

ABSTRACT

Title of Document: TIME AND FORM:
DESIGNING IN THE FOURTH DIMENSION

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Preservation

The human vision for the built environment is characterized by contradictory ideals. Society values buildings that are able to resist or at least mask the degradation that occurs over time so that they can continue to serve their intended purposes and yet, society also romanticizes the fragmentary and deeply evocative ruin that has been completely surrendered to the weathering effects of the environment. Would it be possible to design continually functioning buildings that make the natural and human forces of change manifest, thus developing a narrative that represents more honestly our own fundamental relationship with time? This thesis will investigate how architecture can serve as a record of change in our surroundings and extend our temporal awareness beyond the present condition. To this aim, interpretation center that addresses sea level rise will serve as a testing ground.

TIME AND FORM: DESIGNING IN THE FOURTH DIMENSION

By

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Chapter 1: Relating time and form

The aesthetic character of architecture is strongly influenced by the human understanding of the passage of time. Built form is an expression of our rituals, work, and movements in space and therefore they are already in some way physical manifestations of our path through time. However, for us to have an awareness of that phenomenon, our architecture needs to be grounded in reality and bear the traces of our actions and the actions of nature. On this point, today's architecture is divided. On one hand there is a trend towards sleek, seemingly faultless surfaces that abstract the built form and focus on an idealized spatial experience. On the other, especially in America, our desire for an identity embedded in history leads us to romanticize the marks of time that result from weathering and at times even fake those effects. Regardless of which is more desirable, buildings are inevitably changed by time and we have a choice to either mask and deny that

or design for those changes and embrace them. This thesis is concerned with the latter because of the key role that architecture plays in orienting us within the here and now as well as within a grander narrative of events.

While the investigation is related to issues of sustainability, conservation, and climate change, it is outside of the scope of this thesis to make judgments on current attitudes towards the environment or to make efforts to reverse or minimize the effects of climate change. The assumption here is simply that change is occurring and we should recognize and adapt to it.

This document will begin with a description and analysis of the conceptual framework that this investigation will use as a starting point. Then selected precedents that clarify some of these concepts will be studied and followed by a section on the principles and techniques derived from the readings and precedents. From there, the description and analysis of the

chosen site for the proposal will be discussed leading to the selection of a program. Once the program requirements have been outlined and arranged, three different parts for the proposed building will be introduced.

How we perceive time

Before an architecture that narrates the passage of time can be discussed, it is important to understand how people perceive the passage of time. The perception of time is unique among our senses if it can even be considered to belong to them because it cannot be directly perceived. It must be derived from the other senses and reconstructed by the brain.

However abstract a concept it may seem, human beings are programmed with an inherent awareness of time based on our circadian rhythms. The temporal qualities of our stimuli also have an impact on our sense of aesthetics, such as in the case of music.

Because architecture is often referred to as

frozen music and judged on the quality of the procession, that our appreciation of architecture is largely based on its temporal qualities would not be a farfetched assumption.

Philosophers have long struggled with the seeming immediacy of our sense of time and this inability to directly perceive it, but a discussion of this struggle is too lengthy and perplexing for the purposes of this investigation. In general though, it can be said that we are able to recognize persistence, succession, and change.

Edmund Husserl, the philosopher and mathematician who founded the philosophical school of phenomenology, argues that our temporal awareness is not only aimed at retention of past events but is “protentive,” or anticipatory, as well¹. We do not observe changes or movements without making predictions about what will happen next even if they are unconscious. The most obvious example would be how one anticipates the

trajectory of a ball during a game of catch and not always accurately. The same is true of our observations about built form. Cracks and warping are signs not only of the forces and loads acting upon a building but the signs of an eventual structural failure as well.

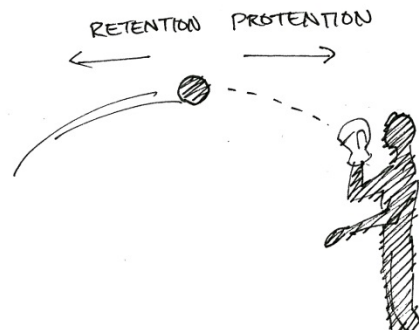


Figure 1 - projection of the movement of objects
Source: author

Another interesting point that Husserl brings up is that our retentions and protentions do not just relate to a change in the object itself but also to our perspective, that is, new discoveries that will arise as we view an object from different angles². Therefore the thought processes that necessarily take place in time and our understanding of spatial concepts combine to form our temporal awareness in which we are both projecting ourselves and the objects that we observe back and forth through space. This fluid temporal aspect of our perception of any phenomenon is reflected in many forms of art such as cubism and futurism.

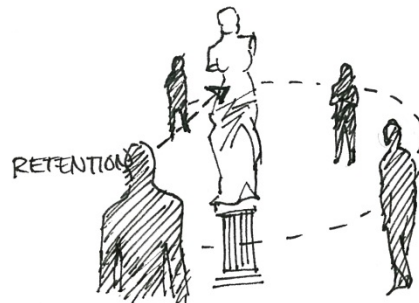


Figure 2 - the anticipation of viewing an object from different angles
Source: author

However, in order for this temporal awareness to function Husserl also states that we must be able to identify the current object of our perception as the same object we were observing moments ago.³ Of course, there is no absolute way to prove such a thing, but generally if we are observing an object continuously or if it retains certain traits from the point at which we originally observed it, we accept it to be the same. This leads me to believe that in the case of architecture narrating a long term event or transformation, some elements must remain generally the same and be recognizable in order to serve as a datum and in order to preserve the identity of the building.



Figure 3 - the need for an object to retain certain features in order to be recognized as having changed
Source: author

Cultural conceptions of time and aging

This investigation concerns itself not only with **how** a building might record a narrative of the past and future, but also with how the physical result will be received in an aesthetic and

ethical sense. In today's world, our thoughts on the passage of time and our thoughts on human historical events tend to be one and the same. Therefore whether we view aging or newness positively or negatively is dependent on how we view historical events. For example, during the Romantic period in the early 1800's, the rationalism of the Enlightenment and the dehumanizing aspects of the Industrial Revolution led many artists and philosophers to look to the ancient past for the answer to a harmonious relationship between man and nature. At any point in history, this view is shifting but it may be helpful to discuss a more recent stance, modernism, which has stronger implications for our current point of view.

The Modern Movement

One of the most obvious commonalities among the early modernist buildings is the most superficial: the vast majority of them are white. Not only are they white, but they are also smooth and flat without any of the articulations

that would collect dirt and grime. This is meant to represent a new and untainted ideal and yet it is impossible for these surfaces to remain in this state indefinitely. The thin layer of paint peels and stains appear meaning that they require constant maintenance. In the book "On Weathering" by Mohsen Mostafavi and David Leatherbarrow, this modernist resistance to the marks and associations of time is examined. The understanding is that architects like Corbusier saw their buildings as achieving perfection and finality upon the completion of construction, and everything that came afterwards, human occupation, rain and snow, was seen as a detriment. White symbolized moral superiority, honesty, and hygiene and the fact that such whiteness could only be achieved in a new and untouched building gave it all the more separation from the flawed ideologies of the past. Thus an unblemished appearance was necessary in creating a clear dichotomy between the new and old.

Current perceptions

Essentially, aging cannot be accepted within a building because people cannot accept it within themselves. People do not wish to be reminded of their own mortality and the prevalence of war and violence make us shrink from ideas of destruction all the more. We retreat to a built environment where shiny, glazed facades fill us with the promise of everlasting newness and purity.

However, in the interest of being forever new, a sacrifice is made as noted in "On Weathering": "The purity of the modern disavows the sense of recollection through association."⁴ It seems that Le Corbusier himself realized this failure of the pure white wall and as he began to work with raw concrete which revealed all its flaws and marks, a new tradition emerged where the signs of weathering and aging added to a building's completeness.

Nevertheless, some of this mentality developed during the modern movement has stayed with us to the present day. When given the choice

between repairing an old building and constructing a new one, a new building is usually the preferred choice. Not without reason though because the inflexibility of older buildings that were not designed with the future in mind are too difficult to retrofit with new systems and too inflexible for new program. However, the reasons for such destruction are still mostly a cultural. In his essay, "Vernacular Paradigms for Post Industrial Architecture," James M. Fitch makes this important observation about this mindset:

"...until a century or so ago, obsolescence was a purely physical phenomenon. The aging process determined quite literally the useful life of the architecture. Current concepts of technological obsolescence...are modern inventions."⁵

It is not because the materials themselves have become useless that we reject them, it is because they are old.

In his book “How Buildings Learn,” Stewart Brand makes the interesting point that the degree to which aging in materials is accepted is highly dependent on whether the material is natural (traditional) or manmade(new)⁶.

Traditional materials have a built-in time dimension and it may be their weathered state that we desire in the first place since it is readily observable in nature. The same is not quite true of steel or concrete and therefore when they are seen to age it is seen more as an error and therefore is undesirable.

However, Brand also makes the somewhat humorous point that this may simply be because these materials are not old enough to be considered beautiful.

This intolerance for aging in new materials is most clearly demonstrated in technology and today people commonly upgrade their already highly advanced mobile phone technology to a new version with minimal improvements almost every year. This is not only an unsustainable way of life but it does not recognize the value

of narratives contained within materials and forms that have acquired age. The expectation of instant gratification in modern society also places a challenge for investing in long term plans of action that will benefit future generations.

The role of built form

The importance of form in allowing us to perceive the passage of time is clear. The transformation and change in position of objects in our environment tell us that time is moving forward and we rely on our memory to understand the significance of these changes. But what of larger scale processes that may take hundreds or thousands of years? The creation of mountains, the process of evolution, the rise in sea level? For these events our memory is not sufficient to understand what is happening and we must look for clues and traces in the materials themselves. We may find the fossil of an extinct marine animal at the top of a mountain or the deep striations in the land

caused by the abrasive force of a glacial flow.

If a mark is present, something has made it
and in this way matter provides a sort of
external memory.

For us, built form is an especially effective
external memory device because we have a
clearer idea of the starting point. A building can
serve as a datum for measuring the
passage of time. When we encounter a
ruin we understand that it did not simply
appear in that state moments before we
arrived. The tendency of human
designers to build pure geometric forms
and compose in straight lines tells us
that pieces are missing and have shifted
from their original positions. We
understand that certain events have
taken place and we are able to interpret the
site with these events in mind.



**Figure 4 - Ruins of
Fountains Abbey
Source: author**

However, given that we are not old enough to
have seen this building when it was newly
constructed, is the building we then imagine

when attempting to reconstruct a complete form the same as the one that existed before? No. Within this “axis of imaginative time,” as Arata Isozaki so calls it, our mind can be soaring back to a point in the past or a point in the future simultaneously⁷. His ideas seem to correspond with those of Husserl with regard to the retentions and protentions that make up our temporal awareness.

There is a beautiful dual significance to such buildings that have been broken down and reduced to mere matter: to memory and to the imagination.

Building designs are conceived of in terms of symbols and ideals that exist outside of time but once constructed and subjected to the forces of nature, a building must take its place in reality and the historical continuum as a physical object. In an age of photorealistic computer renderings and detailed three dimensional models, perhaps a building has to be blemished in some way for us to recognize

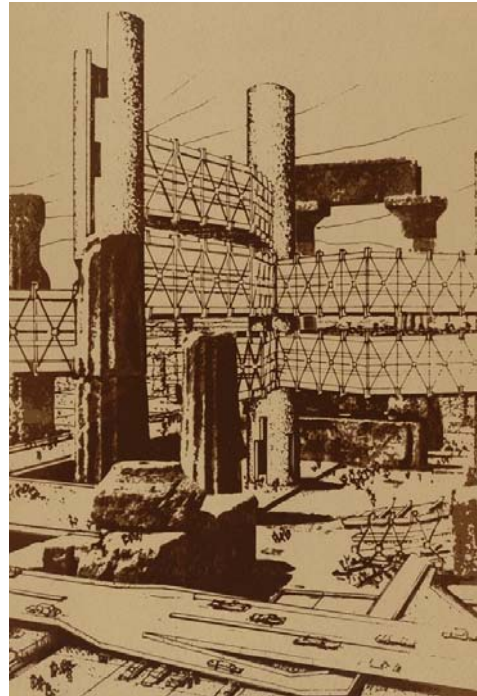


Figure 5 - "Incubation Process" drawing by Isozaki
Source: ARTstor Digital Library

it as being real and for us to realize the same about ourselves. J. B. Jackson, the influential architectural critic and landscape designer, refers to a need of this kind in his article, “the Necessity for Ruins.” “Ruins provide the incentive for restoration and for a return to origins.”⁸ Here I have diagrammed my own interpretation of this phenomenon:

There is an important distinction between form and matter. Form is conceptual and we can hold the image of a form in our minds long after

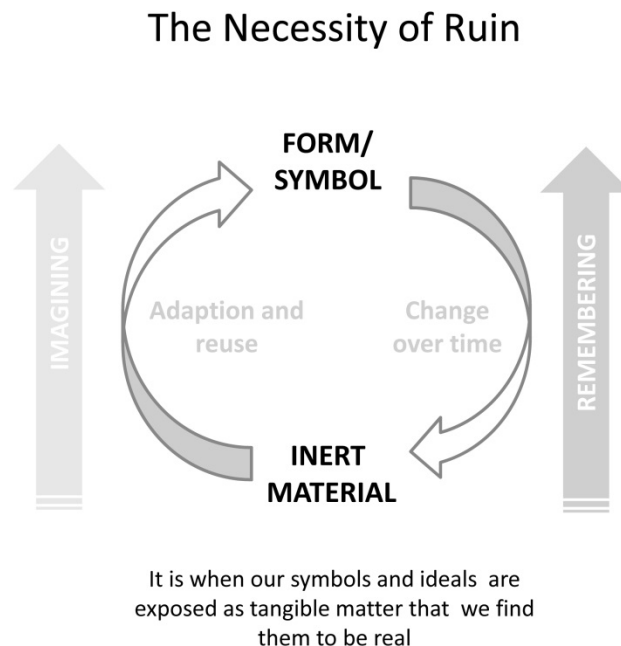


Figure 6 – the cycle between form and matter in a building
Source: author

the object itself has changed or been destroyed but matter is tied to its physical properties and on its own does not hold the same meaning. Over time, buildings and their components cycle between these two perceived states within a building, but the form that results is not the same as the preceding form even if restoration is attempted. Through each step of the cycle, physical acts of humans and nature leave their mark upon a building and accumulate to create a rich narrative of events. Perhaps then a better way to diagram this process as it happens in time is:

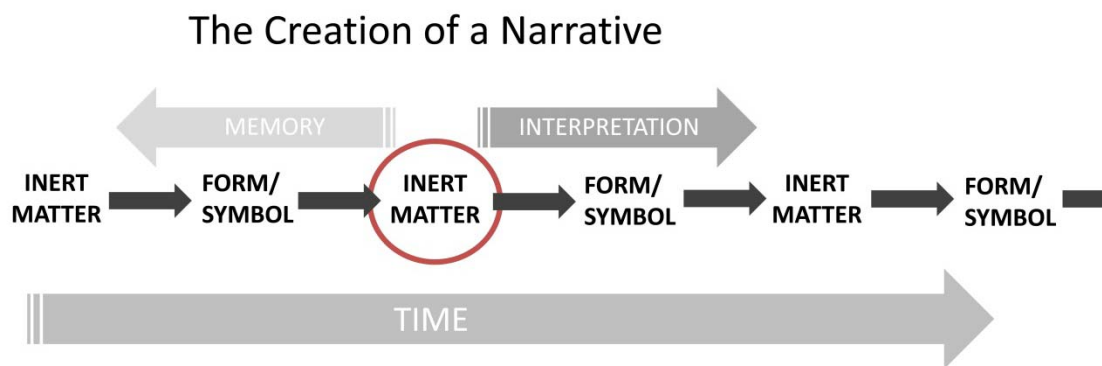


Figure 7 – accumulation of adaptations over time forming a visible narrative
Source: author

The more that change is accepted and responded to, the more information we get from this layering. The accumulation of traces forms a complex narrative that gives a building value and connects it to the human experience.

Chapter 2: Precedents

Igualada Cemetery

Location: Igualada, Spain

Architect: Enric Miralles, 1990

Program: Cemetery and chapel



Figure 8 – Site plan for Igualada Cemetery
Source: Google Maps

Site Situation

The site for the cemetery is somewhat unusual in that while it is directly adjacent to an industrial area of the city, it is a completely natural and untouched site. It seems that

Miralles wanted to intervene in a way that would preserve this character but ironically, in doing so he has scarred the land by excavating and exaggerating the existing topography of deep ridges. This scarring introduced the ideas of healing and time as the site is transformed by nature which perhaps is meant to parallel the process of dealing with the loss of a loved one. The burial niches are inserted into retaining walls demonstrating the interdependence of man, nature and built form. The project is more like the creation of a new landscape than an ins

Use of Materials

Miralles comments that he does not see the history of a building comprising only of the history of its construction but also of the history of the site. "The history of a building can thus be seen as beginning before its construction."⁹ This is demonstrated well by his use of the quarried stones that were dug up as a result of

the construction as retaining walls that line the mausoleum and chapel areas.

Movement/Circulation

The procession accompanying the deceased follows along this scar which slowly descends deeper into the valley, evoking a sort of archaeological association that brings people closer to the past and to the earth. The grid of cells within the arching concrete retaining walls create a rhythm and cadence to the procession allowing one to measure time through the distance that they have travelled.

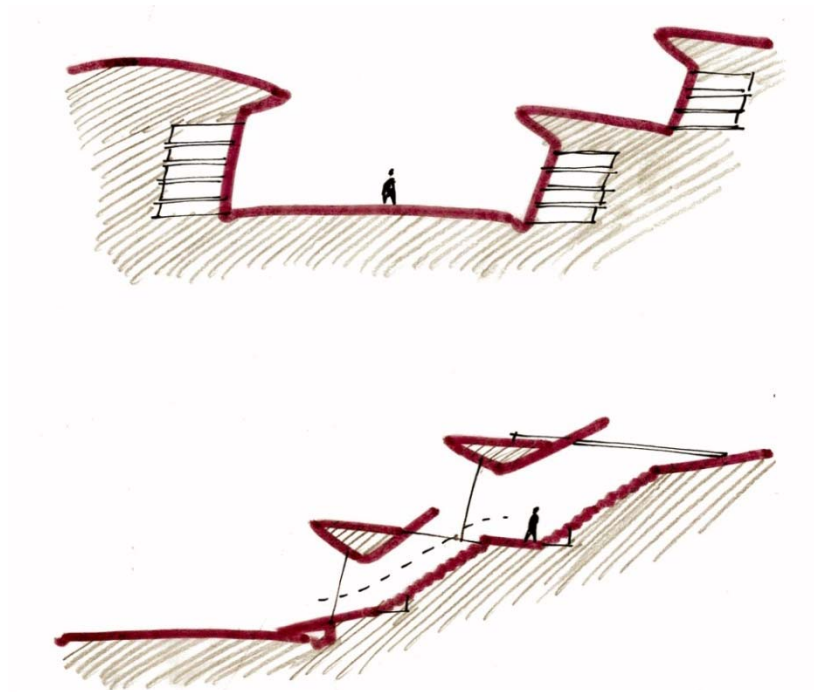


Figure 9 - role of the section in shaping the path of movement
source: author

Querini Stampalia

Location: Venice, Italy
Achitect: Carlo Scarpa
Program: Art Gallery



Figure 10 – context for Querini Stampalia Foundation within Venice
source: Google Maps modified by author

Site situation

The Querini Stampalia foundation project is a renovation of the ground floor of an existing palazzo between two other buildings. There is an existing bridge that crosses the canal in front and leads to an alley adjacent to the site, but Scarpa chose to construct an additional bridge that leads straight to the front door. In order to return to the original use of the ground

floor as an open storage space, Scarpa chose to remove many of unnecessary columns between the front and back of the palazzo. This allowed for an uninterrupted passage of space between the canal and the garden in the rear.

Use of Materials

While a renovation has the connotation of making old new, it is interesting that in many ways, Scarpa has used new elements in order to highlight the old as being old. The smooth and seemingly thinly applied travertine wall panels contrast strongly with the dark, rough courses of brick from the original structure which has been left exposed in many places. This kind of application is also seen in the smooth slabs placed atop a much rougher aggregate in the form of the entry stair. This evokes the sense that Scarpa is cutting sections through time and leads us to wonder if the current world that we see around us is a thin veneer that can be peeled away to reveal the past.

Movement Circulation

The rise in the sea level that occurs in late autumn and early spring as a result of flood tides from the Adriatic was a driving force in designing the circulation for the galleries. Scarpa has effectively manipulated the floor plane of the palazzo in order to create a sequence of unique experiences that marks one's passage through the building in relation to the level of the water that is allowed to enter a series of troughs along the walls. In the case of the entry stair, this becomes almost a literal time telling device in that each step is unique in shape and orientation, clearly marking the rising and receding of the tides.

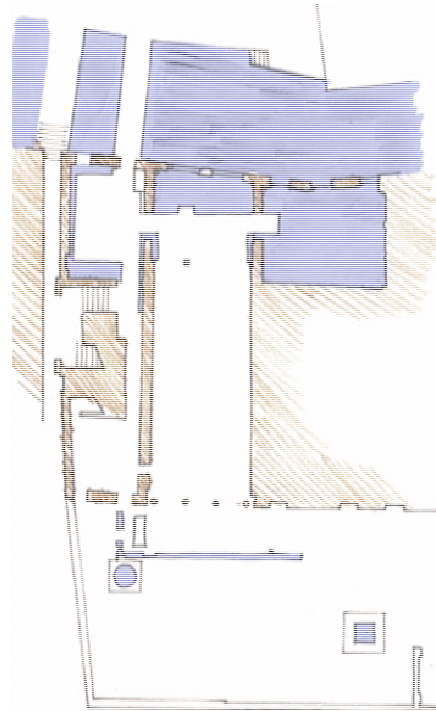


Figure 11 – portions of the water that can be penetrated by water

Source: author

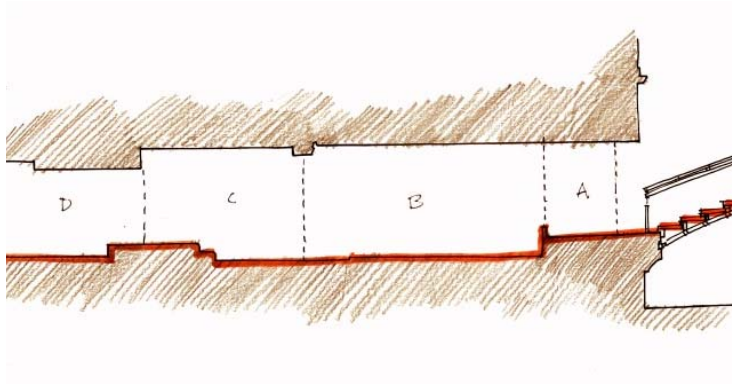


Figure 12 – sequence of spaces defined by changes in floor and ceiling plane
Source: author



Figure 13- photo of entry stair showing unique shape of each step and clear sequence
Source: tomasso_men via Creative Commons

Times Building

Location: Kyoto, Japan

Architect: Tadao Ando

Program: Commercial, retail



Figure 14 – the relationship of the Times Building to the Takase River
Source: John Weiss via Creative Commons

Site Situation

This commercial building in Kyoto along the Takase River was originally intended to be a renovation, but seeing an opportunity for a more intimate connection with the river, Ando proposed an entirely new building. He decided

to site the building several feet below the surrounding buildings so that the ground level is only inches above the surface of the water.

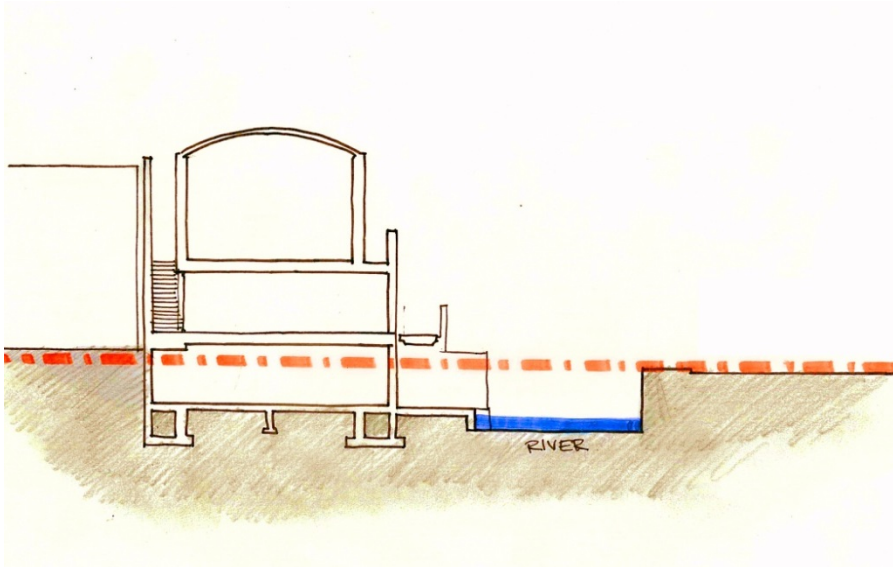


Figure 15 – siting of building below the established urban plane
Source: author

The appearance is that of a boat floating along the canal, much like the ones that transported cargo along this river in the past. The ground level is mostly an open patio with café seating that allows visitors to walk right up to the water's edge and enjoy the sight and sound of it flowing by. When the river rises periodically, this patio is flooded, making the forces of nature manifest themselves even in an urban retail building that seems so far removed from these cycles. Normally a railing would be

required but Ando stubbornly argued against one.

Use of Materials

As is expected of Ando, the use of materials in the Time's project reveals a simple but powerful building logic and tectonic nature of the structure. Concrete masonry units are left exposed on both the interior and exterior without cladding so that the process of construction in terms of the sequence of stacking rows from bottom to top can be read at a glance. Because the appearance of the exterior is made up of load bearing walls, any stains due to water damage cannot be masked and become part of the essential structure of the building. Despite being made from concrete, the size of the openings and porosity of the building gives the walls a thinness that does not create enclosure but marks a layering of thresholds between man and nature, balancing acceptance and rejection.

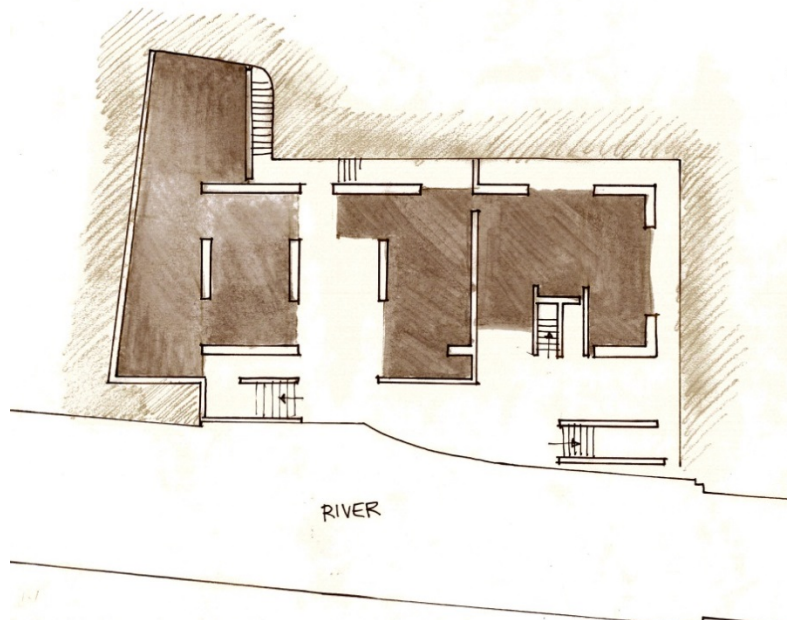


Figure 16 - relationship between interior and exterior space
 Source: author

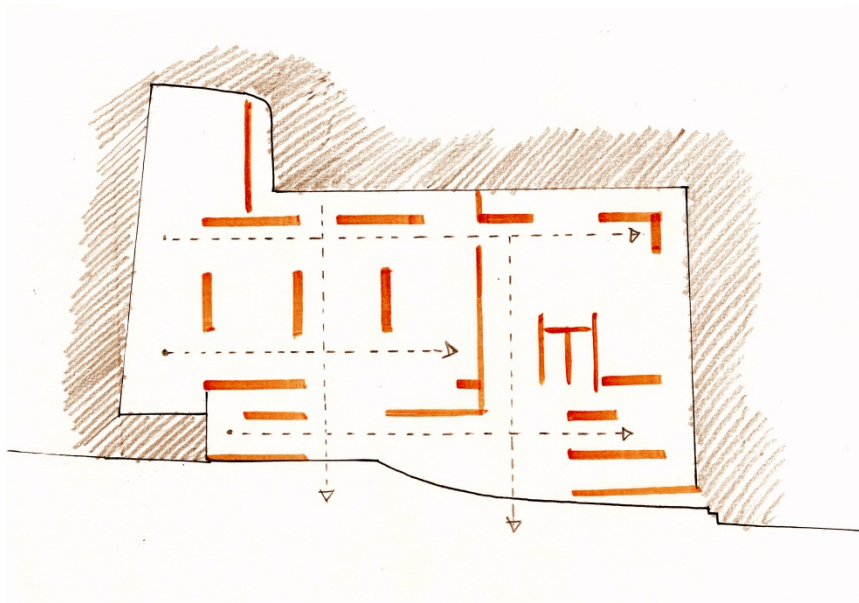


Figure 17 – visual porosity allowing for an awareness of outside conditions and projection of self.
 Source: author

Movement/Circulation

The circulation between the various shops within the Times Building is all exterior so that visitors are aware of sunlight, temperature changes, and wind at all times. The experience of shopping may be different each time depending on the weather. The circulation is also kept mainly on the river side so that it serves as a constant datum with which to orient oneself in the site. By exposing visitors to the constant flow of the river, an awareness of the swift passage of time is awakened. The high degree of visual porosity also enables the sort of projection of self that was discussed earlier, creating an anticipation of different experiences of the building.

Madinat al-Zahra Museum

Location: Cordoba, Spain

Architect: Nieto Sobejano Architects, 2008

Program: museum and archaeological offices



Figure 18 – site plan of nuseum in relation to Madinat al-Zahra archaeological site
Source: Nieto Google Maps modified by author

Site situation

This museum holds the artifacts and information related to the adjacent archaeological site of Madinat al-Zahra where a tenth-century palace is being excavated. The museum avoids becoming a conspicuous object in the landscape and takes the form of an underground complex that itself resembles

an archaeological dig site. It appears solid from above at ground level but as one steps down into the site, a variety of passages and chambers reveal themselves, mirroring the process of excavation. Setting the building below ground evokes a greater sense of connecting to the past and to origins.

Use of Materials

The formwork makes the construction method manifest in building and the horizontal rhythm is evocative of strata and compression. The weightiness of these walls serves as a reminder that you are below the ground and surrounded by earth. One of the most interesting aspects of this project is that it was designed with the intent of the surfaces weathering to come to resemble a ruin. The roofing material was specifically chosen so that it would stain the walls and the surfaces provided by the imprint of the formwork retain the dirt and discoloration. This has begun to take effect even though the building was only completed four years ago. The changes are

highlighted at well-defined interior/exterior joints which measure the passage of time through juxtaposition.

Movement Circulation

Similarly to the Igualada Cemetery, one must enter the museum by descending along a ramp but here the destination is not clear from the start and is only revealed as one travels down a series of passageways. Because the project is for the most part enclosed and underground, orientation and an awareness of outside conditions is provided by a number of skylights that shed light on the walls and a series of courtyards. There is a tension between concealment and revealing, perhaps relating to ideas of excavation and archaeological discovery, embodied in the circulation where at times adjacent rooms are only visible through a few small punctures in the wall and then later in the procession one is able to enter the room.



Figure 19 –interior/exterior joints highlighting changes in the surface over time. Photo courtesy of Michele Lamprakos

Chapter 3: Principles

Overall concept diagram

Based on the theory and precedents that have been examined and keeping in mind the original question and goal of creating, a set of principles and methods have been derived that can be applied to the design proposal. Here is a simple representation of the main ideas:

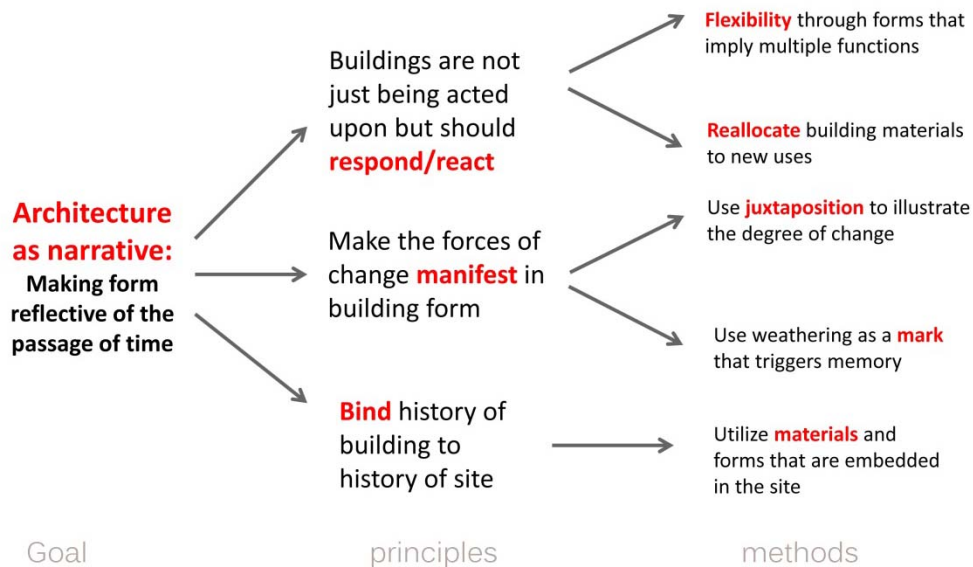


Figure 20 – diagram of main principles and methods
Source: author

The three main principles correspond to the theory discussed regarding the anticipations and retentions that are an integral component of our temporal awareness. The object of this

chapter is to translate these ideas into architectural design parameters that can serve to form the narrative that will awaken temporal awareness.

Making forces of change manifest

This principle is centered on the idea that changes in our surroundings should not be presented simply as information through indirect means but should have real, observable effects on the building itself. This may mean allowing elements into the building or allowing forces to leave marks on the building so that traces of these phenomena can be read and interpreted. This principle also involves demonstrating the degree of change that is occurring and therefore ways of using built form as a means of measure.

Table 1: Make Forces of change manifest in building

Method/Technique	Specific examples in precedents	Theoretical context
Intentional marks and stains that show traces of weather activity and materials	Madinat al-Zahra: roof material intentionally chosen to stain walls Time's Building: building's finish is structural and therefore stains are permanent.	On Weathering: marks allow for the associations that trigger memory
Juxtapositions that illustrate the degree of change	Madinat at Zahra: interior and exterior surfaces shown in direct contrast to show degree of weathering	Husserl on temporal perception: Temporal awareness functions on the premise that the object being observed is the same as the object that was observed at a point in the past
Unique sequences that allow for the measure of change or strength of forces	Querini Stampalia: entry stair, each step is unique so that rise of water can be measured	Husserl on temporal perception: human understanding of succession

(images accompanying examples will be included in the next iteration)

Binding history of site to building

This principle relates to the idea of retention in our understanding of the passage of time. We need a reference for what has come before in order to understand what meaning that holds

for the present and therefore a building should illuminate these histories even if they are histories that came before the construction of the building itself.

Table 2: Bind History of building to History of Site

Method/Technique	Specific examples in precedents	Theoretical context
Make references to previous uses, not just the present use	Querini Stampalia: removal of columns to refer back to original function of first floor of palazzo Time's Building: refer to the form of historic cargo boats that are associated with the takase river	Lamp of Memory: buildings architecture should strive toward the creation of meaningful connections between past and current conditions, an understanding of origins
Site building in relation to existing contours	Igualada Cemetery: excavation of site relates to existing ridges and valleys in site and therefore geological history	Enric Miralles: the history of the building should begin before the construction
Reallocation of site materials for use in buildings	Igualada Cemetery: rocks that were excavated during construction are used to line the retaining walls of the mausoleum area	The building should not just impose upon the land but give back to it as well. Interventions should make peace with the site

React to changing conditions

This principle relates to the idea of anticipations as a component of our temporal awareness and while they are not always

accurate it is important to use this element of the imagination in order to find ways to keep our buildings relevant and to make sure that our built environment continues to stimulate and inspire us.

Table 3 - Building should respond and react

Method/Technique	Specific example in precedent	Theoretical context
Create flexibility for the creation of new spaces	Madinat al-Zahra Museum: certain portions of the building can be repurposed or subdivided as expansion becomes necessary	Husserl on temporal awareness: our temporal awareness is composed of both retentions and anticipations
Utilize modular materials that can be reallocated as the needs of the building change	Times Building: the CMU construction allows for change if necessary that will be in keeping with the original character of the building	How Buildings Learn: Buildings become obsolete because they have not accounted for future change and cannot be retrofitted
Use visual porosity and fragmentation to invite new interpretation	Times Building: the lack of total enclosure and alignment of openings allows people to anticipate new points of view and experiences of the building	Husserl on temporal awareness: our anticipations also project our own experiences, not just objects

Chapter 4: Site

In this chapter the rationale for choosing a site conducive to time-based architecture and a description of the chosen site, the Blackwater National Wildlife Refuge, will be discussed.

The site will then be analyzed in terms of climate, existing features both natural and manmade, and finally possible building sites will be identified.

Rationale for Site choice

To study how a building might make forces of change over time manifest, it is important that the project be located within a climate that receives a fair amount of precipitation and where the experience of each season is well marked by temperature changes and changes in the foliage. In order to evaluate the flexibility of a building and its ability to react to changing conditions, a site where conditions are changing over a long period of time and would directly affect how a building is used

would be preferable. A place where changes occurring at very different timescales can be observed would also provide a good laboratory for the creation of architecture capable of accommodating and recording daily, seasonal, and longer term changes.

As mentioned in the discussion of how humans perceive time, our perceptions are directed and therefore overstimulation of the senses can prevent the observation of certain phenomena.

A certain degree of isolation from other buildings may be necessary, especially since the object of this proposal is to design a building that will provide the context for interpreting an otherwise undefined environment.

Because all of the precedents examined in this document involve some encroachment of nature into the building, phenomena such as sea level rise that could temporarily or permanently change the nature of a building and how it would be used present possibilities

in a site. Sea level rise is also a long term change that is not readily observable without prior data in most cases and therefore provides the opportunity for a building to be the vehicle of that awareness.

With this in mind as well as with thoughts on a fairly isolated site within the sort of climate described earlier, areas of eastern Maryland where much of the landscape is low-lying marshland seem appropriate. Density in this part of the state is much lower and in Dorchester County, the rate of sea level rise is twice that of the global rate. This has led to some dramatic change such as the inundation of certain islands and the significant loss of wetland within the Blackwater Wildlife Refuge.

Brief history of the site

The Blackwater Wildlife Refuge is made up of the saltwater marsh and forest land surrounding the Blackwater River in Dorchester County, Maryland on the eastern shore of the Chesapeake Bay. Dorchester County is made up of several long peninsulas that broken up by a number of creeks and marshes, making it highly vulnerable to flooding and inundation due to sea level rise. The refuge is primarily a sanctuary for waterfowl migrating along the Atlantic Flyway but it is also home to a variety of other bird and animal species including bald eagles and the endangered Delmarva Fox Squirrel.

The refuge was established in 1933 and since then has seen significant change in the ecosystem, largely due to the sea level rise mentioned earlier but also due to erosion, land subsidence and invasive species. There have been efforts to mitigate these effects by rebuilding the marshland with



Figure 21 – overlay of 1942 map and 2011 map of the Blackwater Wildlife Refuge showing wetland loss.

Source: U.S. Geological Survey

soil dredged from elsewhere and through extermination of a certain species of muskrat that is destructive to the vegetation.

Site climate conditions

Precipitation and temperature

The temperature changes occurring between warm and cold seasons are fairly dramatic within the refuge. The warm season lasts from late May until mid-September with mean highs above 78 degrees and the cold season lasts from early December until early March with mean temperatures below 51 degrees.

Wind

Because the site is for the most part open water and marshland with some forest, the wind will have a significant impact on the siting of the intervention. According to data from weatherspark, the wind blows most



Figure 22 – wind direction and frequency throughout year
Source: author

commonly from the south and northwest and generally the wind speed is between 0 and 16 mph¹⁰. This is mild enough that it may be desirable to expose visitors to the wind at certain points within the intervention as a way of creating awareness of changing temperatures and wind direction throughout the day.

Sun angle

The openness of the site also entails a great deal of exposure to the sun. The following diagram illustrates the angle of the sun at various times of year and throughout the day as well as the length and direction of shadows that are produced. It is clear that the length of the day varies significantly throughout the year.

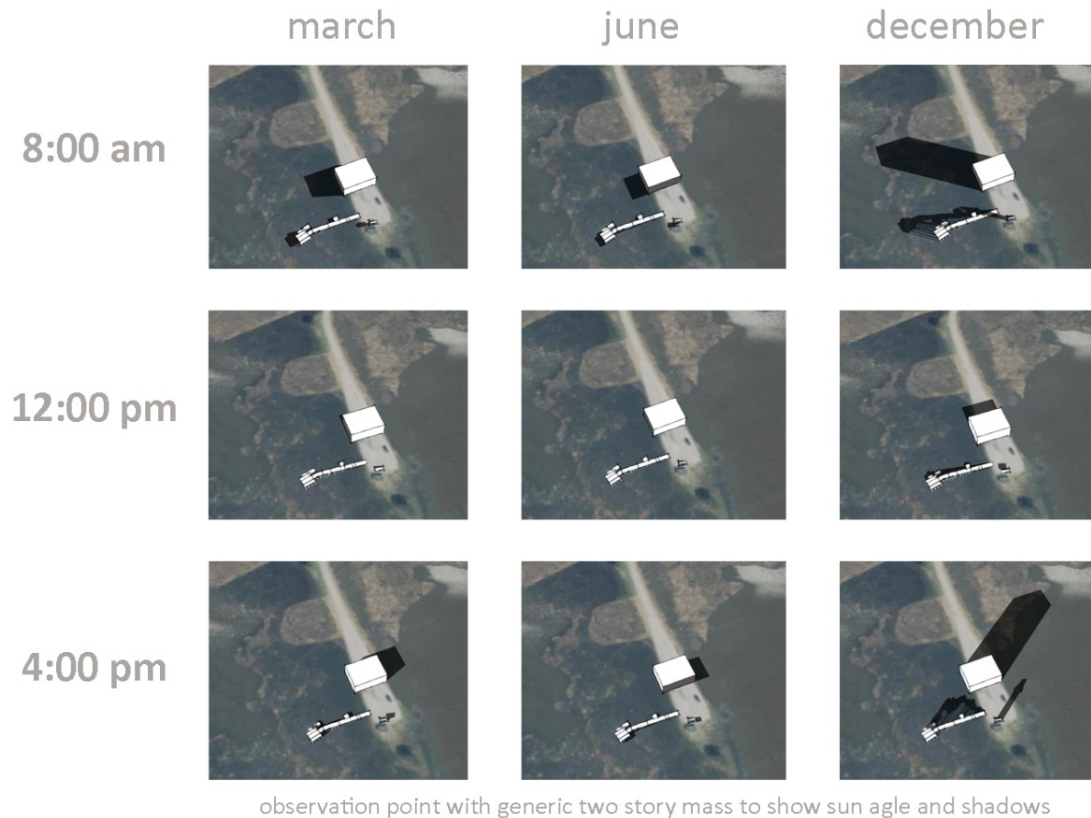


Figure 23 - sun angle/shadow study of site near observation point with two story mass
Source: author

Existing features

Manmade

There are very few buildings in the immediate vicinity and the closest building is the environmental education center which is being used as the visitor center temporarily as the actual visitor center undergoes renovation.

There are a few small structures nearer to the

site including a covered picnicking pavilion along the marsh edge trail. This appears to have access to some electricity and fresh water. There are a number of benches for viewing the refuge scattered throughout the marsh edge trail and 3 piers that extend into the marsh. The main pier is the ramping boardwalk constructed with prefabricated concrete planks at the observation point.

Natural

The distinction between land and water is not very clear due to the marshy nature of the site and it is difficult to make this determination based on topography because it is almost completely flat (Figure 25).

However, one does observe a threshold between forested area and marsh where the remnants of dead trees mark what was once forest. These trees are mostly pines but it is the leaves fallen from deciduous trees that provide the tannin that gives the water its dark brown color (thus Blackwater).



Figure 24 - site topography
Source: author with U.S. Geological Survey base

Site Photos

The observation point is situated along the threshold of this transitional landscape and while it is sitting on land that will be inundated in a century or so, it will still be quite close to the new shoreline that will be established and may be at least visible if not accessible.

The following is a measured drawing made at the site of the newly constructed pier and parking area:

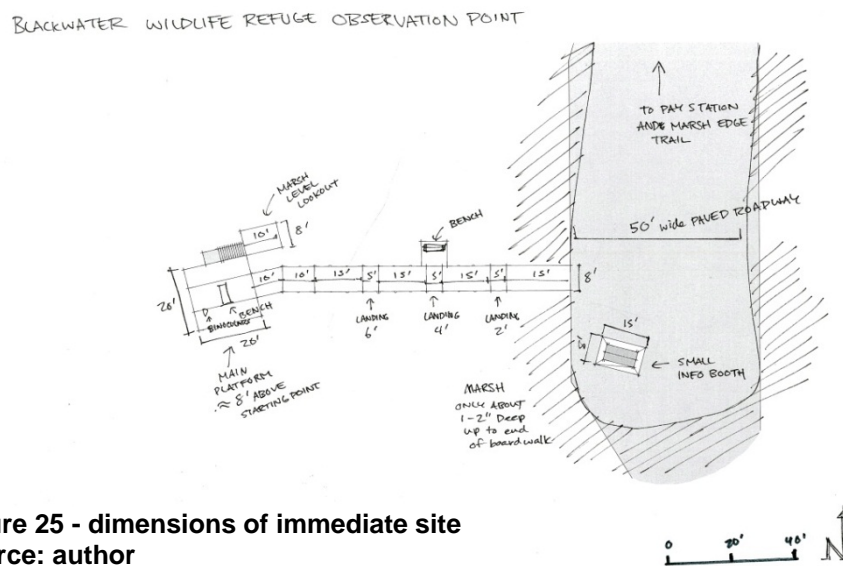


Figure 25 - dimensions of immediate site
Source: author

The following image is a view key for the site
photos on the next two pages.



Figure 26 - points from which photos of the site were taken
Source: author with base from Google Maps



view of marsh looking back towards forest



view of marsh from end of pier



pier from access road



pier from north



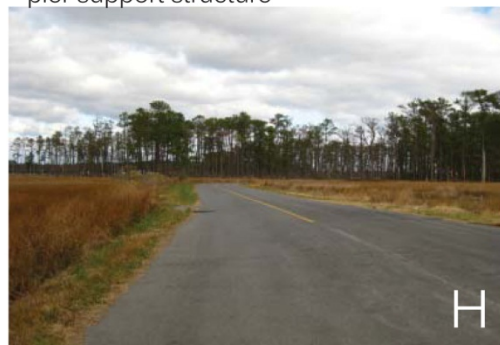
view back towards access road from pier



pier support structure



view of marsh looking back towards forest



view of marsh from end of pier

Figure 27 - photos of the observation point
Source: author



small info stand at end of access road



picnic area near marsh edge trail



trees along marsh edge trail



looking back at pier from woods



view of river from marsh edge trail



existing visitor center from wildlife drive



transitional landscape along wildlife drive

Figure 28 – second set of site photos taken at locations other than the observation point

Source: author

Special regulations and considerations

Critical area designation

The chosen site is located within the critical area as defined by the Maryland General Assembly's Critical Area Program which is designed to protect the health and resources of the Chesapeake Bay¹¹. The critical area includes all lands within 1000 feet of tidal waters and a special commission reviews all proposals within this area. Additionally, there is a 100 foot buffer designed to protect habitat and no development related activities can occur within this zone. Because the intervention is meant to be low impact and is not development related, none of these regulations would restrict the construction of an interpretive center within this zone but erosion control methods are encouraged.

Sustainability

In the interest of sustainability, modular materials that are easily replaced or disassembled would be ideal so that energy is not wasted on expensive custom fabrication and needless demolition. If the building can somehow serve as a means of preventing erosion in some areas depending on how it is sited, this will also help to preserve some habitat needed for the species that are dependent on this ecosystem.

Wildlife

Because the refuge is such a sensitive and vital area for a number of animal species, it seems wise to first of all build at a smaller scale in order to have less of an impact on the habitat and secondly, employ a method of construction that will create the least amount of disturbance in terms of noise and the number of laborers necessary. To this aim, the pier located on the site offers some clues because

it is composed of mostly prefabricated concrete and wood components that are assembled in a simple manner, making the structure quick and easy to construct.

Chapter 5: Program

Design objectives

As explained in “How Buildings Learn,” by Stewart Brand, institutional buildings are designed to be far more resistant to change than commercial or domestic buildings and yet they are just as likely to outgrow their space¹².

Museums and schools constantly require renovations and additions, but for whatever reason, they are designed in denial of this inevitable growth. However, these are the buildings that tend to last the longest and therefore would serve as the ideal testing ground for how a building can be affected by long term processes. Because institutional buildings are historically the most problematic in designing for change and because they allow for the span of time necessary to show these changes, a museum or interpretive center seems like an appropriate building type for this investigation. Additionally, museums are one notable place where the quality of the experience is more important than saving time.

People must naturally slow their pace in order to absorb the information contained within museums and reflect upon it.

Typology and program tabulation

An Interpretive center

Because the intent of the architecture generated by this thesis is to provide context that will inform an individual's assessment of current conditions and ideas about future conditions, the program of an interpretive center lends itself to the Blackwater site.

According to the Hicira Handbook on Heritage Interpretation Centers, the aim of in situ interpretation is to present information about a historical or natural heritage within its own context. "The idea of the object as having value in itself in isolation from its function and setting, is rejected."¹³

Because there is already an existing visitor center that addresses the wildlife and ecosystem present at Blackwater, this proposed interpretive center will focus on an

awareness of the phenomenon of sea level rise which will drastically change the landscape within the next century. However, a general awakening of temporal awareness through the use of materials and manipulation of light and air is the main intention. The center will not advocate a particular agenda but rather invite reflection and allow visitors to form connections with the past and draw their own conclusions about the future.

Uses and area requirements

Based on common program uses found in other nature interpretive centers and the specific needs of this particular region, this list of programmatic requirements and area requirements has been generated

Conference room	500 sqft
Classroom/Teaching Lab	400 sqft
Wildlife observation area	750 sqft
Stage/theater	600 sqft
Office	150 sqft
Restrooms	2 at 300 sqft
Mechanical	130 sqft
Storage	150 sqft
Garden	TBA

Because the proposed building is meant to be communicative and didactic in many ways, it lends itself naturally to teaching functions and can be a place that provokes discussion about climate change. Program elements that allow for interaction between the individual and nature are also to be promoted because of the personal nature of temporal awareness. This requires a balance of spaces that can support group activity and individual discovery.

Program organization

The most important considerations in arranging the program will be allowing for views of the Blackwater River and sectional relationships with the water in terms of what areas of program can allow for some inundation or can adjust more easily to new locations. Based on the openness of the site and the importance of a connection to the water, it would seem inappropriate to have more than three levels of program. Figure 27 diagrams the desired vertical distance between certain parts of the

program. While views from all spaces to the water are desired, it may be difficult to hold a conference or keep materials in an office from being damaged if water is allowed to penetrate those spaces. This leads to another consideration about program arrangement regarding the relationship between conditioned and open air spaces and which portions of the program are best suited to which. Here is a preliminary diagram of the possible division:

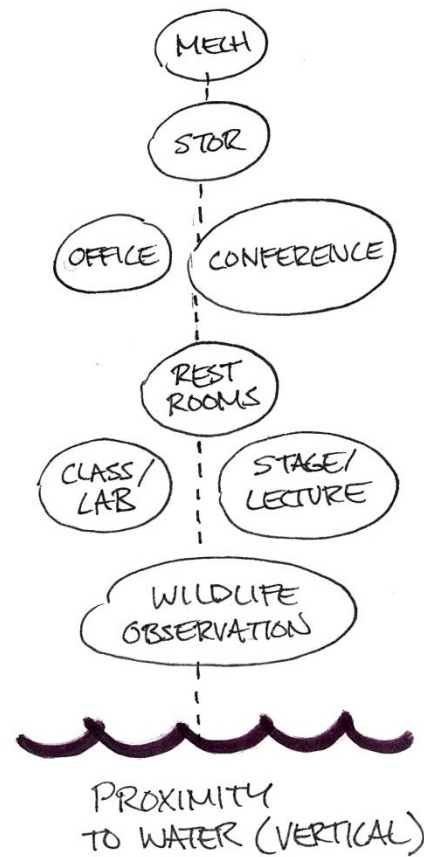


Figure 29 – diagram of desired vertical proximity to water for each program element
Source: author

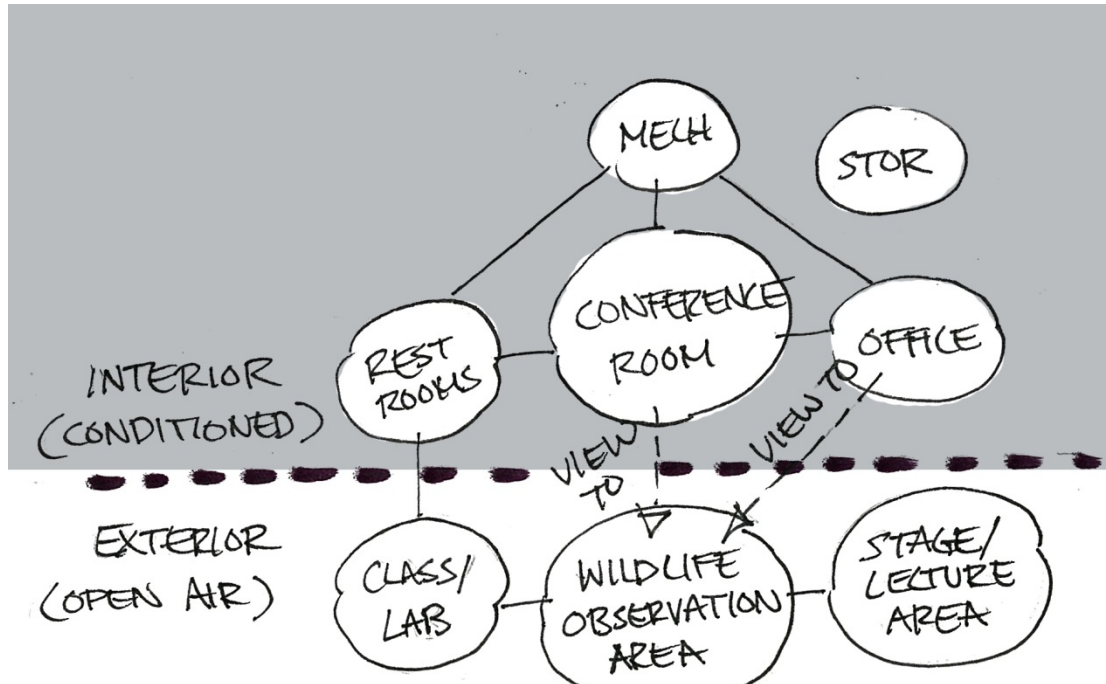


Figure 30 - diagram of program arrangement in terms of interior/exterior relationships
Source: author

Structural and Mechanical implications

Because the building needs to last long enough to accumulate the marks and associations necessary, the supporting structure must be very sturdy and permanent.

Because modification and expansion is sure to take place (and desirable in this case), the structure will most likely have a greater load bearing capacity than necessary for the initial program to allow for the changes.

Alternatively, additions may be supported

independently of the original structure or there must be ways in which the structure can be modified to improve its strength.

Modular, prefabricated elements will also be useful in adapting the building to change and, as mentioned earlier, in allowing for minimal disturbance in the construction process. A simple assembly process will enable one to construct and disassemble the elements quickly and reallocate them to other parts of the building when lower floors become unusable due to sea level rise.

A good degree of distinction between the structure, skin, and services of the building must be present so that when one element becomes outdated or requires repair, this can be done without ripping the entire building apart. Many historic structures have been destroyed because of the difficulty or impossibility of retrofitting them with new systems. This may mean sacrificing some of the seamless integration of these elements that make many buildings beautiful but in order to

design for the passage of time one must take into account the fact that each element of the building has a different lifespan.

Chapter 6: Design Approach

Design Considerations

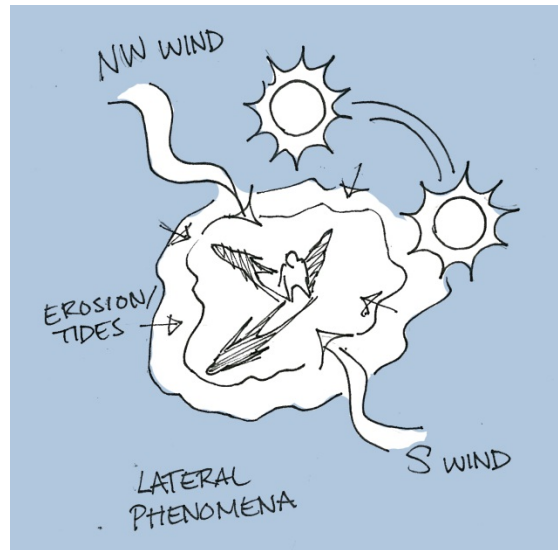


Figure 30 - lateral forces at work on the site
Source: author

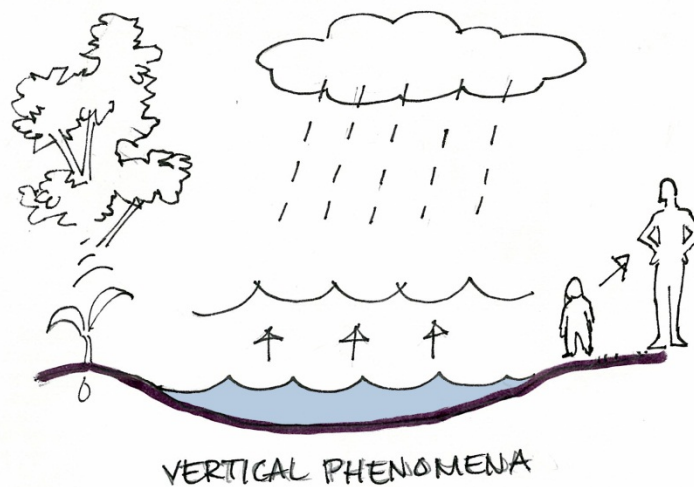


Figure 31 - vertical changes occurring on the site
Source: author

Parallel parti

The object of this scheme is to incorporate the existing pier as a way of entering the building and to allow for unobscured views of the river. There would be two levels that divide the interior and open air functions of the building. The idea of using prefabricated concrete planks to construct areas of the deck is also introduced so that in the future, materials that are no longer useful on the lower level can be reallocated to new functions.

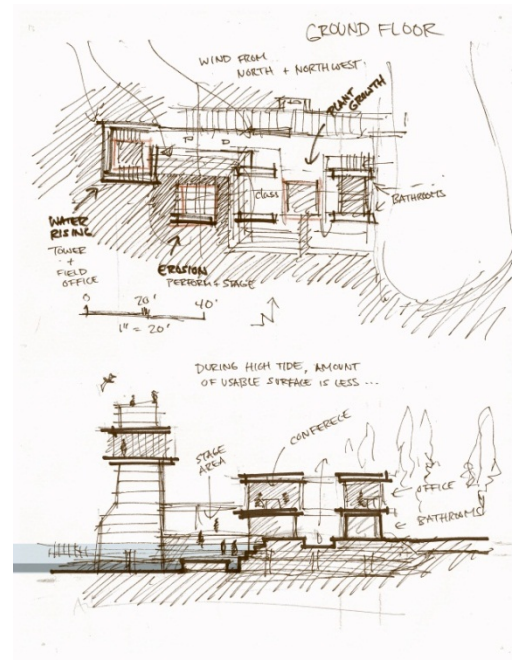


Figure 33 - plan and section of parallel scheme
Source: author

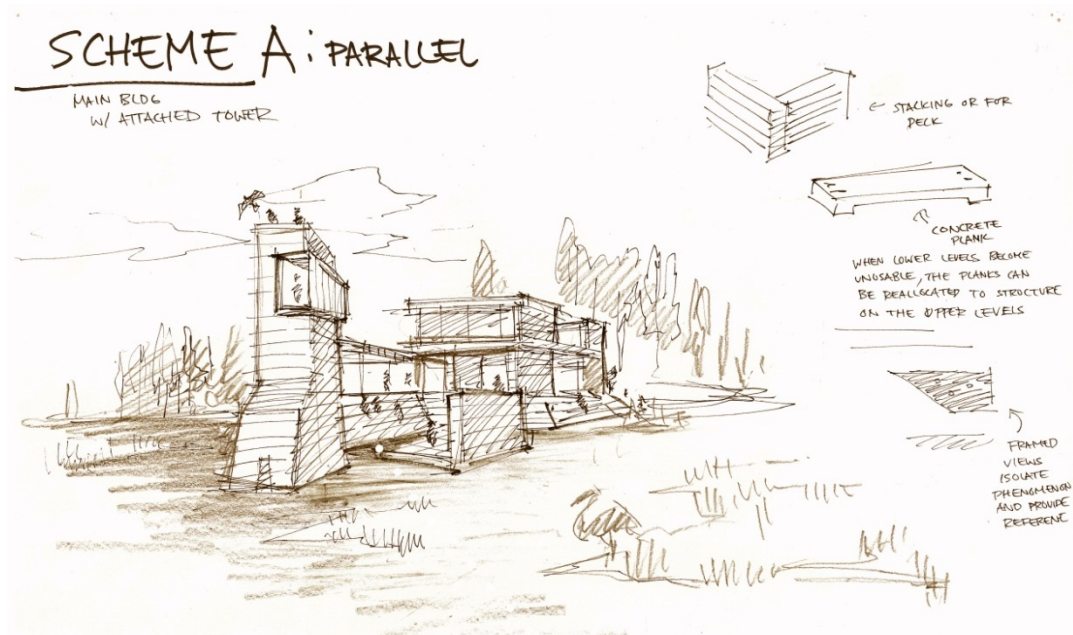


Figure 32 - perspective of parallel scheme
Source: author

Vertical Parti

The object of the vertical scheme is to create a framework within which portions of the program can shift upwards as inundation renders lower levels unusable but leave traces that will provide the narrative for the site. The tower and its unique levels serve as a means of measuring the change directly as well.

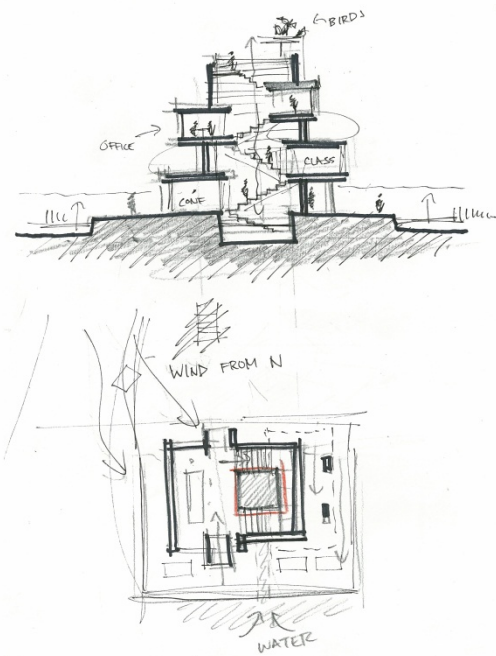


Figure 34 - plan and section of vertical scheme
Source: author

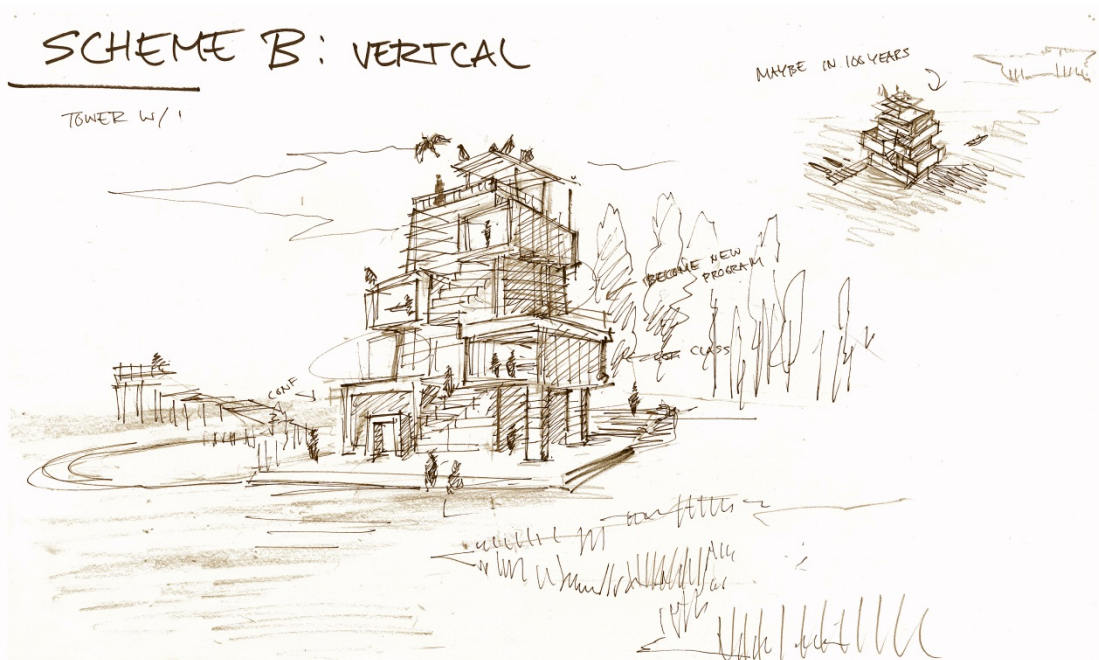


Figure 35 - perspective view of vertical scheme
Source: author

Contour Parti

The main idea in this parti is to preserve the history of the existing site which is threatened by inundation and erosion by taking on the shape of the current shoreline. This creates a set of pavilions that are linked by an elevated walkway with an observation area that is in direct contact with the tides below.

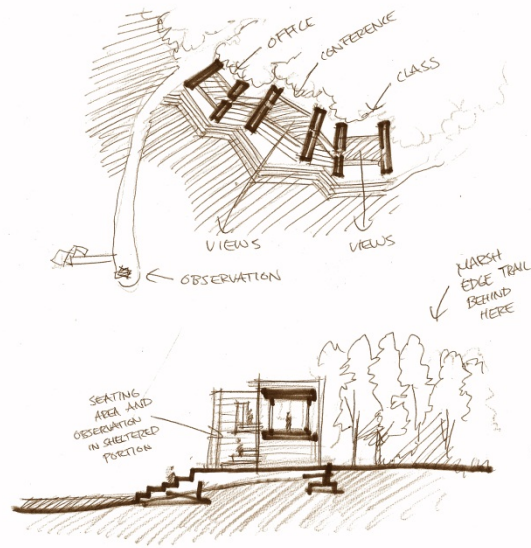


Figure 36 - plan and section of contour plan
Source: author

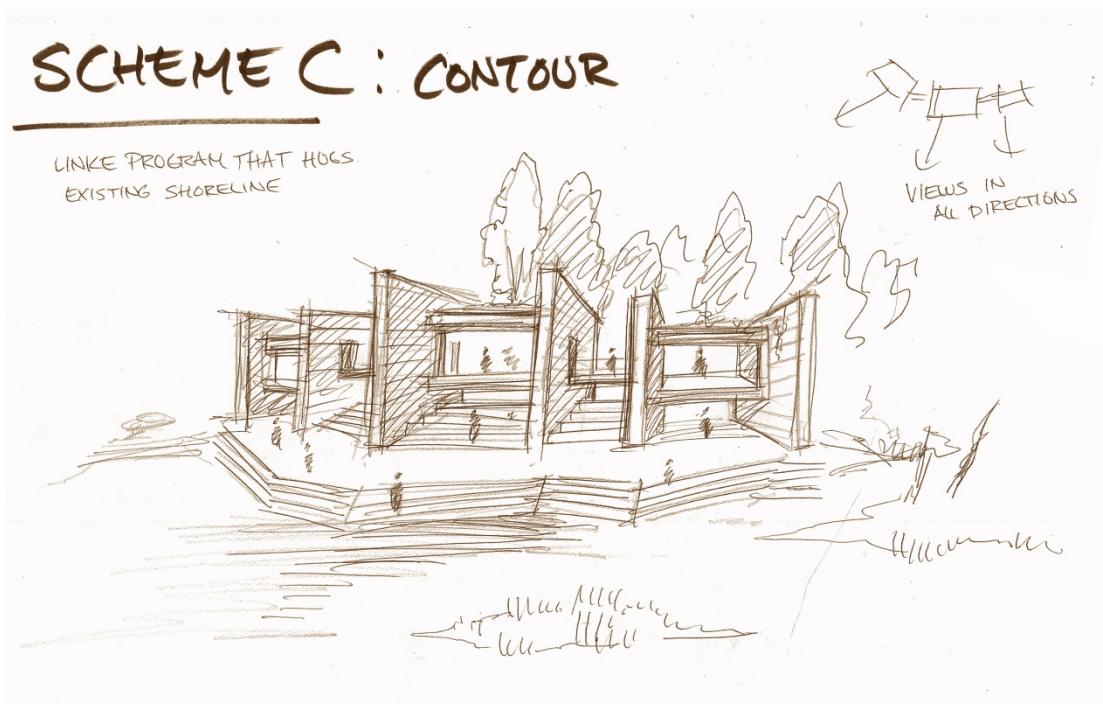


Figure 37 - perspective of contour parti
Source: author

Strategies

Based on analysis of the site and the preliminary explorations of parti, a set of basic strategies for the intervention can be generated. These are:

- 1. Change over time** - identify long term and daily/seasonal changes on the site
- 2. Linear Organization** – distinguish the manmade from the natural landscape
- 3. Small scale interventions** – mark the site without interfering with natural processes
- 4. Simple construction** – allow for disassembly and reallocation of materials
- 5. Flexible framework** – invites new interpretations and reveals traces of past iterations

The explanation of the final proposed intervention will be organized by these strategies.

Change over Time

Though this was already touched upon within the site analysis, the key to positioning and designing the various components of the program is understanding how the landscape will change over time, whether these are changes that happen daily, seasonally, or over a century.

The major long term change that determines the directionality of the intervention is sea level rise. Based on the topography of the site, it appears that the inundation will occur in a roughly linear manner and, for the most part, from the southwestern portion of the site, affecting the steeper northern portion of the site minimally. This establishes a clear axis of long term change which can be used to organize the built elements.

Figure 38 – effects of sea level rise on site over 100 years
Source: author with Google Maps base



The inundation will also affect the distribution and size of marsh zones and the saltwater intrusion will cause many of the loblolly pines on the site to die. Using the wood from the site as part of the construction process is an effective way of preserving the memory of the past landscape and building in a sustainable manner.

Some notable seasonal changes over time are the migrations of different species of birds, the change in the height of the groundwater on the site which fluctuates by about six to seven feet between spring and fall, and changes in the temperature and foliage. Daily changes to consider are the movement of the sun, the subtle effects of the tide, and changes in temperature and wind direction.

There have also been changes in the manmade structures on the site. The observation point had a tall tower structure built upon it during the 70's which was shortened significantly in the 80's and then disassembled

altogether in the 90's. This provides a useful precedent for adapting buildings on the site in accordance with climate change.

Linear Organization

As mentioned above, the inundation of the site over time has a clear directionality which establishes an axis of change. In order to allow visitors to experience this as much as possible and to allow these processes to leave their mark on the manmade interventions, the programmatic elements are organized along this axis in a linear procession.

A linear architecture provides a datum for the measurement of change in landscape and forms a strong connection between the passage of time and distance traveled, therefore space. Echoing this rectilinear geometry in the individual architectural elements as well creates a strong distinction between built elements and natural features

which makes the changes due to weathering
and other processes all the more apparent.



Figure 39 – axis along which sea level rise will have the greatest effect
Source: author with Google Maps base



Figure 40 –sight lines between significant points on site and from approach
Source: author with Google Maps base



Figure 41 – plan of proposed intervention
Source: author



Figure 42 – axial arrangement referencing long term change
 Source: author



Figure 43 – series of interventions focusing on shorter term changes
 Source: author

Small scale interventions

With the overall axial procession marking the change on the site due to sea level rise, the individual interventions that occur along the way take time down in scale as well and explore daily and seasonal changes. At the highest point of the site on the north end the trail begins with the main building which includes the meeting area, field office, and restrooms. Moving towards the south one encounters the outdoor teaching area, the sun and rain passageway, a series of tide pavilions, and finally the observation tower.



Figure 44 – perspective of approach to main building
Source: author



Figure 45 – perspective of exterior of meeting hall and field office
Source: author



section through meeting room looking northeast

Figure 46 – section through meeting area looking northeast
Source: author



Figure 48 – plan of ground level showing meeting area, storage, and restrooms
Source: author



Figure 47 – plan of upper level showing field office
Source: author

Outdoor teaching area



Figure 49 – overhead perspective of outdoor teaching area in fall when groundwater level is low
Source: author



Figure 50 – overhead perspective of outdoor teaching area in spring when groundwater is high
Source: author

Sun and rain passageway

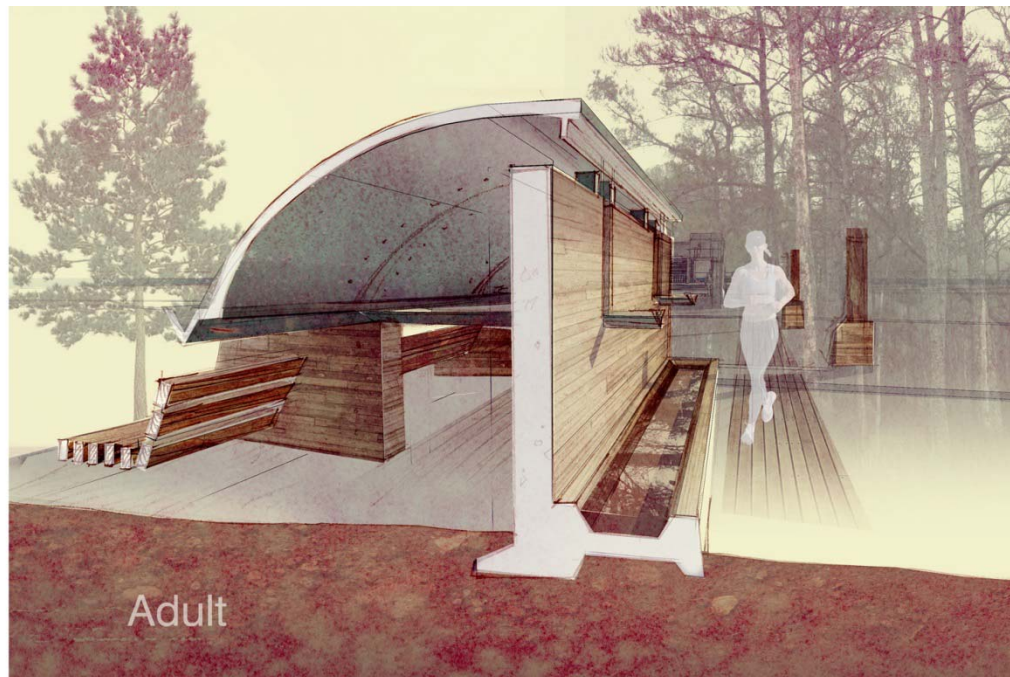
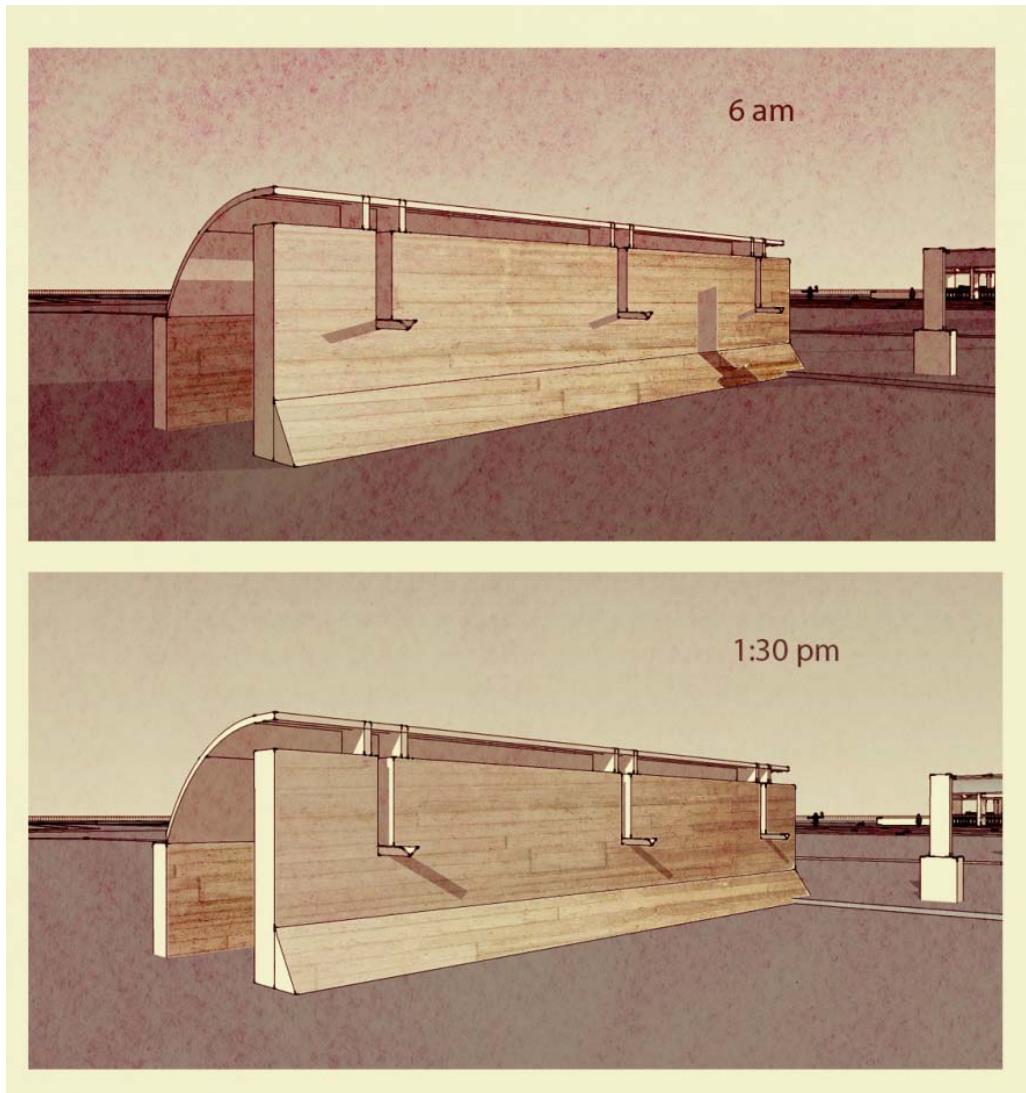


Figure 52 - section perspective of sun and rain passage showing experience of adults who remain on the exterior
Source:author



Figure 51 - section perspective of sun and rain passage shoeing experience for young children who can explore the interior
Source: author



**Figure 53 – exterior of passage at different times of day
when it is sunny
Source: author**

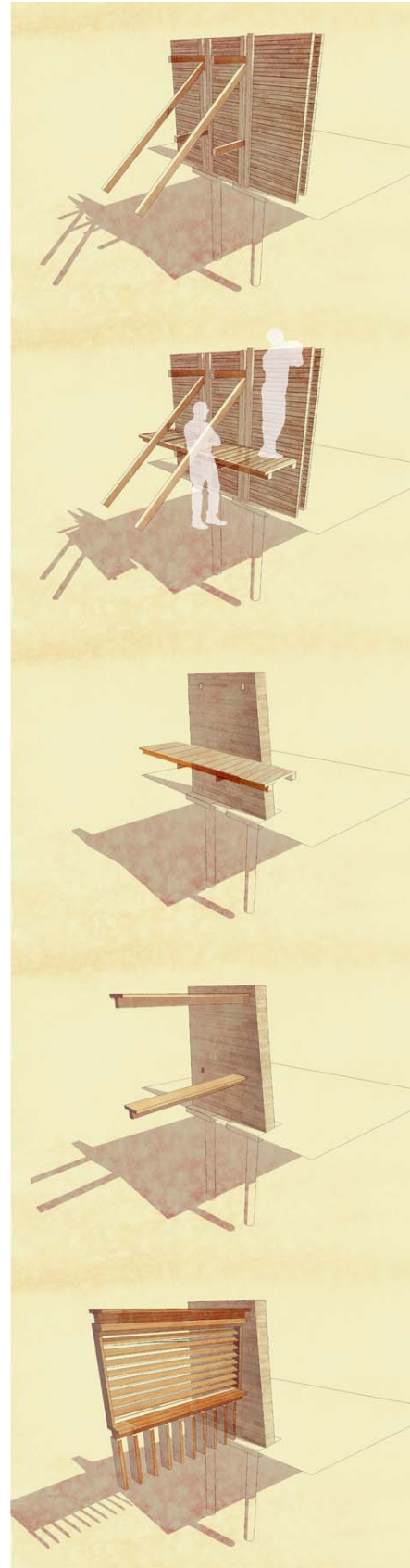


Figure 54 – perspective of observation tower
Source: author

Simple Construction

The above interventions are all joined by a common vocabulary and construction technique though they differ in function. This construction method begins with a series of excavations for the insertion friction piles which will be cast in place. The load bearing walls are then poured in place using the wood from trees that have died on the site due to saltwater intrusion for the formwork. For walls of greater height, a four foot high platform must be erected so that a nine foot wall can be poured by hand. Once the formwork is removed, vestiges of the platform can remain in the form of patios, shelves, and stair landings. The holes left by the formwork can also be used to insert the structure for the wooden infill of the façade. The panels of louvers are a simple module that can be disassembled and reallocated.

Figure 55 – sequence of construction for the various interventions composed of both permanent and flexible elements
Source: author



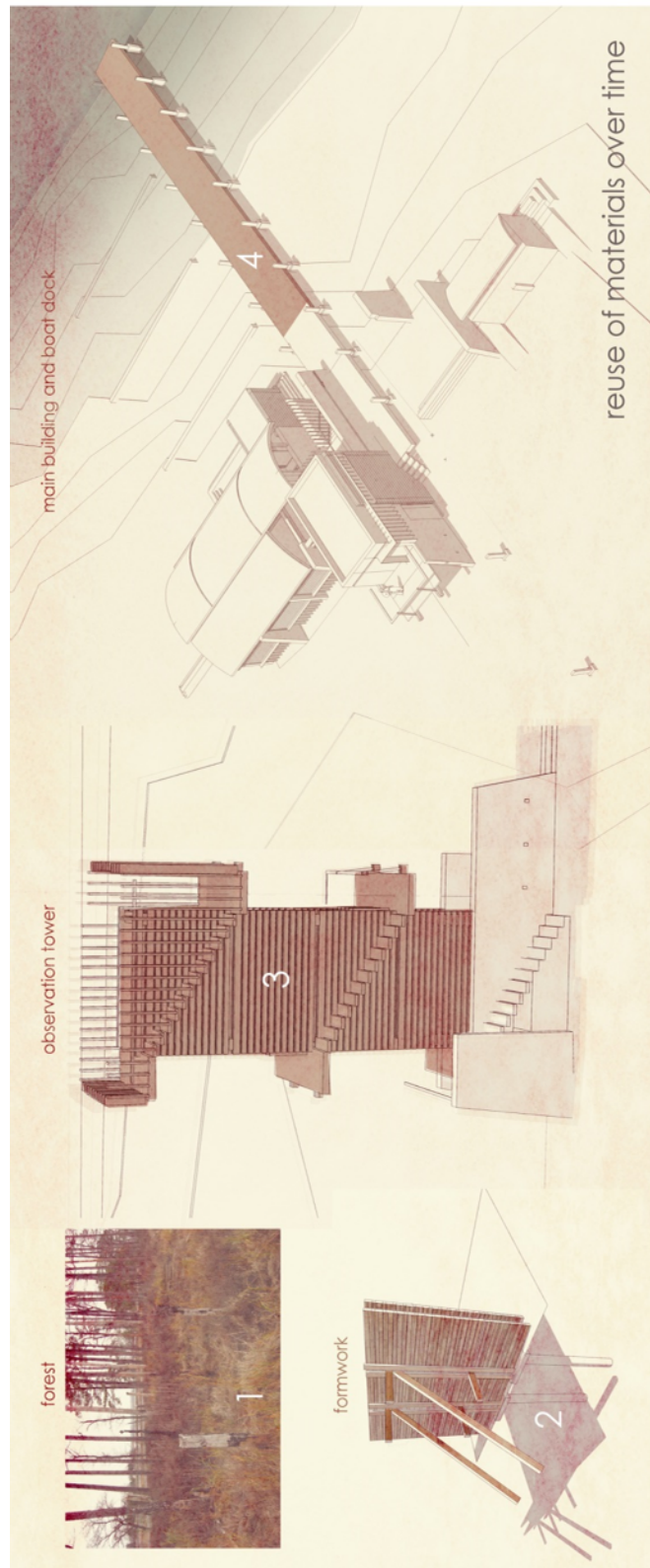


Figure 56 – diagram showing continuity of materials throughout construction process over many years

Create a framework

Because interpretability and the opportunity for visitors to reimagine the intervention with new programs and forms, it is important that the way in which the buildings evolve is not overly prescriptive. Therefore the following images that depict the various parts of the intervention at different points over the next hundred years are simply a suggestion based on what possible needs may be such as a boat dock or moving the meeting room up to a second level. The real needs of future users are of course unknown. The only requirement is that traces of past iterations remain just as traces of the original construction process remain and are used in new ways. The overall plan itself is sparse enough to allow for the addition of additional pavilions, sculpture, or other installations along the path.



Figure 57- perspective of main building showing approach from boat dock on the Little Blackwater River after about 70 years
 Source: author



Figure 58 – perspective of observation tower showing partial state of disassembly and tide pavilions after approximately 30 years
 Source: author



Figure 59 – perspective of tower base after inundation in approximately 70 years
Source: author

Chapter 7: Conclusions

The proposal described above is one very much dominated by the conditions of the site and one which inherently reveals those conditions through some very simple positioning and geometry. At first, these conditions seemed very restrictive and did not allow for a form or construction based solely on aesthetic considerations. However, in attempting to work closely with the materials of site and creating a construction process that was both unobtrusive and practical, a very dynamic project came into being which may

amount to more the design of a process rather than the design of a building.

While the architecture itself is very site specific, these strategies can be employed with a variety of programs on a variety of sites.

Essentially, all that is necessary is the insertion of a foreign object that creates a point of reference from which a person can reflect on memories generated by associations with marks from the past as well as make predictions about the objects future form.

The basic formula for such an object is a permanent but somewhat fragmentary structure, coupled with more adaptable elements that will allow the form to remain useful with changing needs.

In summary, the goal of this investigation was to design an architecture that was capable of telling its own story and to a certain extent, the story of its surroundings. The desire was to reconnect the human understanding of time with the understanding of space by allowing

visitors to experience change not only of the building but also of experience as one moves through and through repeated visits. This can be seen as an attempt to humanize buildings and let them show their age as we ourselves do.

The proposed solution is also grounded in sustainability. In a world of constant global climate change, old solutions shouldn't be discarded so that a brand new building exists for every necessary adjustment. While it may require a little more effort and foresight, existing conditions should be built upon so that their history can remain and be learned from in the future. It may be that people can care more deeply for a building that bears the marks of past generations and on which they in turn can leave their own mark.

Notes

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- ¹ Izchak Miller, *Husserl, Perception, and Temporal Awareness* (Cambridge, MA: MIT, 1984) 84
- ² Miller 86
- ³ Miller 93
- ⁴ Mohsen Mostafavi and David Leatherbarrow, *On Weathering: The Life of Buildings in Time* (Cambridge, MA: MIT, 1993) 86
- ⁵ James Marston Fitch, *Selected Writings on Architecture, Preservation, and the Built Environment* (New York: W.W. Norton, 2006) 239
- ⁶ Stewart Brand, *How Buildings Learn: What Happens after They're Built* (New York, NY: Viking, 1994) 119
- ⁷ Arata Isozaki, "On Ruins" (*Lotus International* 93, 1997)
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- ¹¹ Angie Carlisle, Caleb Conn and Steven Fabijanski, *Dorchester County Inundation Study* (Towson: Towson University, 2006) 5
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