Material Choices

Cal Poly had the opportunity to work in a collaborative design cohort in the fall quarter of 2017. The purpose of the cohort was to aid a company called Greater Northern Services (GNS) in developing workforce housing for the city they operate in, Weed, California. In order to effectively develop the plot of land they had acquired, GNS would have to be extremely cost-effective in their design and construction methodology.

The plan was for the students of the IPD class to design the panels and then for a different class to build the panels. This meant that the panels had to be light and small enough for students to handle them without damaging themselves or the panels. In addition, the panels would be shipped from Cal Poly to Weed, so they had to fit inside a shipping container with dimensions only slightly larger than eight feet.

The panels were designed concurrent with the design of the building using Autocad to create 3D models of the panels and shop drawings. Many of the panels in the areas without the pitched roof ended up being eight foot high and very long. In the places where the roof was pitched, the panels are eight foot or less in width with heights up to around eighteen feet. The tops of these panels would be slanted to follow the 3:12 roof line. The panels were built using conventional framing methods. They have 2x6 studs and 16" O.C. spacing along with one bottom and top plate. A second top plate is to be installed in the field that overlaps the panels to help tie them together. Even though 16" spacing was maintained, we found that due to many of the panels being eight feet wide the final bay would only be 14.5". This was simply an oversight that led to dimensions on shop drawings that could be confusing.

Another aspect of the project that was intended to help drive the cost of the house down was the exterior wall system of the house. Cal Poly students with lumber donated from a local plant. The purpose of this study is to analyze the design choices of those panels and how they effected the design and price of the house overall.

In panels where there were penetrations in the form of windows or doors, the entire penetration’s assembly was built into the panels. As the panels would be delivered to the site all the carpenters would have to do would be figure out where the panel goes, fasten down, and then nail the panels together where their end studs met. This was supposed to save labor costs since the framers would only have to stand the panels up and fasten them down.

Material Choice and pricing for the homes was one of the most important parts of the design. The homes needed to be affordable, resilient, aesthetically pleasing, structurally sound, and weather resistant. Different skill sets worked together through the process of Integrated Project Delivery. The knowledge from Architects for aesthetics, Architectural Engineers for Structure, Weather, and something common in non-profit work. The price range was a constant burden but forced the teams to explore options which can be cheaper, yet just as durable. Examples were using TUF-BAR, a fiberglass rebar which is more durable and cheaper than normal rebar. Barn-board was used for exterior sheathing which is more aesthetically pleasing and cheaper than normal siding. These are a few examples of how the integrated discussion of material choice was beneficial, but the price allowed impacted the home in exponentially negative ways compared to positively.

Another important factor was the effort to design a resilient building. There were many new ideas brought forth. One common idea was fireproofing the walls. Adding durable fireproofing to homes allowed more durability also increasing the R-value. The last important factor designing the home with effective MEP equipment. With a low price there was not many options. Pellet furnaces were used as cheaper and smaller heating systems. The homes had one plumbing wall close to the intake systems to reduce the amount of plumbing fixtures needed.

Cal Poly had the opportunity to work in a collaborative design cohort in the fall quarter of 2017. The purpose of the cohort was to aid a company called Greater Northern Services (GNS) in developing workforce housing for the city they operate in, Weed, California. In order to effectively develop the plot of land they had acquired, GNS would have to be extremely cost-effective in their design and construction methodology.

The panels were designed concurrent with the design of the building using Autocad to create 3D models of the panels and shop drawings. Many of the panels in the areas without the pitched roof ended up being eight foot high and very long. In the places where the roof was pitched, the panels are eight foot or less in width with heights up to around eighteen feet. The tops of these panels would be slanted to follow the 3:12 roof line. The panels were built using conventional framing methods. They have 2x6 studs and 16" O.C. spacing along with one bottom and top plate. A second top plate is to be installed in the field that overlaps the panels to help tie them together. Even though 16" spacing was maintained, we found that due to many of the panels being eight feet wide the final bay would only be 14.5". This was simply an oversight that led to dimensions on shop drawings that could be confusing.

Another aspect of the project that was intended to help drive the cost of the house down was the exterior wall system of the house. Cal Poly students with lumber donated from a local plant. The purpose of this study is to analyze the design choices of those panels and how they effected the design and price of the house overall.

In panels where there were penetrations in the form of windows or doors, the entire penetration’s assembly was built into the panels. As the panels would be delivered to the site all the carpenters would have to do would be figure out where the panel goes, fasten down, and then nail the panels together where their end studs met. This was supposed to save labor costs since the framers would only have to stand the panels up and fasten them down.

Material Choice and pricing for the homes was one of the most important parts of the design. The homes needed to be affordable, resilient, aesthetically pleasing, structurally sound, and weather resistant. Different skill sets worked together through the process of Integrated Project Delivery. The knowledge from Architects for aesthetics, Architectural Engineers for Structure, Weather, and something common in non-profit work. The price range was a constant burden but forced the teams to explore options which can be cheaper, yet just as durable. Examples were using TUF-BAR, a fiberglass rebar which is more durable and cheaper than normal rebar. Barn-board was used for exterior sheathing which is more aesthetically pleasing and cheaper than normal siding. These are a few examples of how the integrated discussion of material choice was beneficial, but the price allowed impacted the home in exponentially negative ways compared to positively.

Another important factor was the effort to design a resilient building. There were many new ideas brought forth. One common idea was fireproofing the walls. Adding durable fireproofing to homes allowed more durability also increasing the R-value. The last important factor designing the home with effective MEP equipment. With a low price there was not many options. Pellet furnaces were used as cheaper and smaller heating systems. The homes had one plumbing wall close to the intake systems to reduce the amount of plumbing fixtures needed.

Another aspect of the project that was intended to help drive the cost of the house down was the exterior wall system of the house. Cal Poly students with lumber donated from a local plant. The purpose of this study is to analyze the design choices of those panels and how they effected the design and price of the house overall.

In panels where there were penetrations in the form of windows or doors, the entire penetration’s assembly was built into the panels. As the panels would be delivered to the site all the carpenters would have to do would be figure out where the panel goes, fasten down, and then nail the panels together where their end studs met. This was supposed to save labor costs since the framers would only have to stand the panels up and fasten them down.

Material Choice and pricing for the homes was one of the most important parts of the design. The homes needed to be affordable, resilient, aesthetically pleasing, structurally sound, and weather resistant. Different skill sets worked together through the process of Integrated Project Delivery. The knowledge from Architects for aesthetics, Architectural Engineers for Structure, Weather, and something common in non-profit work. The price range was a constant burden but forced the teams to explore options which can be cheaper, yet just as durable. Examples were using TUF-BAR, a fiberglass rebar which is more durable and cheaper than normal rebar. Barn-board was used for exterior sheathing which is more aesthetically pleasing and cheaper than normal siding. These are a few examples of how the integrated discussion of material choice was beneficial, but the price allowed impacted the home in exponentially negative ways compared to positively.

Another important factor was the effort to design a resilient building. There were many new ideas brought forth. One common idea was fireproofing the walls. Adding durable fireproofing to homes allowed more durability also increasing the R-value. The last important factor designing the home with effective MEP equipment. With a low price there was not many options. Pellet furnaces were used as cheaper and smaller heating systems. The homes had one plumbing wall close to the intake systems to reduce the amount of plumbing fixtures needed.