Blackstone Valley Regional Vocational Technical High School
Student Portfolio- Project Reflection

Date	**3-15-24**
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Subject	**CEA (11th)**
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Instructor's Signature	**Mrs. dos Santos**

In this project, we are challenged to create a home for our client whilst also following the Habitat for Humanity guidelines. Habitat for Humanity is a nonprofit that helps those in need. This means that the homes must be accessible and affordable for everyone. Due to this, my home has to follow very specific regulations. When defining affordable one must not only think of the cost upfront when purchasing/building a home however it should also be inexpensive throughout time. This means a home must be efficient and effective with its usage of energy. This creates more challenges that I will have to face when creating this home.

The first step I took when taking on this project was to take a client survey. This survey allowed me to understand what my client is going through and what my client needs. In this survey, I learned that my client had two of the same gender children and a husband, which means that the home must have at least two bedrooms. This means that the house must not exceed the square footage of 900 whilst also having all the essentials such as a bathroom, a closet in each room, a family room, etc. In this survey, I also learned the style of home my client wants and that they want a patio.

With my client's necessities laid out and understood, I could then start creating bubble diagrams. To draw a bubble diagram you would draw a circle with down your biggest need first, and then slowly start adding smaller bubbles off it based on other necessities. With this, you can then identify a layout and quickly sketch the outside and inside walls of a house. I created two bubble diagrams and transformed both of them into sketches. These sketches were shown to my client in which they chose one. With a final design selected, I could then start creating the final sketch. This is a very important sketch as it is going to be the outline for my final product. Because of this, I made sure to fully dimension my sketch whilst also making it to scale. I also included any major equipment using floor plan symbols. While creating the final sketch I did have to move parts of it around to make more room in the bedroom and allow for a five-foot diameter turn space for anyone who may be in a wheelchair. This five-foot diameter must also be incorporated within the kitchen however that was not an obstacle as I already had all the space I needed. To conclude my sketching process I asked my instructor to check if it met regulations in which I was allowed to move on.

The next step I took was to transfer my sketch into Revit. Revit is a CAD software used by professionals to model homes. I began creating the perimeter of my home using four-inch walls; however, I noticed that I could not fit all the components of my walls into them. This meant I had to expand my wall into eight-inch thick walls, which took a long time, as I had to keep the home in the same dimensions. I then added interior walls to my home and imported some furniture such as beds and dressers. In my floor plan, I also included all the components of my bathrooms and kitchen such as a toilet, sink, and shower. The final step I took in my Revit floor plan was adding custom doors and windows. I first began importing both windows and doors from the internet for their shape, then in the material properties, I changed their materials to black steel to add to the modern aesthetic.

In Revit, I also created a four-foot crawl space as specified by Habitat for Humanity. However, before creating it in Revit one must first consider factors such as soil characteristics, flood elevation, and frost depth to justify a foundation type and depth. Frost depth is dependent on area and is the depth to which the groundwater

in soil is expected to freeze which can alter the structural integrity of a home. With this in mind then sketched out a foundation and inputted it into Revit. This may seem easy however this is much more complicated as the foundation must be somewhat connected with the walls. Using the footing and sectional view tools, I was able to create a strong and sensible foundation that is realistic to what would be seen in real life.

Later in the project, I had to do some more calculations. When one is calculating for residential water supply, they are trying to identify if a system needs a pressure gauge or water pump to advocate for state laws in residential homes. The main reason one must have to calculate pressure is that friction occurs when water is traveling through the pipes and if the pipe is longer more friction occurs. This friction causes a head loss. In our scenario, I must find the head loss, which is the loss of pressure due to major and minor losses. Minor losses are losses caused by valves and elbows within a system. Major losses are those due to the length of a straight pipe. Adding these two up and using the Hazen-Williams formula gives you the total head loss. With head, loss found you must find the dynamic head, which is the difference between static head and head loss. The static head is simply the difference between the source and discharge point. With the dynamic head found, you must then convert the feet into psi using a simple conversion. The dynamic head in psi tells us the pressure a home has and if it is between 40-80 psi then it is acceptable for the home. When calculating wastewater one is trying to create the sewage system for the home. To do so I used specified dimensions/constraints in the Plumbing Code Requirements. Using these numbers, I began to sketch the sewer main in my engineering notebook and label specific parts with values to help with the creation of the main. The idea used in the project is to create a sewer slope that is connected to a POTW, as it is the cheapest method of disposing waste. The difficult part in creating the slope is having the proper slope while also having enough length to connect to the sewer main. Once my sewage system was created I then started to think of ways to collect water and stop storm water runoff. To calculate the storm water runoff one must use the peak runoff equation, which uses which uses variables such as the runoff coefficient and runoff coefficient adjustment factor, which are dependent on material and return periods, respectively. Other variables include the rainfall intensity, which can be found by doing individual research on an area's rainfall and the area of a piece of land in acres. For scenarios where land has many different types of materials, you could do a large calculation using the equation for each surface and then add them, and finally divide them over the total area of the land. Using this equation I could use the area of my home and its materials to find the amount of water that may land during a 2-yr, 24-hr storm. Using this number, I could then think of a water collection system that could collect that amount of water in which I decided to use rain buckets that could contain 1600 gallons of water. I chose rain buckets as all the water collected from the rain can be used again by my client as they live in their affordable home.

I then went back to Revit where I exported my floor plan into a drawing. This drawing was then imported into AutoCAD. In AutoCAD, I could then create an electrical floor plan. In the electrical plan, I included things such as lighting, overhead fans, switches, and outlets. This may be simple however when putting in outlets and switches there are many rules to follow. Some of these rules include using GFI outlets in places where water is prevalent, no receptacles are more than six feet apart, and in kitchens, an outlet must be placed every one to four feet. This was the hardest part of the project, as this was the first time I had ever used AutoCAD, however, the more I used the software I found creating the plan much easier.

The last step taken in the project was the site plan. This is important as it helps deduce the orientation of a home. e. Many factors must be considered when placing a home on a site, such as solar and wind orientation. Having the sun hit the house more in one area of a home will leave that side warmer. Having proper wind orientation can maximize the benefits of cooling breezes in hot weather. Other factors include sound, terrain, and view orientation. Many homebuyers want a home with a nice view and a sloped terrain can make it

more difficult to build a home. Many homeowners do not want to live near noise either and knowing where that noise comes from can help a site planner create devices to reduce noise. Just as one can reduce noise, one can also reduce sunrays on a home and wind breezes. Trees are one of the best ways to reduce these factors, as during the winter tree leaves will fall allowing for more sunlight to shine on the home and during the summer block those hot rays. For the project, I used the existing features of the lot, which are trees on the west I was able to block the wind coming from that direction. I then placed more trees in the southwest to continue to help with the wind. For the sun, I placed stubs and trees on the east and west where the sun sets and rises. I faced my home south due to a concept known as southern exposure, which allows a home to get the most sunlight possible. The last thing I added to the site was mulch to reduce the amount of water used to take care of the land, making the home more cost-effective. With all this drawn out on a site plan I then transported it into Revit. In Revit, I also added sewage and water lines and created the driveway and patio, completing my affordable home.

Technical competencies and academic skills demonstrated by completing this assignment.

Framework Standard	Description
2.D.02.04	**Apply scale, dimensioning, and tolerance standards to drawings**
2.F.01.03	**Describe the components of and coordination required of an entire construction document set including: mechanical, electrical, plumbing, civil, structural and architectural drawings.**
2.C.06.3.5	**Identify and explain sources of resistance (e.g.,, 45º elbow, 90º elbow, changes in diameter) for water moving through a pipe**
2.F.02.03	**Analyze a site and determine the drainage requirements**
Embedded Academics	**Description**
2.B.01.05	**Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.**
2.B.01.1.1.3	**Produce and analyze multi-view drawings (orthographic projections) and pictorial drawings (isometric, oblique, perspective), using various techniques**
2.D.02.04.3	**Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.**
2.C.06.18.1.3.4	**Explain how water flows into and through a watershed. Explain the roles of aquifers, wells, porosity, permeability, water table, and runoff.**