Architects have been experimenting with pre-fabricated buildings, modular buildings, and mass produced buildings ever since the Industrial Revolution. The repetition of the machine and the standardized products that were being created inspired some architects to design homes that embraced the mass-production of the materials. The modernist movement is full of attempts to create homes that could be pre-fabricated and mass produced, but unfortunately were never as successful as hoped. [1] Today, technology is changing faster than ever before and it has encouraged architects to again try their hand at pre-fabricated architecture. Most notably, Kieran and Timberlake designed the Loblolly House using a reinvented process of construction, made possible by new computer programs and materials. Previous attempts at such architecture have been considered failures in the past, but it seems that Kieran and Timberlake have solved the problems of previous systems and designed a beautiful, site sensitive home.

Loblolly House

Date: November 12, 2012
Author: mlehman
Category: Uncategorized
The facade that faces the Chesapeake Bay. See Images at bottom for source.

Kieran and Timberlake have designed a higher quality home that takes less time to build, but unless the building industry embraces the idea it will pass away like other attempts. The Loblolly House is suggesting a change in the way that architecture is designed, by viewing it as a kit of parts that can be pre-fabricated, assembled on site, and then disassembled and later recycled. Only time can decide if this new method is embraced or rejected, but if accepted it would have lasting impacts on the way that architecture is designed and perceived.

Architects such as Konrad Wachsmann, Walter Gropius, and Le Corbusier began looking at new construction methods after more and more building materials began to be produced by machines. Wachsmann may have developed the most complete system for a pre-fabricated house, but even it had its flaws. With the help and consultation of Gropius, Wachsmann developed a system called the General Panel System. [2] This system consisted of composite wood panels that could be used in any orientation or position and connected with a special metal “wedge connector”.

http://mlehman.wordpress.ncsu.edu/2012/11/12/8/
Wachsmann did not want the panels to create only a single configuration, so he took special care to design the panels so that a number of configurations could be assembled. He struggled to find sponsors, but eventually a factory was purchased and the designs began to be produced. The factory was unable to produce parts to the high tolerances that were required by Wachsmann’s design. The idea received praise from the press, but not enough investors were found to continue the project and it eventually failed. [3]

Wachsmann was not the only architect looking at the possibilities of pre-fabricated architecture and the integration of machines into architecture. Walter Gropius was a part of the General Panel System, but also did work of his own in this field. While they did not see eye to eye about all aspects of the growing industrialism, they did agree about a lack of emphasis on the actual construction and production of architecture. Gropius wrote, “The architect of the future – if he wants to rise to the top again – will be forced by the trend of events to draw closer once more to the building production. If he will build up a closely co-operating team together with the engineer, the scientist and the builder, then design, construction and economy may again become an entity – a fusion of art, science, and business.” [4] Gropius worked on many projects that related to mass production, and new construction techniques, but the most relevant to this discussion in his work with Adolf Meyer. Gropius and Meyer developed a system of interlocking parts called Baukasten, which translates to “building blocks”. The idea was formed around a series of building elements that could be interchanged and rearranged to create an infinite number of configurations. The elements consisted of wood, steel, and glass pieces as opposed to solely wood panels as Wachsmann developed. Gropius described the elements as “an oversized set of toy building blocks out of which, depending on the number of inhabitants and their needs, different types of machines for living can be assembled”. [5] The elements were never actually produced, but the idea led to other developments within the Bauhaus attitude.
A variety of pieces and configurations that were a part of the Baukasten system. See Images at bottom for source.

Much of Charles Edouard Jeanneret’s (Le Corbusier) work also related to the ideas of mass production, and new construction methods. One of his earliest designs, the Domino House, expressed his Five Points of Architecture and created a frame that he would later add to in order to create a home that could be mass produced. Le Corbusier looked to other industries for inspiration while trying to come up with designs that could be easily replicated. He looked intently at the Citroen car and designed the Maison Citrohan upon his observations. The Maison Citrohan was named intentionally to reflect the Citroen brand, and was a development of multiple earlier projects. The house was lifted on concrete “pilotes” and was designed to be mass produced. [6]
Le Corbusier’s Maison Citrohan, which was named after the Citroen car. See Images at bottom for source.

Le Corbusier’s Domino house which was based on his 5 Point of Architecture. See Images at bottom for source.
His intentions and thoughts about mass producing architecture were very clear in his writings when he said, "Architecture has for
its first duty, in this period of renewal, that of bringing about a revision of values, a revision of the constituent elements of
the house. Mass-production is based on analysis and experiment. Industry on the grand scale must occupy itself with building and
establish the elements of the house on a mass-production basis. We must create the mass-production spirit. The spirit of
constructing mass production houses. The spirit of living in mass production houses. The spirit of conceiving mass production
houses." [7] Le Corbusier always imagined his designs merely as a piece of a larger whole. He designed homes that could be fit
together to create entire cities like his City for Three Million Inhabitants.

Fast forward about a half of a century and architects are still trying to perfect the idea of the mass produced house. Kieran and
Timberlake (KT) are a Philadelphia based firm that have focused a great deal of attention, time, and resources to reinventing the
way that buildings are constructed and designed. [8] The architects aimed their research at the relationship between the four
major disciplines of the building process. KT looked at the interactions between architects, contactors, material scientists, and
product engineers. KT realized that there was very restricted communication between and among all four disciplines and thought
this prevented innovation in construction methods from taking place. KT argued that a more integrated communication was
needed between the disciplines, so that each discipline was working with every other discipline instead of just one or two other
disciplines. KT also looked at the ever-changing automotive industry. Automotive industries began to move away from the fast
and repetitive assembly that had been used since the Model T and moved towards a modular assembly process. In this new
process, smaller modules are assembled separately and merely assembled onto the final vehicle. This allows for a more controlled
manufacturing of the individual pieces and provides an opportunity for customization by simply interchanging different parts. KT
thought that architecture could learn from the automotive industry and could offer an answer to the unsuccessful prefabricated
houses that have been designed and even assembled throughout the past century. With a beautiful site overlooking the
Chesapeake Bay and an idea borrowed from the automotive industry, design began on the Loblolly House, which was named
after the loblolly pines that covered the site. KT began by applying the modular manufacturing to small pieces like doors, which
arrived at the site fully assembled and ready for a simply installation. This idea evolved and ended with the Loblolly House being
made up of a series of “cartridges” that fit together within a frame to create a simple house. The idea of a modular assembly
allowed the site to left alone as much as possible as the modules were brought to the site at precisely the right time and quickly
installed into the frame. This new manufacturing process also allowed for less field labor and fewer on site connections, which
created a very quick erection time with a small staging area. [9]
A diagram of the pieces that went into the assembly, and images of the construction process. See Images at bottom for source.

Naturally there are many comparisons between Kieran and Timberlake and the pioneers like Wachsmann, Gropius, and Le Corbusier. KT had the advantage of looking back upon what their predecessors had gotten right, and what they had failed to address. Whether KT truly solved all the problems that plagued past attempts at mass-production and standardization, will be determined in the years to come. Wachsmann gave a great amount of attention to the joint in his General Panel System as well as his Mobilar Structure. His critics said that he had a “myopia that focuses only on a mythical universal joint”. Wachsmann spent time drawing extremely detailed connectors that eventually ended up being the demise of his system due to the extremely high tolerances that were crucial to the design but unachievable with the technology of that time. KT also had to devote a considerable amount of time and resources to the connection of the structural frame. The columns and beams were standard aluminum extrusions that were picked out of a catalog but, they were not intended for architectural applications. There were some existing connectors that fit in T-shaped grooves in the side of the aluminum members, but KT had to custom design many of connectors in order for them to be able to handle the loads from the house. Through these simple dry connections, KT made the frame something that needed to be merely assembled, not constructed. [10] The assemblers need a wrench and set of directions to assemble the whole frame which made it an extremely quick process, but more importantly, the dry connections allow for the entire frame to taken apart and fully recycled at the end of it’s life.

The idea of the cartridges, was derived after carefully examining the automotive and aviation industries. KT was not the first to look at automobiles for inspiration. Le Corbusier looked extensively at Citroen and the mass-production of vehicles. He thought that this same principle could be applied to architecture to provide housing in the post-war years. [11] The automotive industry
made significant changes in the years after Le Corbusier worked on the Maison Citrohan, and KT learned something entirely new from the same automotive industry that Le Corbusier had studied years earlier. The modular assembly provides a higher quality for a lower price, due to the nature of pre-fabricated elements. Work on the cartridges could be done in controlled environments and are easier to work on in a factory as opposed to on site. On site labor is more expensive than factory labor so the cost is reduced and a higher quality product is produced. Light treading was also encouraged on the fragile site, and the cartridges eliminated materials sitting on the site. The cartridges included everything from walls, insulation, floors, electrical wires and conduits, to plumbing, appliances, doors and windows. Through a BIM program all of the mechanical systems were organized so that they could connect from cartridge to cartridge and then into the main system of the house. The idea of the individual cartridges would allow for a nearly unlimited customization as long as the cartridge can still be plugged into the main frame. This was the idea that drove Gropius’ and Meyer’s Baukasten project; they were trying to create a series of building blocks that could be fit together in numerous ways, so there could be variety among the mass-production. The current factory-built home that are designed around the hauling requirements of the highway system, have very little customization and have received the unfortunate name of “Katrina Houses”. Gropius and Meyer knew that some customization and differences were necessary between homes and designed around this premise. The Baukasten project never made it past drawings, so there is no way to know how well the system would have worked. KT was thinking along the same lines, because they were not interested in creating a single design to merely be replicated over and over. They were more interested in reinventing the construction process and finding a better way to design and build homes. Their methods allowed for differences between one house and another, while still operating while a larger frame that could be replicated and easily fabricated again. Kieran and Timberlake were only able to accomplish what they did with the Loblolly House, because of what their predecessors accomplished before them. They were able to stand on the shoulders of Wachsmann, Gropius, Meyer, and Le Corbusier; they built upon what had already been done, which spared them from starting at the very beginning.
While the Loblolly House can be seen in a similar light as previous pre-fabricated and mass production projects, there are crucial differences in the design, which has allowed the Loblolly House to be seemingly more successful than past attempts. Technological changes allowed KT to design in a way that their predecessors were never able to. Advancements in materials provided them with new opportunities and abilities. The Loblolly House was designed and coordinated with BIM, which stands for Building Information Modeling. KT wrote, “Despite the integration of computers within the field of architecture more than twenty-five years ago, the drawing types we use to describe our buildings have changed little since the Renaissance. Each exists by itself as an artifact, each represents architecture at a particular time and place and from a particular point of view, be it a plan, section, elevation, or detail.” [14] They suggest that the traditional drawing methods have hindered the ability to think about architecture as something that must be built. It has caused designers to forget about connections, and aspects that do not show up in a particular drawing. The BIM model is built just like the actual house will be built and so every connection is handled in the model before it is handled in the field. The new technology and BIM model allowed KT to approach this project quite differently from their predecessors. Wachsmann and Le Corbusier were trying to simplify everything as much as possible, even to the point where one panel could be used for the floor, ceiling, and walls. KT approached the Loblolly House from the complete opposite direction. They knew that in order for everything to fit together and work seamlessly together the design was going to need to be very complex. The BIM model helped coordinate and keep track of the added complexity to make everything work. The complexity and innovation was a major part of the success that KT achieved and something that Wachsmann and Le Corbusier did have available.
to them because of the lack of new technology.

In addition to the changing technology, the material palette available to architects is also changing. The Loblolly House utilizes an aluminum frame, which is very strong and light, but more importantly can be manufactured with extremely precise tolerances. Wood or steel would not have been accurate or precise enough to accommodate all of the cartridges fitting together and creating a watertight seal. The extruded aluminum framing members and connectors were able to be manufactured with a tolerance of only a few millimeters. [15] The tolerances of Wachsmann’s system were not compatible and the system did not actually work the way that it was designed, eventually leading to the failure of his system. KT avoided this failure by using aluminum, which is typically not used for structural purposes in architecture. KT’s new innovative ideas and technological changes allowed them to design, create, and build a very different pre-fabricated home that ever before. The new strategies that were used set this apart from others that have attempted to do the same.

Kieran and Timberlake are a very forward thinking group that have created a high quality, customizable, prefabricated home that takes less time to build than a traditional home. Wachsmann, Gropius, and Le Corbusier designed systems with similar traits, but they never stood the test of time. They were considered unsuccessful in creating a new architecture after failing the test of time. The Loblolly House has been considered a success and seems to have solved the issues that it’s predecessors faced through an innovative use of new technology and materials. Only time can determine whether the process used by Kieran and Timberlake will be embraced and repeated or whether it will be rejected because it is new and different. If the new building method that the Loblolly House displays is accepted within the building industry, architecture will be perceived differently. Kieran and Timberlake’s new method and process would place a greater emphasis on the construction of architecture. Architects would be forced to more carefully consider the physicality of buildings as opposed to working solely with representations. Representation would become less important and simulation would arise as an architects main design tool. Kieran and Timberlake seem to have invented a more efficient way to design and construct buildings, but only time can decide whether the methodology of the Loblolly House will be seen as a spark to a new movement or a flawed system that will get replaced by the architecture of the future.

Footnotes

1. Bergdoll, Barry, Peter Christensen, and Ron Broadhurst. Home delivery: fabricating the modern dwelling. New York: Museum of Modern Art ;, 2008. Print. This book provides many examples of architects and other innovative thinkers such as Thomas Edison who were experimenting with new ways of pre-fabricating homes.

Wachsmann, by the end of his career was an architect, engineer, theorist and teacher. Wachsmann was born in Germany and dropped out of high school to work for a carpenter and cabinetmaker. He later floated around between art schools and architecture firms until he showed up at Walter Gropius’ door. Wachsmann in his years of woodworking had become very knowledgeable about carpentry and woodworking and applied his experience to architecture. Gropius and Wachsmann later split due to a disagreement about the role of machines in society and specifically their relation to architecture.


8. Hart, Sara. “New Ways to Build Better, Faster, Cheaper.” *Architectural Record* July (2002): 131-138. Print. In 2001 Stephen Kieran and James Timberlake were awarded the Latrobes Fellowship by the AIA which awarded them with $50,000 to use towards research that would significantly advance architecture as a profession.


Bibliography


Images


Baukasten- http://www.laboratorio1.unict.it/2006/lezioni/11_tremodi/pagine/08.htm

Citroahn- http://www.studyblue.com/notes/note/n/lecture-10/deck/897125


5 Responses

mlehman  December 5, 2012 at 1:10 pm ·

Final Comment from Ryan Whitley via email:

Overall your blog is one of the most clear and concise. The progression of topics as you introduce precedents to support a greater theme is done very well. The pictures and video aspects work very well in conjunction to your paragraphs and the writing flows very nicely. Everything seems correct with your sources, it seems like you have gone to a variety of sources to get all your information which shows your wide understanding of the project. I feel that you are very educated on the building while I’m reading, which gives it much more credibility. Really good job!

Rachel Gonsalves  November 29, 2012 at 1:53 pm ·

Nicely done! I love the simplicity of the blog and the images you selected really exhibit the project well. The essay is well written and makes good connections to other projects. I like how you didn’t just give me a history of the project itself but you provided good analysis. One thing: you missed a “Lobllolly house”, the rest are consistent with each other. Overall, great job and I love the stop motion video you found!

rtwhitl2  November 25, 2012 at 2:07 am ·

The comments regarding the need to embrace this style of architecture, or prefabrication, seemed a bit redundant in the initial paragraphs. Although it is a bit redundant, it does start to support the paragraphs regarding why it has failed in the past. I thought I was going to read much more about the specific building itself, but you brought a very nice approach to the building with the past successes and failures of previous architects and how those details effected the outcome of the Loblolly house. Pictures are clear to the topic, and the “video” was very helpful understanding its corresponding paragraph. Are there any other examples that are starting to figure out this whole prefabrication idea? Or any modern examples that could serve as precedents other than Corbusier or Gropius? Overall it flows very nicely and is well written. Good Work!
I think this paper does a very good job at first analyzing what sparked and initiated this idea of prefabrication and how it is such a continuously growing technological advance in architecture. I do feel that you could talk a little more about how specifically Le Corbusier’s five points affected the modern age at that time and then talk about what pros and cons prefabrication faces in today’s society and how most people view it. The images are very well organized and correspond very nicely to the material it represents.

1) First paragraph: You say “the Loblolly”. You should probably call it by its full name “the Loblolly House”. On the same note, throughout the paper you switch between the “Loblolly House” and “Loblolly house”. Minor issue, but I would go through and correct so that it is consistent throughout the paper.

2) As you are talking about the General Panel System, the following line isn’t relevant to your paper. This little fun fact can be footnoted:
Gropius and Wachsmann later split due to a disagreement about the role of machines in society and specifically their relation to architecture.

3) Overall, I like the connections you make between the prefabrication of the Loblolly House and how its predecessors help serve as precedents. You also do a good job looking into the prefabrication system used.