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The sleeping giant: Revealing the potential energy of abandoned industry through adaptive transformation

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The Sleeping Giant:
Revealing the Potential Energy of Abandoned Industry Through Adaptive Transformation

by

Wesley A. Bradley

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Architecture
School of Architecture and Community Design
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Dedication:

To my wife Holly who is the most understand and loving person I know.
Acknowledgments:

I would like to first thank my family for their support, love, and encouragement. A special thanks to Jim and Joh Lybass for their continuous love and kindness to our family. I would also like to thank my fellow students and faculty at the school of Architecture at the University of South Florida.
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Abstract:

With the downfall of industry, cityscapes have become speckled with post-industrial building fragments. Skeletons, left as the evidence of a past generation are waiting patiently for their chance to reemerge as active elements. Furthermore, they are ever-present but remain out of touch within the thriving urban organism that has engulfed their surroundings. These condemned giants, rich in history, location, aesthetics, and vigor sleep underneath the growth. Their post-industrial urban sites are generally discarded and forgotten. On these sites the fragments of the massive and extraordinary crumble. These large industrial buildings have become a burden to their communities. Not realizing what these decaying giants have to offer, people in the community wish to see them removed, losing the potential and beauty of these buildings forever.

Through adaptive-reuse, these sites can become active contributing parts of their communities. Sites become a canvas on which the voices of the past and present can speak to the future. Through research in new and inventive renovation techniques, cost efficiency, historical value, modern innovations,
green design, technology, as well as the use of new and existing materials, these buildings can begin to gain the approval of those opposed to their existence. Through an in-depth, hands-on look into interesting areas of mechanics, industrial gearing, and machinery, interactive elements of the past can come to life. These unused irritations can then be molded into working inhabitable elements for the future.

On a small island in Saco Maine a few of these giants slumber. A design project [reusing] these buildings and their sites will be developed to invigorate the area. This development will be designed using prior research and conceptual thinking related to an adaptive reuse strategy. This pursuit awakens idle, industrial buildings and generates a progression that links these elements as a cohesive part of the city.
Problem Statement:

“What we need is continuity . . . historic preservation is not sentimentality but a psychological necessity. We must learn to cherish history and to preserve worthy old buildings . . . we must learn how to preserve them, not as pathetic museum pieces, but by giving them new uses.”

Ada Louise Huxtable
Lessons In Healing the City’s Scars

As the discharge of [new-fangled] construction woefully wanders amongst the ancient air currents, drifting vast distances as a weightless essence of an ever evolving world, it begins to settle on objects unfamiliar to its youth. Slowly swaying downward and seductively curving aloft these particles drift like a stray leaf on a lonely autumn gale. Their destination is unknown, left to chance by the fickle urges of an adolescent breeze. For an eternity these infinitesimal remains of modern manufacturing glide, forgetting the frictional vibration that was their creation and taking their claim in the world as ever-present aspects known only as Dust. It is not the Dust itself that is of any
relevance so to speak, but more so what the dust comes to settle upon.

With the lightest touch, a few of these particles slowly slide to rest upon a curious looking item. A sliver of sunlight slips through a sequence of corroded holes in a rusting roof and drapes across the newly settled dust. In the shadows, the dim silhouette of an aged steel press rests snugly between two rusting I-beams. The amount of dust collected on the surface of this magnificent machine advertises the decades that have passed since its retirement. Years upon years have come and gone with no disruption. Its existence has been forgotten. The condition of the press is to degraded to be of any industrial use today. The major steam line sags as the woodblocks supporting it crumble with rot. To some it is trash, but to others it is a starting point. The remains of our forgotten industrial error sit untouched, covered with dust from an evolving world. A memory mostly found in a history book, too long forgotten, and far too long untouched.

These forgotten buildings of industry are found skirting most major cities. Once resonating with power and wealth, these massive giants ruled the land. Found along power providing rivers, filled-in canals, forgotten turnpike arteries, commercial ports, and near sources of raw materials, these buildings became the back drop of the cityscape (Bradley 1999, 3). Each structure was built to compete with its rival. Stronger more efficient buildings took the work of smaller factories. The battle of the industrial gods had begun. Steel clad giants crushing, ripping, and shredding their way into the twenty-first century. These factories were built to last, and are still found structurally intact today. “Virtually every city in the nation’s older industrial regions, no matter its size, grapples with the challenge of unused manufacturing facilities and other industrial sites” (Kirkwood 2001, 100). In the heat of battle these industrial giants devoured
raw materials and bled pollution. From their smoke stacks spewed the waste of burnt oil and coal. These thriving factories had only one goal-to produce-and produce they did until their services were no longer needed. Due to the decline of heavy industry in the late-twentieth century, these abandoned industrial sites became abundant (Jacobs 2009, 1). Almost as fast as it came, the industrial boom fizzled out. Hundreds of factories were closed and left vacant. The workers packed up and the doors were locked.

Today these building are still standing, doors still locked and covered in dust. “Public concerns about health effects from hazardous chemicals, stricter environmental laws, and changing private-sector development priorities have made it increasingly difficult for communities to restore and reuse these former manufacturing sites” (Kirkwood 2001, 127). These industrial buildings have collected and formed “Manufactured sites” (Kirkwood 2001, 127). The term Manufactured sites relates to the emerging efforts to address the legacy of contaminated and derelict lands that have been left by past industrial activity (Kirkwood 2001, 127). Some industrial sites have turned into hazardous wastelands, leaving little legal room for land use options. These hazardous industrial sites are becoming more difficult to deal with.

Not all of these abandoned industrial sites are hazardous. There are quite a few that are fit for the subject of “reclaiming and recycling” (Kirkwood 2001, 128). However, the industrial sites and buildings that make it in the media today almost always are affecting our cities and environment negatively. These blighted landscapes conjure up two main issues in today’s society. The first is the “remaining pervasive pattern of hazardous substances found in the soil, groundwater and within the fabric of the buildings and infrastructure left standing on-site. Second, the motivation to return these manufactured sites to productive use and the physical means
by which this can be carried out" (Kirkwood 2001, 128). As these manufactured sites continue to decay and deteriorate, the conditions of their surrounding environments suffer not always from chemical hazards, but also through visual deterioration. These industrial areas are aesthetically displeasing to most people. Their rusting facades and lack of feral landscape does not always complement the newer buildings surrounding them, however, these buildings give an identity to the context that is surrounding them. These industrial sites carry with them the history of their cities. It is not viable to just remove and replace these buildings in the same manner we clean the dust from our ceiling fans. These areas were constructed in a different era with pride in the American economy. American industrial works consisted of a number of buildings engineered specifically for manufacturing, yet were adaptable enough to house various types of industrial operations (Bradley 1999, 3). These factories created a space and identity for each manufacturing task that operated within them. Their functional layout allows them to easily be adapted, reused, and transformed to meet the needs of tomorrow.

Fortunately, there are financial incentives and numerous planning tools available that help make the adaptive reuse of these facilities more economically feasible. The existence of a sustainable building site, along with some existing infrastructure and materials, creates an alternative to our modern bulldoze and build mentality. There will always be additional costs in the reuse of buildings and sites, but through careful planning, sound judgment, and creativity these items can be effectively addressed.

Adaptive reuse is simply the act of adapting old structures to facilitate new functions. It is described as “a process by which structurally sound older buildings are developed for economically viable new uses” (Austin 1988, 49). Initially developed as a method to preserve historic buildings from demolition; adaptive reuse has
long been an important aspect in the development of cities. It started in the 1960s and 1970s when old buildings were reused in order to limit construction costs. At this time there were growing concerns for the environment and natural resources were becoming extremely expensive. High costs and associated difficulties securing building permits were just a few of the reasons that adaptive reuse became a popular method of development (Fitch 1976, 169). Large open spaces like those found in industrial buildings are often well suited for reuse. These industrial facilities were built to be extremely strong and durable. Buildings built in the early nineteenth century are found standing today with their brick exterior and columns still able to support heavy industrial loads. This allows some factories to be reused with a minimum amount of structural effort. In most cities, developers utilizing adaptive-reuse techniques are re-purposing buildings as residential units for financial benefits. Reusing these facilities as residential housing allows for a quick turn of revenues but does not always include what is best for the city. The act of converting these abandoned buildings into residential units may be a good idea in areas troubled by insufficient housing, but this is not the case in all cities. In many areas there are better alternatives than conversions to residential development.

The potential of these factories and their sites far outweighs the cost of construction. When left with no other option, adaptive reuse should be the preferred strategy for industrial application, favored over demolition and redevelopment. The potential benefit of these sites goes far beyond the lives of the occupants and into areas of green communities, transit applications, and sustainable transformation. It is from these old buildings that the roots of our cities grew and it is in these old buildings that the new development of our cities should come. “For a city to work and appeal to all different types of people, old buildings become a must. These accentual old
buildings, decapitated in state, make it possible for a city to grow” (Jacobs 1861, 187).
Site selection is a major area of importance for this thesis. Research began by investigating sections of cities that were overrun by abandoned buildings. Each location was evaluated with these main aspects: the site needed to have unused industrial structures, have some historical value, allow for new development, have a need for improvement, and influence the city’s development. The site would need to not only house an adaptive-transformation project but be able to feed its new found livelihood back to the cities surrounding it. After researching many areas a small island in the city of Saco, Maine was found to have an appropriate site for this proposed project.

The City of Saco Maine is located six miles form the Atlantic coast ofSoutheastern Maine. It is bordered by the Saco River to its south. The City of Saco has a total population of 18,164. Saco’s twin city located across the Saco River to it south is Biddeford. The city of Biddeford has a total population of 21,594. Both cities are home to an early 1800s mill complex consisting of over twenty mill buildings and over eight million square feet of mill space. Four of these building are located on Saco Island.
consisting of over 690,000 square feet of mill space wafting to be transformed.

The chosen site is located between the cities of Saco and Biddeford, Maine on Saco Island. Saco Island is nestled between Saco and Biddeford on Mane Street that connects the twin cities over the Saco River. The 35 acre site allows for ample redevelopment options as well as adaptive-transformation space. The purposed design for the island will be a six million gallon aquarium facility, marina, and park. The two of the four existing mill buildings located on the island will become the Maine Aquarium. A major advantage of this site is that it sits only a block from both Saco and Biddeford’s downtown shopping strips. Its access to public transportation, walkability, water access, and the already existing Amtrak station all work together to connect this site to its surroundings creating an ideal location for this design project to be implemented.
In most cities today, graveyards of abandoned buildings can be found clustered in inactive corners. These buildings that helped shape their cities now sit as tributary tombstones of an industrial past. The reuse of these buildings can not only save money in economic times, but bring new life to otherwise dead areas of our cities.

The major goal within this thesis is to reactivate a section of the deteriorating industrial fabric of Saco and Biddeford, Maine. A large number of unused factories and mill buildings are clustered together in the heart of these two cities. Small attempts at converting some of these buildings into residential units and shopping malls have been unsuccessfully implemented. The need for housing in the Saco and Biddeford area is not adequate enough to justify the reuse of mill buildings for residential use. Since the decline of the milling industry both Saco, and Biddeford have struggled, leaving most of the industry’s buildings empty. Saco Island is home to four of these mill buildings. It is on this island that an adaptive-transformation will take place changing the semi-abandoned mill complex into the Maine Aquarium.
generating new activity for the island and surrounding areas.

This project focuses on activating the island environment in order to stimulate the cities. It will not only bring people back into these buildings but allow the potential energy of these buildings and their site to be unleashed. More than an adaptive-reuse strategy, this project utilizes an adaptive-transformation process that allows the buildings to transform in order to reveal and express their potential energy. The term adaptive-transformation is applied to this thesis, deliberately distinguishing it from the common stereotypes associated with adaptive-reuse and historic preservation. With this transformation, opportunities for the community and surrounding areas of Maine will arise. The reactivation of the island will consist of: The Maine Aquarium, The Saco Marina, Sobi Park, and the Saco River Walk. These four new elements, in conjunction with the existing mill buildings, hydraulic power station, and an Amtrak station will reenergize not only the island but the surrounding cities as well.

Saco Island’s four existing mills are located on the southwest side of the island. Building one is a brewery and pub (Fig. 2), building two is residential condos (Fig. 3), and buildings three (Fig. 4,5) and four (Fig. 6) are empty. The Amtrak station is located on the northwest side of the island (Fig. 7). Adjacent to the Amtrak station, just across Main Street, is NextEra Energy Resource’s hydroelectric project (Fig. 8). The master plan will connect and utilize all of the existing elements on the island, allowing a fluid transition between the park, marina, rail, and aquarium. Parking will be available, but limited in order to boost the cities public transit opportunities.

Saco Island is a reminder of the industrial past of Saco and Biddeford, Maine. The central location of the island allowed it to thrive during the 1800s, but the decline of the milling industries left the island abandoned. The four-story red brick mills, that now sit
unused, were originally saw milling operations that utilized water powered turbines to operate the machinery. As the needs of the rapidly growing cities of the nineteenth century changed so did the mills of Saco. The mills first changed from sawmill, to steel mill, then to textile mill, and then closed. The large red brick buildings now act as a token of the cities history. It is not the intention of this project to compromise the historical value of these mill buildings, but rather to create a transformation that will alter their historical appearance while enhancing the historical awareness and potential of the mills. The transformation is an acceptable means of evolution for the buildings. It will allow the buildings to express the potential energy of the historic facility in a new and exciting environment. The Maine Aquarium will be the major focus of the projects adaptive transformation strategy. It will utilize Mill Buildings Two and Three as the new aquarium facility. Each building will be evaluated and then allowed to react with a controlled stimulus creating a kinetic reaction, resulting in the buildings transformative evolution. This stimulation will alter the appearance of the building creating an exciting and new aquatic based environment. The new facility will allow people to kinetically interact with new and old elements. As people are allowed to experience the aquarium and utilize the new facilities, Saco Island will evolve from a place in passing to a place of destination.
Fig. 5. Mill 3

Fig. 6. Mill 4
Fig. 7. Amtrak Station

Fig. 8. NextEra Energy Resource's hydroelectric
“Any city is comprised of many systems—economic, technological, social, cultural—which overlay and interact with one another in complex ways. Each system is different, but from one point of view all share a common purpose—the organization of energy—and a common goal—giving the cumulative energy of the city a coherent form.”

The Architecture of Energy
Lebbeus Woods

Energy exists in all things; however it is not always recognized as energy. The clothing that people wear for instance, might appear to hang in the closet and have no signs of energy, but if the shirt or pants is examined closely the evidence of energy is undeniable. The intricate weaving of the thread patterns that make up the thousands of precise maneuvers that were used in creating this magnificent epidermis cover not only physically show the energy that was used to create it, but show the potential energy it posses. If this article of clothing was not hanging in a closet the amount of energy that would be needed to replace it
would equal the original item's potential energy. In order to replace or make a new article of clothing, some sort of kinetic energy will have to take place. The energy might come from the years of studying diverse weaving patterns, building the weaving machinery, building the factory that housed the machinery, training the people to work the machinery, and finally manufacturing the article of clothing itself. This one single lifeless item potentially possesses this entire process of energy.

In an installation called the Architecture of Energy by Lebbeus Woods, the potential energy of an object is represented in a kinetic form. Woods started this process by creating a two-dimensional drawing that represented the energy of a city (Fig. 9). He then created a new drawing that began to represent the first drawing of energy and the kinetic effort of creating it (Fig. 10). From this new drawing he moved into the third dimension, creating a series of room installations that expressed the kinetic process of creating the drawings and their potential energy. (Fig. 11, 12) Each step Woods took began to change the static energy of his original drawing and transform it into a visual form of energy. As the project proceeded, Woods searched for a coherent form to represent this potential energy. The final installation that was implemented in the city itself vividly expressed this kinetic process and allowed the potential of a static wall to interact with the kinetic design of the installation, resulting in the wall's potential energy becoming conceptually kinetic. This concept of expressing potential energy through kinetic formations can be applied in an architectural manner allowing the energy of a city to influence and alter the appearance of static objects.

The potential energy of an object is not always represented by the object itself, but is often represented by the object's interactions. “The larger part of the city’s potential energy is contained in its people” (Woods 2009, 1). People are often the source of energy...
for an object. If an object is new it is more likely to be thought of as possessing it’s initial energy, but as an object ages and begins to receive less and less interaction, its’ initial energy will decline. The initial energy of an object is the energy needed to keep the object looking new. “New energy—in the form of maintenance—must continually be added to the system of materials, or they will decay. Metaphysically speaking, new energy—in the form of human thought, emotion, activity—must continually be added to the system of boundaries, or they will lose their purpose and meaning” (Woods 2009, 1). As soon as an object is made it begins to decay and requires energy to be put back into it. This allows the object to retain its original functions. The less interaction the object receives the harder it is to recognize the objects initial energy. This occurs until the object is thought of as possessing nothing of value and is then discarded. The interaction between people and the object is vital in maintaining the initial energy of an object.

Old buildings have often lost their initial energy but still retain potential energy. The mill buildings on Saco Island are a prime example of this. These buildings have very low initial energy due to their abandonment and lack of proper maintenance. Their potential energy is not as visible as their lack of initial energy making it difficult to gauge. In order to reveal their potential energy in a cohesive form a series of kinetic reactions must occur. As in the instillation done by woods a layering of kinetic exercises can be used to formulate and express the mill building’s potential energy.
Kinetic movement through the city (Woods)

Fig. 13.

Conceptual sketches

Fig. 14. Conceptual sketches
Fig. 15. Kinetic movement through streets (Woods)

Fig. 16. Expression of energy (Woods)
Fig. 17. Final installation (Lebbeus Woods)

Fig. 18. Conceptual sketches
Saco Island is burdened by abandoned mill buildings that haunt its further development. The island has the potential to become a major contributing part to both Saco and Biddeford, Maine, but currently lacks the infrastructure. Without the development of this island the two cities will never be able to truly connect and feed from each others growth. The development of these unused mill buildings becomes the key element in converting the island. The buildings need to become the source of life for the island. The mills cannot be redeveloped into static development, but need to be allowed to express their potential.

The problems throughout this thesis will be answered with research on select case studies, experimentation with materials, observations, and applications. These methods of research will reinforce the theoretical concepts of the project through out the design process. The research will be tested in small scale applications that will reveal their successfulness and potential.

The design methods for this project will encourage the reaction, change, expression, and evolution of the buildings. These four items, when applied to the adaptive-transformation
process; allow the expression of the building’s potential energy to be revealed.

Allowing the mill buildings to react is the primary starting point in unveiling their potential energy. The buildings will react when the construction process introduces the application of new materials. In the initial phase the buildings and their contents are forced to react to the preparation for the conversion. Items will be removed and elements cleaned. It is in this first phase when the initial energy of the buildings are low that some of the buildings potential energy can be overlooked. Items that may not be of any use to the buildings at this time may become very important elements later on. For example, old mill machinery may later become interactive exhibits that engage and interest the new users. The buildings must also be allowed to react to their new use as an aquarium. This allows the buildings’ potential energy to become a kinetic part of the renovation process. The buildings will react differently to different materials and procedures. These reactions can then be expressed in the architecture from a range of very controlled to unrestrained.

As the mill buildings are allowed to react changes begin to occur. The amount of change is directly related to the reaction and how controlled it is. There are also other elements that will evoke change in the buildings. The function of the buildings as an aquarium will demand the need for structural change. This change can be controlled to reveal and express the buildings potential energy in a form of kinetic representation. This change will draw attention to the new aquarium allowing the mill building’s potential energy to be revealed.

The expression of the kinetic process of change is a key element in revealing the potential energy of the mill buildings. Without the expression of this process the kinetic energy used in the transformation may be overlooked. Kinetic energy can be
expressed in several different ways. It can be expressed in craft, design, fabrication, and many others. This part of the transformation is a deliberate step used to reveal the potential energy of the mill buildings and the entire project to the world.

The final step is to allow the buildings to evolve. It is important to think of the mill buildings as a creature that is constantly evolving during its adaptation to an aquarium. By allowing the buildings to evolve during and after the adaptive-transformation process the building’s potential energy can creatively be expressed utilizing the building’s full potential. Allowing the potential energy of these buildings to be revealed in a more kinetic experience, the mill buildings of Saco Island will be transformed into an exciting aquarium facility.
Case Studies: Adaptive-reuse

The following case studies were chosen to research industrial adaptive-reuse. The adaptive-reuse of a power relay station, shipping warehouse, and blast furnace were studied to help understand the process of adapting buildings for new uses. The research of these case studies aided in the development of this thesis’s adaptive-transformation strategy.
Case Study 1: Powerhouse, Dallas, Texas
Date of Project: 1988, Architect: Gary Cunningham

The Powerhouse is an adaptive reuse project designed by Gary Cunningham. The 1920s electrical substation in Dallas, Texas was converted into a residential home by Cunningham. With the start of the conversion Cunningham discovered that the old brick building was more than just a shell. The building was structurally sound, but at first glance appeared to be in a state of major distress. The building’s “initial energy” was depleting after years of zero maintenance and purpose. As Cunningham began to assess the building’s potential, he noticed the original character of the building. The building was originally built to house not people but machinery. This energy moved through the building coming and going the same as the original worker would have. Cunningham began to realize the similarity between the energy that used to reside in the building and the people that would soon inhabit it. This connection became the rationalization of
the building's potential to become a home not just for energy but for people.

With the start of the demolition and clean up Cunningham and his crew got their first taste of what was underneath all the dust and decaying rubble. They were able to accurately examine the building's structural components and assess what state of “initial energy” the building was in. They were amazed to find that not only was the building in relatively good condition, but all of the interesting electrical elements were still intact. Cunningham knew as he carefully cleaned out the old electrical elements that he was not just removing dirt and debris he was introducing energy back into the building. He found intriguing electrical chase ways hidden beneath the rubble of the deteriorating interior. He found old chain hoists hanging between floors. Cunningham could feel the “initial energy” in the building beginning to grow. As the building was cleaned, chains were oiled, iron was exposed, and the energy of the building was recharged.

It was in the next step of the construction that a new level of energy was reached. A small reaction between the old existing elements of the building and the new materials Cunningham introduced to the building allowed the building’s potential energy to become kinetic. The fluid movement from room to room mimics that of the movement of energy carried by the cables that used to serenade the building. Cunningham did not plan for this reaction to occur, he may not have even noticed it, but nevertheless it happened. Cunningham’s select use of materials in the house allowed him to achieve this energetic state in a controlled fashion. At the time he may not have been thinking about the building’s potential energy or even its initial energy, but it is evident in reviewing this project that both were utilized. The completed house allows the charm of the original facility to flow through it in addition to meeting the needs set forth by its new owner. Cunningham’s vision of the power house
began to possess a power that would bring people back into its interior not just to work but to live.

The power house can be used as a starting place for this project. The existing mill buildings on Saco Island have similar qualities that can be explored. Unlike the power house, the mills of Saco Island will be allowed to transform and express the kinetic reactions that take place. In the power house only a small portion of the buildings potential energy revealed to the new owners. This was sufficient for a single family home that did not need to bring groups of people back into the facility. An Aquarium, on the other hand, will have to create an exciting display that draws interest into the buildings.

Fig. 22. Case study diagrams of Powerhouse
Case Study 2:

Natural Capital Center, Portland, Oregon
Date of Project: 2001, Designed by: Ecotrust council members

The Natural Capital Center in Portland Oregon is a prime example of a building’s potential energy. The building, originally known as the McCraken Warehouse, was built around 1895 in the Richardsonian Romanesque style. It was used as a storage facility until 1997 when it was purchased by Ecotrust. Ecotrust, a nonprofit organization devoted to regional conservation issues, was looking for a building to make a statement in this rapidly developing area of Portland.

The plan was simple. Ecotrust would restore the warehouse but in the process make it as green as possible. A team of council members headed by Stewart Brand took on the challenge of redesigning this green building. The process of making the warehouse environmentally friendly created a reaction between the new green materials and the old materials of the original construction. It was in this reaction that the old warehouse’s
potential energy began to be revealed. These changes were the result of the building’s potential energy reacting with a form of kinetic energy. As the building began to be remodeled it also began to be renewed. The warehouse was renewed not only in a physical way, with new doors and windows, but in an environmental way, allowing the building to give back to the surrounding area of Portland. The potential energy of the new building began to be realized as the warehouse changed from an old storage building into a mixed use facility and headquarters for Ecotrust.

The new building was rebuilt to be green. From the roof garden above to the pervious parking lot below the building invested its new found energy in the environment. The building became more than just a green structure when citizens of the community gathered in its parking lot on market days. The energy of the building spread through the streets allowing people to access the building in more efficient ways. The old warehouse can still be seen underneath the new renovation, but a new respect and appreciation for the warehouse is now realized. Whether it is shopping in the environmentally conservative stores or riding a bike to the fresh market, a person can see and actively engage with the building and the environment.

The potential energy of the McCraken Warehouse can now be seen and utilized. A building that once just took from the environment now gives back to the community. Through this controlled green reaction the warehouse was allowed to kinetically change to better its environmental surroundings. The Natural Capital Center and its site are no longer just an old storage warehouse that people drive by on their way to work. It is a building that people go to learn about green construction and environmental issues.

This study shows a different angle for expressing a building’s potential energy. Allowing the building’s new purpose to change how people view the world can directly affect the energy and power...
it possesses. The aquarium will try to expand its potential energy through the education of the community and aid the marine wildlife in the area. However the expression of the kinetic development of the natural capital building was non-existent. This does not allow people to understand the building’s full capabilities.
Fig. 27. Case study diagrams of Natural Capital Center
Case Study 3:

Museo del Acero, Monterrey, Mexico
Date of Project: 2005, Architect: Grimshaw Architects

The silhouette of a decommissioned blast furnace from the 1960s accents the skyline of the city of Monterrey, Mexico. Its jagged edges and unusual lines provoke the imaginations of the passing pedestrians. The blast furnace has no use other than that of visual diversity for the surrounding city. It had been this way for some time until the Grimshaw Architects firm was commissioned in 2005 to design a Museum of Steel from this towering beast. For Grimshaw this was not the first time he laid his eyes on the beast. A previous trip to Monterrey in 1997 allowed him to see the steel-making heritage along with the hulking Fundidora blast furnaces in the area.

The 70-meter-high furnace structure towers over a popular and verdant park. It is strictly in the uniqueness of this furnace that the revealing of potential energy becomes relevant. The climate and site of this adaptive reuse project are of no use in this

Fig. 28. Museo del Acero
study, but the adaptive reuse strategy and evaluation are intensely cohesive. As Grimshaw added a series of habitable spaces into this primarily uninhabitable monster, he revealed another way to allow the potential energy of the building to be explored. It is the exploration of uninhabitable space that is relevant to this project. Creating habitable space in formerly uninhabitable areas is like allowing kinetic energy to interact with potential energy. As people begin to explore these new areas of the blast furnace a kinetic experiences is created that expresses the potential of these formerly static areas.

Giving people to access to the catwalks and view areas of the blast furnace that were not possible before allows the building the capability to reveal its potential energy in an interactive form. Unlike the reaction created between two materials that can be controlled, this reaction takes place on an individual basis and differs for all users. It is this form of reaction that is needed to allow the potential energy of a building to divulge itself. Some may experience an exciting new environment while others may be disturbed and uninterested with the unfamiliar elements. Both reactions are the type of responses needed to be able to truly experience a buildings potential energy.

This uncontrolled reaction between people and a new experience, coupled with the controlled reaction created between old materials and new materials, allows new elements of the building’s potential energy to be explored. This reaction allows the users to experience the building from a new and stimulating angle, answering their exploratory users. The explorative qualities of an aquarium when combined with the unfamiliar elements of the mill buildings will draw people in like insects to a street lamp at dusk. The aquarium would then allow the users to explore and experience the animals and architecture in different ways. One user may then be allowed to have several different adventures in the same facility. Like the blast furnace, an Aquarium will need to start stimulating the
imagination of the user prior to the entrance of the building. People driving by will then be allowed to explore the unusual exterior of the aquarium resulting in anticipated exploration. The typical need to hide all unpleasant machinery, pumps, sumps, skimmers, and aquatic plumbing will no longer be required, these elements create contrast to the clean lines of normality. The equipment can become visual elements like the towering stacks of the furnace that visitors can be allowed to explore in controlled situations. Applying these intriguing elements form this adaptive-reuse study will allow people to interact not only with the aquarium exhibits and marine life, but with the architecture.

Fig.31. Museo del Acero catwalk

Fig.32. Case study diagrams of Museo del Acero
Fig. 33. Museo del Acero stairs case

Fig. 34. Museo del Acero floor plans
Case study diagrams of Museo del Acero
Case Studies: Aquariums

The following case studies were used in research aquarium facilities. These case studies were looked at to determine the program of spaces that will need to be inserted into this adaptive-transformation project. They were also reviewed to show public activity surrounding their sites. These case studies can then be implemented into the design process.
Case Study 4:

The Georgia Aquarium, Atlanta, Georgia
Date of Project: 2005, Architect: Thompson, Ventulett, Stainback, & Associates

The Georgia Aquarium is one of the world’s largest aquariums with more than 8.1 million US gallons of marine and fresh water exhibits. Located in Atlanta, Georgia at Pemberton Place, the Aquarium is home to more than 100,000 animals of 500 different species. Its largest tank holds more than 6.5 million gallons of salt water and is home for a variety of marine life, including four young whale sharks, three beluga whales and a manta ray. This makes it the only aquarium outside Asia to house whale sharks. The aquarium was built on a 20 acre site north of Centennial Olympic Park in downtown Atlanta. Its close proximity to the park, Georgia Dome, the Georgia World Congress Center, Philips Arena, and CNN Center allow the aquarium’s visitors the capability to experience the city on foot.

The Georgia Aquarium helped drive new development in
the Atlanta area. The revitalized downtown can credit the aquarium with much of its new found energy. With the building of the aquarium new development flooded the surrounding area. New development is what is missing from this thesis’s site and surrounding cities. The development of a large scale aquarium, which will function as an anchor for Saco Island, will bring visitors from across the state. Like the Georgia Aquarium, this new level of activity will bring with it new development for the remaining mills and areas of Saco and Biddeford, Maine.

“A vessel of conservation, preservation and education, the Georgia Aquarium is a window to life in the deepest seas. The exterior hull shape ungluates against Atlanta’s “shoreline” while the interior immerses the visitor in this world without walls.” (TVS Design)

The users’ experience starts outside of the Georgia Aquarium when they see the unique exterior to this extraordinary building. The abstracted shape of a ship can be seen from the street constructed of blue metal and glass. The curved flowing roof design that represents swells in the ocean flow over the hull. The dynamic shapes of the exterior catch the eye of passing pedestrians.

The mere size of the aquarium’s marine tank capacity draws in crowds of people daily. As people enter the facility they are encouraged to explore the building’s exhibits. The act of allowing people to explore a space can sometimes create confusion, but also provides people the possibility to experience the Aquarium differently over several trips. This permits the building to change and evolve to entertain and stimulate the minds of its visitors.
Case Study 5:  

The Monterey Bay Aquarium, Monterey, California  
Date of Project: 1984, Architect: Esherick Homsey Dodge & Davis  

The Monterey Bay Aquarium is a fascinating aquatic experience for young and old alike. It was designed by Esherick Homsey Dodge & Davis as an adaptive-reuse of a sardine cannery on the Pacific Ocean shoreline in Monterey, California.

"Nostalgia for the days of Steinbeck’s Cannery Row dictated much of the design for this deceptively laid-back aquarium. The warehouse and boilerhouse—complete with eye-catching chimneys—of an abandoned cannery were supplemented by new construction which, though staunchly built of concrete, brashly parades timber framing like the earlier building and looks out on Monterey Bay through window walls of industrial sash. The layout of exhibits is casual and nonrestrictive; 20,000...
square feet of decks overlook the water.”

Contemporary North American Architecture:
From Postwar to Postmodern. p28-29.
Sylvia Hart Wright

The Monterey Bay Aquarium’s design allowed for it to become part of the shoreline of Monterey Bay. The conversion of the old canning building incorporated an aquatic cove that compliments the rocky shoreline and creates a natural sanctuary for marine life. This permits the building to become a part of the bay. This idea of building up to the waters edge can be applied on Saco Island creating a fresh water viewing area for local fish and wildlife.

1.8 million people walk through the doors the Monterey Bay Aquarium annually. Over 35,000 plants and animals can be found in the exhibits that benefit from a high circulation of ocean water obtained through pipes and pump in fresh from Monterey Bay. Utilizing its proximity to naturally balanced sea water, allows the aquarium to maintain and manage their exhibits to mimic that of the bay. This is a useful solution that can be applied to the development of the Maine Aquarium allowing it to filter and use the fresh water of the Saco River.

With the goal “to inspire conservation of the oceans” the Monterey Bay Aquarium educates its visitors. It is in this education that the aquarium is able to convert some of its potential energy into a kinetic form of education allowing it to expand beyond its walls. The aquarium also is home to the Ocean’s Edge Wing exhibit that has as a centerpiece, a 33-foot high, 1/3 million gallon tank for viewing California coastal marine life. Utilizing this tank, and mimicking the wave patterns of the ocean, the aquarium was the first in the world to grow live California Giant Kelp. In the Outer Bay Wing of the aquarium, a 1.3 million gallon tank features one of the
world’s largest single-paned windows.

The basic design of the aquarium supplies Monterey Bay ocean water to more than 100 exhibit tanks at rate of 2000 gallons/minute. This water is filtered during the day time viewing hours allowing visitors to see the exhibits clearly, but after closing the filters are bypassed allowing raw unfiltered ocean water into the tanks. The unfiltered water is cloudy but has more nutrients and food (plankton) for the plants and animals. The waste ocean water is returned to the bay completing the ecologically essential cycle of marine water. This natural cycle allows for the growth of items like the California Giant Kelp in an aquarium environment.

On Saco Island the rushing water of the Saco River that was used to power the mills in the past may be able to supply the new aquarium with water and power. Utilizing the surrounding resources like the Monterey Bay Aquarium, the Maine Aquarium will be able to sustain local marine life with minimal efforts.
Fig. 44. Monterey Bay Aquarium map
The description of this project is designed to create an Aquarium facility that becomes an anchor, bringing people and development to the cities of Saco and Biddeford, Maine. The Maine Aquarium will include multiple exhibits of local and exotic marine life. A variety of transitional spaces will allow the users to explore the facility and discover new elements. Six-to-ten-million gallons of fresh and salt water tanks will be implemented throughout the facility.

The aquarium’s visitor center and exhibits will be reusing and transforming the 600,000+ square feet of Mill Buildings One and Two. The dynamic transformation of these building will connect to several outdoor interactive areas that change with the climate. The aquarium will also house a research facility and water treatment plant. The plant will supply filtered water to the interior and exterior exhibits. It will also treat, mix, and supply the aquarium with salt water for its ocean experiences. Limited parking will be provided on the island, encouraging the use of public transit.

On the Island’s southwest side a 50 boat marina and river
walk will connect to the aquarium and Amtrak Station. Seven-to-ten acres of public park space will move pedestrians across the island. Several opportunities for commercial spaces will be implemented into the aquarium and marina. Saco Island will be converted from its current state of industrial leftovers into an activated destination for the surrounding communities.
### Aquarium Space Allocations

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<td>The Reef</td>
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<tr>
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<tr>
<td><strong>Employee areas</strong></td>
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</tr>
<tr>
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<tr>
<td>Marine Kitchen</td>
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<td>6,000</td>
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<tr>
<td>Break Room</td>
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<tr>
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<td>2,000</td>
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<tr>
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### Dry Food Storage
- 1,000
- 4
- 4,000

### Marine Medical Facility
- 5,000
- 2
- 10,000

### Water Treatment and Research
- Main Pump Floor: 60,000, 1, 60,000
- Mechanical Room: 1,000, 12, 12,000
- Labs: 10,000, 1, 10,000
- Machinery: 30,000, 1, 30,000
- Storage: 2,000, 1, 2,000
- Restrooms: 500, 2, 1,000
- Pump Room: 30,000, 1, 30,000
- Filtration: 10,000, 3, 30,000
- Salinity Mixing: 10,000, 1, 10,000

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### Marina
- Dry Boat Storage: 10,000, 1, 10,000
- Restaurants: 4,000, 2, 8,000
- Shops: 1,000, 6, 6,000
- Office: 1,000, 1, 1,000
- Kitchen: 2,000, 1, 2,000
- Loading Dock: 800, 1, 800

**Total:**

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Fig.45. Project program
After researching the downfall of American industry, the search for a site was implemented. Two distinct types of abandoned industrial buildings were categorized. The first were the red brick giants left behind form the early 1800s that gave rise to many cities in America. The second were the iron and steel structures of the 1900s that pushed our country through the Industrial Revolution. A decision was made early on to search for a site that contained the massive remains of our country’s earlier brick structures. The challenge of adapting and transforming these almost inflexible beasts fit within the conceptual dialect of this thesis.

In two small cities in the southeast of Maine a gathering of these brick giants was located. Over eight million square feet of unused mill buildings were found clustered on the banks of the Saco River. The twin cities of Saco and Biddeford, Maine were the resting place for the twenty, nineteenth century mills buildings. Biddeford, Maine housed sixteen of the mills and Saco Island, was home of the remaining four.

Three sites were chosen in the Saco-Biddeford area and
compared using several factors including location, square footage, and accessibility. The first site was located in Biddeford on Lincoln Street at the Lincoln Mill. The Lincoln Mill is a massive brick building with intriguing smoke stacks, clock tower, and a west facing wall covered with beautiful vines and green growth. The second site was east a few blocks down Main Street. Mill Building Seventeen located on the west bank of the Saco River and Mill Building Nineteen were inspected. The third and final site was Saco Island. Its lack of activation contrasted its centralized location between the two cities. The mill buildings were located on the west side of the island, skirting the bank of the Saco, River. In comparing these three sites, the potential of Saco Island allowed it to be more compatible with the goals of this thesis. Its ability to directly affect both of the twin cities and completely implement new environmental, transportation, and educational settings gave the project a site with immense potential energy.

Saco Island is a 35+ acre island surrounded by the Saco River. The River flows from northwest to southeast dropping nearly 30 feet as it passes the island. The southeastern side of the island is the lowest point for the river and is affected by 6-10 foot tidal changes. After the river passes the island it flows a little over 5 miles and spills into Saco Bay. The river is accessible by boat from the southeastern portion of Saco Island to the Atlantic Ocean.

The island mills were important leaders of industry in the early nineteenth century, supplying resident workers to the growing cities. Now the 600,000+ square feet of hardwood mill flooring sit partially abandoned. There are four mill buildings on the site, all are built from red brick and consist of four to five stories.

The topography of the island can be seen in (Fig. 48). The island has a very drastic decrease in level, on the southeast portion, dropping almost 35 feet. A hydroelectric dam takes advantage of
this topography, harnessing natural energy from the north side of the Saco River. The site is also regarded as a green island due to the large wind-turbine that harnesses the energy of the passing wind. A train track carrying Amtrak’s Downeaster stops on the northeast edge of the island.

Saco Island appears to be the site most compatible with this thesis’s conceptual train of thought. With the adaptive-transformation of the mill buildings the island will be brought back to life and once again be the center of activity for the twin cities.
The first step of this study was to experiment with the expression of an object potential energy. A common masonry brick was used to represent an object whose potential energy is easily overlooked. A massive amount of energy was spent on the creation and experimentation that led to this brick’s formation.
The brick was next introduced to a new medium (steel). The steel was welded around the brick allowing the brick to remain intact but changing its appearance. The new exterior of the brick expresses the kinetic action of welding. It attracts the eye of the viewer with its outer shell. The brick has not physically changed. It is technically the same brick, but now reacts by contrasting the steel that surrounds it.
The next step was to express the energy that went into welding and cutting the steel and apply it to the bricks potential. The new reaction would be given the liberty to alter the two materials. The base brick still remains intact as new fragments of broken brick are fastened to the brick with steal harnesses. The brick visually takes on a transformation that permit the expression of it's potential. In its new form the brick is no longer a brick, but a compilation of kinetic and potential energy. Its new manifestation provokes a higher level of interaction and visual awareness. As people interact with the new formation they, in turn, are interacting with the original brick's potential.

This study gives an example of the conceptual process that will be applied to the design project. The concluding facts support the designers expression of potential energy through kinetic interactions. It also coincides with an adaptive-transformation straightly focused on reactivation.

Fig.51. Expression of a bricks potential energy
The following is a collection of conceptual parti models. They begin to show the application of conceptual designs and ideas on the site.

Model One shows the conceptual activation of both the river front and Main Street. A shiny metal tube represents the need to address Main Street in a visually appealing and stimulating way. The less contrasting copper tube represents the need to move people alone the river front without interrupting the natural aspects of the river bank. A node of interception between these two tubes was recognized and are shown as the red fading circle. This area was thought to become one of the larger exhibits or an interactive outdoor space.
Models Two and Three were constructed to represent different aspects of movement around the existing mill buildings. In Model Two, the aluminium tubing represents areas of enhanced visual stimulation when viewed on foot. These areas were allowed to extend, overtaking Main Street, and create opportunities for connection between the West and East sides of the island. In Model Three, copper tubbing was used to show the potential for walk-able paths that bring people to and from the mills.
In Model Four, a large structure was implemented to tower above the existing mills to act as a way finder. Utilizing the lines created from downtown Main Street Saco and Biddeford Public Park, a viewpoint was established to create a common visible connection from both sides of the river.

In Model Five, a connection to the Amtrak station was conceptually explored. Relating elements of the building to the existing Amtrak Station, was a beneficial transit solution reducing the need for on site parking and allowing the island to have a more natural landscape.
Model Six displays a conceptual idea to collect water from upriver for treatment and then pipe it to the facility. The use of Mill Building Four would be required for this layout and would house the water treatment machinery as well as a research facility. The water would eventually be dispersed back into the river on the South side of the island.
The following is a collection of conceptual overlays that were used to formulate spaces and start to depict some of the building's shape. These two dimensional images, when overlaid on the site and existing buildings generated a situation where the buildings and the site were allowed to react to the image. It is important to note that the two dimensional images were not just created at random, but are photos of the brick sculpture of potential energy (Fig. 51).
Three photos of the sculpture were combined to create the image shown (Fig. 59). When it is overlaid on the site, a conceptual linking takes place between the potential energy of the original brick and the potential energy of the site. The energy of the brick that is represented by the two dimensional image allows for experimentation on the potential energy of the building by transforming its appearance and purpose.
Site Overlays One, Two, and Three focus on the island as a whole. The overlays were placed to create opportunities that would connect major elements on the island.
Site Overlay Four focused on the grouping of the mill buildings. Connecting all four mill buildings created an array of potential dynamic spaces. These diagrams also began to formulate pathways for both pedestrians and mechanical equipment to move between the mills.
Building Overlays One and Two were created to focus the relationships that existed between Mill Buildings Two and Three. Several opportunities to connect the buildings were observed in these overlays as well as a three part separation parti that would section the buildings into three definable spaces per floor.
Building Overlay Three was used in formulating a conceptual grouping of spaces, exhibits, circulation, and water movement. It also begins to explore the removal and addition of new and old structure.
Building Overlay Four was used in generating a series of organic and dynamic spaces that could be applied to the existing buildings of mill two and three. The process of beginning to break apart the mill buildings and separate them with natural exhibits were generated from these diagrams.
The following are a collection of sketch models that explore form, function, river engagement, and land use. These models were used as a study of expression through form. The sketch models were based off the previous collection of site overlays and have been compiled into three dimensional representations. Intriguing elements from these models would be used in guiding the design of the draft model.

Sketch Model One applied the new dynamic shape of the aquarium’s exhibit spaces. These spaces were intended to intrigue the public eye creating awareness of the energy of the new facility. A large outdoor area has been dedicated to resume a natural environment for wildlife. There are two outdoor arenas that will house large aquatic animals year round as well as a large river inlet that will allow the aquarium to interact with the Saco River.
In Sketch Model Two a large natural park space has been implemented between Mill Building Three and the Amtrak Station. Mill Building Two has been split to accompany a small stream that will interact with its lower levels. Two main enclosed exhibits connect Buildings Two and Three and became part the building’s circulation.

Sketch Model Three deals with the notion of covering a large portion of the aquarium with the local landscape creating a rooftop garden and park. The lower levels under the garden would be used for low light exhibit spaces like “The Dark” which would house aquatic animals that are sensitive to light. A large exhibit space has been added to the East side of the building addressing the street’s edge.
Sketch Models Four and Five were used to explore the form of the new aquarium. These two layouts utilize dynamic additions to express the building’s energy in a visual format. The spaces were designed to become way finding devices for the island and cities of Saco and Biddeford.
The Draft Model was created utilizing the research and design applications gathered from previous studies. Compiling the working elements from the parti models, overlays, and sketch models a dynamic design for expressing energy was developed.
The Draft Model took advantage of the native landscape inviting the river to come into the site and interact with the aquarium. A small portion of the island was sacrificed to the river becoming a natural animal sanctuary. The building's form took its sculptural shape from the adaptive transformation process in order to express the potential energy of the original mill buildings. This however, was not achieved. The new facility was only expressing the energy of the new construction and negatively effecting the original potential of the mill buildings.
It was at this point in the project that the conceptual design of the aquarium was reevaluated. It was noticed that the processes that led up to the form of the building at this point were overly focused on introducing new elements to the old buildings resulting in only the expression of these new materials. Looking at the draft model it is clear to see that only the energy of the new spaces and dynamic structures were being expressed. The potential of the original mill buildings have been overtaken by new construction instead of being complimented by them.

At this time a decision was made to review the steps taken in the conceptual design. Starting with the conceptual studies of the brick and moving forward through the overlays and models. Immediately starting with the conceptual study of the brick a flaw was noticed. In the first step of the study, the brick and steal worked well together. The brick gave the steal its form and the steal expressed a new level of energy that the brick alone was not capable of expressing.

It was when the actual potential energy of the brick was forced into an expressive state that the original energy of the brick
was lost. The original potential energy of the brick was replaced by the new potential energy of the sculpting process. This process was the leading factor in the failure to currently express the original mill buildings potential energy. While the kinetic energy esthetically expressed by the sculpture is more visually apparent, the desired effects were not restrained.

In order to achieve the desired expression of potential energy this second process would have to be removed and the design process of the aquarium restarted. In looking at the brick and steel shown below in (Fig. 77) it became apparent that all the necessary movements were being expressed. The steel had moved from the normal placement of rebar hidden inside the brick, to becoming the expressive elements that represent the bricks potential energy. Instead of strengthening the brick from inside the steel becomes an exoskeleton for the brick showing its purpose to the viewer.

The brick in the mill buildings also have several hidden elements behind their facade. If these elements were redirected from their normal paths to address the exterior of the building then the potential energy of the mills would be more accurately represented through existing and necessary elements.

By extending the structural elements of the mill buildings and creating a support system, the mechanical elements of the building can wrap the facade creating a visually stimulating experience for the visitors as well as expressing the original energy of the buildings. This allowed the building’s shape to stay the same with exceptions to a few areas of large exhibit spaces.
Sketch Model Part Two:

The new design utilized only Mills Two and Three. The dynamic sculptural appearance of the previous design has been replaced with a more form fitting expression of potential energy that will run along the exterior of the buildings. The main entrance has been shifted to the North facade of Mill Building Three becoming a way finder between both Saco's Main Street and Biddeford Downtown Park. The street's edge will be addressed with a transparent ocean exhibit. The exposed plumbing, electrical, and HAVC systems will be contrasted by a series of channel glass circulation that will also move around the exterior of the building.

Fig.79. Sketch Model No. 6 image 1
Schematic Design: Plans
Service Area
Active Floor Plan
Salt Water System
Fresh Water System

Fig. 81. Basement
Fig. 82. First Floor

1) Valley Exhibit  
2) Rock Climb  
3) The Deep  
4) Research Lab  
5) Fresh Water Filtration Room  
6) Moose Range  
7) Moose Stables  
8) Mechanical Room  
9) Bottom Life  
10) Observation Tunnel  
11) Tidal Experience  
12) IMAX Theater  
13) IMAX Lobby  
14) Great Tank  
15) Service yard
1) Main Lobby  
2) Restaurant  
3) Gift Shop  
4) Mountain Water Exhibit  
5) The Reef  
6) Arctic Water Exhibit  
7) Penguin Habitat  
8) North Sea Exhibit  
9) Coral Reef  
10) IMAX Service Area  
11) IMAX Acoustical Inclosure

Fig. 83. Second Floor
Fig. 84. Third Floor

1) Penguin Overlook
2) Tropical Collection
3) Rock Climb Overlook
4) Exotic Marine Life
5) Touch Ponds
6) Coffee Shop
7) Surface Encounter
8) IMAX Film Storage
9) IMAX Projection Booth
10) Overnight Service Area
Fig. 85. Forth Floor

1) Grand Foyer  2) Ball Room  3) Flexible Exhibit Space  4) Exotic Collection  5) Touch Ponds  6) Roof Deck and Garden  7) Roof Top Pond
Schematic Design: Sections

Fig. 86. Section cut diagram
Fig. 88. Section A-A 2
Fig. 90. Section A-A 4
Fig. 94. East IMAX entrance Spring
Fig. 96. East IMAX entrance spring 2
Fig. 97. Main entrance
Fig. 99. Touch ponds
Final Model: View from Southwest
Fig. 101. View from North

Fig. 102. View from South
Fig. 105. View from Top
Energy exists in all things; however it is not always easily recognized. During research it was revealed that all items contain a potential energy. This form of energy allows an object to take a visually kinetic or static form. The size, shape, color, and weight of the object have no relevance to this process. Only through a series of controlled reactions can an object's potential energy begin to be unveiled in a visual form. It was apparent that the brick that was examined had no physical energy. After being altered by a series of reactions the brick’s potential energy started to become visible in its appearance. The brick was not changed in anyway shape or form, but the steel that now surrounded it allowed people to view the brick in a new fashion.

Experimentation took place throughout this project to reveal the potential energy of Mill Building Two and Three. An aquarium was chosen for its ability to activate these dormant buildings and regenerate portions of the site. The aquarium's ability to be flexible and generate a large amount of public interest were viewed as a necessity in revealing the building's
The first attempt at expressing the mill buildings potential energy was rendered unsuccessful due to over emphasis on new forms. The mill building reacted in the same fashion as the brick. Controlling this reaction was much more difficult then first anticipated. The results that were achieved with the completion of the draft model expressed only the energy of the new construction. Not only was the original energy of the mills overpowered by these new forms but it was actually decreased due to the removal of portions of the building. The buildings went from originally being unused to now being unseen and overshadowed by newer dynamic forms.

With the first few steps of the design project leading to undesired results, the need to reevaluate the conceptual process was implemented. It was only through these mistakes that an awareness of the delicacy of the mill building’s potential energy was recognized. Without the realization of this error the process of expressing the original mill building’s potential energy would not have been realized. It is sometimes in our errors that truth is revealed.

The final product of this design allows both the original mill buildings and their potential energy to be seen in harmony. Energy can be seen flowing out the many windows of the old mills facades and circulating along its exterior walls. With the extension of the original structure, people are able to gain an understanding of how the structural interior is laid out. Allowing people to interact with the aquarium in a visual format before they enter, the building reveals the potential energy of the facility. People walking along the exterior of the building begin to understand that the building is actually kinetic. Pipes moving up and down rushing with life supporting water and electricity gives an incredible awareness of the functions of the aquarium.

The program for this facility was designed with spaces that
would allow ample interaction between visitors and the building. In order to transition through the aquarium, visitors are moved through a specific circulation that requires them to interact with the building, aquatic exhibits, people, and mechanical elements. Many of the original qualities of the mills were left and implemented into the circulation. The circulation of the facility is a one way flowing circulation representing the flow of the Saco River. It is designed to allow visitors to explore exhibit spaces in a sequence.

Upon entry into the aquarium people will be engulfed by large eighty foot tall fins that not only act as a iconic symbol, but function as passive ventilation during the summer months and also collect and move roof top precipitation to the filtration room in the lower level of the South wing. As people enter into the two-story lobby they are greeted by a thirty foot tall cylinder tank that towers up toward the original heavy timber structure that supports the forth floor. People will be walking along the original hardwood floors as they pass through the North wing and follow the curved walls of the fins to the first exhibit space.

Visitors will be lead through the aquarium via a specific order of exhibits. Starting at the source for the Saco River, the White Mountains exhibit allows visitors to explore the origins of the local river and its aquatic life. As people enter this exhibit they immediately notice the water flowing out twenty five windows spanning over two hundred feet and cascading down the Northern facade into the moose exhibit lake. This water represents Saco Lake the actual source of the Saco River. Water will continuously be pumped out of several artificial springs and flow out slots below the water’s surface in the window frame. This circulation of water creates a stimulating view from the dining room of the mill restaurant, but also aids in the water aeration process used in preparing the water for the aquarium.

The exhibits are separated by elements of circulation and
vertical movement that break apart the seven hundred foot long mill buildings. Moving the visitors on a path that is not formulated in a predictable manor stimulates the user’s experience as well as moving the user in a kinetic style, mimicking the buildings potential energy.

Moving from the mountain exhibit the visitors will enter into a portion of channel glass circulation that moves users along the exterior of the building to the lower level of the south wing and into the valley and stream exhibits. In these exhibits the visitors will be allowed to experience a wide variety of fresh water animals, as well as utilize the rock climbing walls that move up through the mountain exhibit. As the visitors move from one exhibit space to another they are met with new interactive elements that allow them to fully experience the aquarium in a kinetic manor.

The new construction materials were limited to channel glass, concrete, and steal. These three materials were used in a minimal fashion only to designate certain qualities. The channel glass was used as an exterior circulation device allowing a glimpse of the interior exhibits and reflecting the richness of the brick masonry on it surface. Concrete was used in the creation of the fins and for reinforcing the structural elements of the building to support the new weight loads created by the aquarium. The concrete fins that tower above the original buildings are four feet thick and became part of the load bearing supports for both the North and South wings. The steal was used to reinforce some of the structural areas that will have heavier weight loads, as well as for extending the structural grid of the building and exposing it along the aquariums faced.

The design of this facility allowed both the old and new architecture to coexist side by side in a complimentary state. This delicate process of complimenting the existing qualities of the mills with new materials has proven to be extremely successful in exposing
the original buildings potential energy. Energy now flows through the mechanical exterior of the aquarium allowing the building’s potential energy to be experienced by those who interact with it. What was once asleep has now been awoken and brings energy to the cities of Saco and Biddeford Maine.


