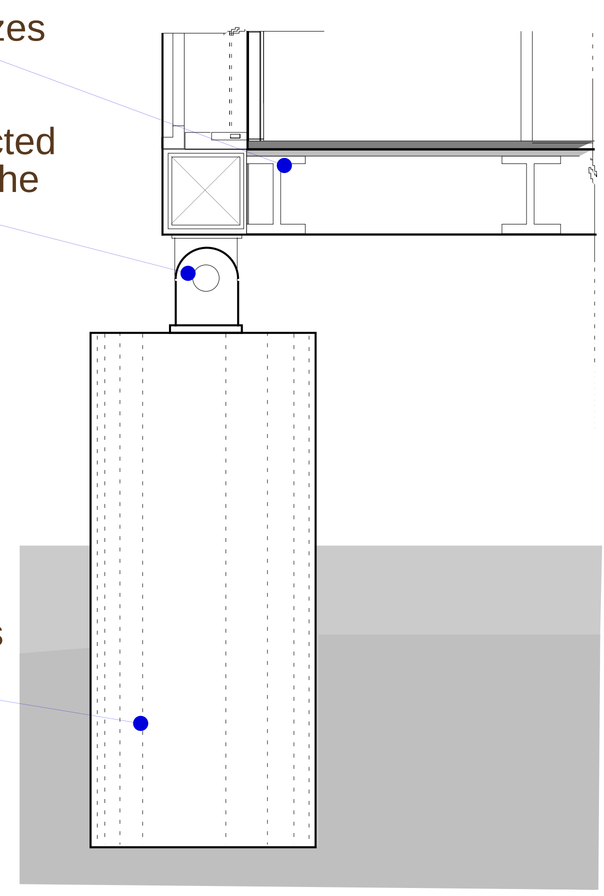
Lower portion has open air volume w/ water cooled piping systems below.

Slats of louvered frame structure is utilized on the outside for control of solar rays filtration.

Thermal insulated panels set on track system for removal and ease of mobility during over heated southern exposure to sun.



SECTION (Model 2 footer)



SECTION (Model3 footer)

Lower level frame system utilizes recycled steel tubing for stable decking construction.

Secondary decking utilizes fiberglass "I" beams.

Footer portion is connected by socket & pin joint to the overall frame structure.

Encased in a durable polyethylene coated concrete form allows for use in aquatic low level water conditions.

Note concrete footer is resting within solid soil portion - this design is applies to soil and grass conditions.

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Isaacs, Ken
How to Build your own Living Structures (1974, Harmony Books/ Crown Publishing New York)

Illustratives and Photos

p.4 (Figure #1)
DNA Sciences -Electron micrograph image by Dr. George Sotos.The Gene Trust (web site) http://www.dna.com

p.6 (Figure #2)
Braun™ Water Kettel WK200/210
(domestic appliance company’s web site) http://www.braun.com

p.14 p.15 (Figure #3)
Lecture on Lessons from nature -Environmental Design & Sustainability (Calatrava’s Kronprinzen Bridge, Berlin)

p.15 (Figure #4)
BP Solar
(BP Solar Amco Group website) www.bpsolar.ocm

p.15 (Figures #5) includes all other images on this page with the exception of #4)
Renewable - Environmental Design & Sustainability course syllabus material-(Virginia Tech State University)

p.16 &17 (Figures #6 &#7)
Photographs (building falling) by Charles Edgar Nash
Map art by C. Bruce Morser
National Geographic Vol.192,No.2 (August1997)

p.17 (Figures #8)
National Geological Survey map- (GIS map and soil sample map was provided by Landscape Architecture Department of Virginia Tech& State University)

p.18 (Figures #9)
Prouve, Jean
Jean Prouve: oeuvre complete 1934-1944

p.20&21 (Figures #10 &11)
Pratt, Doug & Schaeffer,John
compost & wind turbine images (tenth edition of Real Goods Solar Living Source Book)

p.23
photovoltaic cell images
Environmental Design & Sustainability course syllabus material-(Virginia Tech State University)

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