[redacted] | Learning Portfolio

ARCH [redacted] Spring [redacted]

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Reflective Essay

Part I | Overview and Reflections

When I first began this class, I was apprehensive and rather scared, honestly. I was never one to have formidable mathematical skills and I thought that would be my downfall and after the first few weeks of class living up to my pessimistic expectations, I was expecting this class to make or break my architectural career. But then I reached my breaking point and vowed to not let it. So I worked as hard as I could and did my absolute best. And I think that because I had to work harder to overcome a rocky start, I have absorbed the concepts and skills in a different way. However cliché it might be, I now look at things around me in terms of structural concepts. I look at the rafters in my attic differently, I look at the lintels above my window and load trace in my mind, I try to imagine if a concrete column has spiral reinforcement and what size bars are used. So even though this semester began with some sub-par grades, the concepts and skills have not only been acquired but have begun to be incorporated into other designs as well as my everyday life.

In assignment 3, I learned how to find the shear and bending moment as well as the resultant forces from distributed and point loads on beams supported at both ends as well as cantilever beams. This is done by first summing forces and determining if the force will be clockwise or counterclockwise around a set point. The next step is to then sum moments around a given point taking into account the distance each load is from the point chosen. Distances are included because the likelihood of bending increases the farther away from the support or the pinned or fixed end of the beam. In other words, a bending moment will be greater the farther away from the supports is gets because of a greater opportunity for bending. This was also the first opportunity I had to use MultiFrame. While I did not understand the entirety of the concepts covered at the time, I revisited and redid the assignment in the next section; Illustrative Documentation.

The following assignment, assignment 4, I learned how to find the centriod and the moment of inertia for cross-sectional areas of steel beams. This is done by find the area of the geometric parts of the beam and their respective centers and then comparing all the centers of the parts that make of the beam to each other to find a single centriod, the exact middle of the beam's mass.

Assignment 5 consisted of more shear and bending moment diagrams, but this time for a pinned frame. This was another opportunity to become familiar with MultiFrame and explore lateral loads. This type of loading was not only new and interesting, but it let us look at structures in a larger way;

instead of looking at a beam with assumed and mysterious end connections, I got to see the beam as part of an entire frame and how it reacts with the columns supporting it.

Assignment 6 introduced me to load tracing and tributary widths. This was of particular interest because I have always been strangely fascinated by floor construction. It was also my first taste of the design of structural members. The assignment required me to make choices as to which member I would suggest to use in the given situation and by doing this I understood the complexity of structural design and the broad flexibility of design.

Assignment 7, 8 and 9 introduced a big concept; allowable loads. This changed the way the problems were approached because for the first time, the capacity of the material comes into play. Members are no longer vague materials that can be negated for simplicity's sake, they are made out of No. 2 Grade or stud grade or structural grade. Connections also were introduced in this assignment. Bolt and nail capacity were analyzed and factored into the amount of load the structure can handle. This also changed the way the problems were visualized. We were no longer working with vague end conditions that were, again, simplified, we were looking at specific types and quantities of nails or bolts, adding another layer of difficulty and another layer of intrigue. So to determine the allowable loads of a connection, the type of material as well as the type of connection as well as the number of connections must be taken into account.

The next assignment, Assignment 10, brought in another new connection type; welds. I was scared of welds at first because they seemed to be so complex and difficult to analyze and determine values for. Maybe because welding is a skilled labor and few of us have experienced it made it more mysterious and foreign. But after studying it I realized that it's just like any other connection and it analyzed in the same way. Welds have capacities and different grades and just like you determine how far apart to space nails or bolts, you determine how far apart you space welds. Not scary at all.

And then came concrete. I was also scared of concrete. After doing problems weeks before where steel plates were attached to wood plates and the nightmare of determining thermal expansion, I thought reinforced concrete would be similar because it is a composite material. But, like almost all of my apprehensions, it was ungrounded. It helped me a great deal to imagine the steel bars as a connection that must be spaced and chosen properly. Just as a 3/8" bolt was chosen and was determined to be spaced at 5", 3 # 6 bars were chosen to be spaced at 4". Not scary at all.

Our last assignment, Assignment 12, was all about foundations. This is something that has always interested me. Partly because the structure is largely hidden and can't be studied by eye and partly because I just didn't understand slab design, I enjoyed this section.

Part II | Structural Concepts

Basically, I had very little working knowledge of anything related to the underlying structural concepts of buildings before this semester. I knew basic terms, knew the different between a beam and a truss, had a basic understanding that cantilevers that were absurdly long had to be supported with columns which caused the cantilever to no longer be a cantilever, and knew the awesome structural power of the arch and the triangle. Other than that, I knew nothing about how to calculate loads, how to determine if a given beam could support the load being required of it, or any working knowledge of the ways structures can fail. After this semester, I now know how to calculate loads and that those loads can cause moments and shear and deflection. I know that the member can be loaded within the elastic range which will allow the member to return to its original shape if it was deformed during loading or it can be pushed past that limit and it will no longer return to its original shape. At the beginning of the semester I did not fully understand truss analysis, but as will be seen in the following section; Illustrative Documentation, that is a concept I can now grasp. Before this semester, I would not have known what a moment was. Now, I know that a moment is a member's tendency to rotate under a load. Moments are not seen at connections as the connection prevents are rotating so the farther away from the connection a load is, the greater the chance of having a large moment which increases the member's chances of failure.

Part III | Structural Skills

One of the most important things that can determine the success of an analysis is the free body diagram. When not drawn clearly, it can not only cause confusion and misunderstanding, but it can also cause you to visualize the situation differently, often resulting in an incorrect answer. The free body diagram is particularly valuable to beam analysis and load tracing as it keeps the various loads organized and visually understandable. I learned the hard way to draw a clear and concise diagram when I would draw one hurriedly and then not be able to understand it later. Being able to set up basic equations is also vital to the success of an analysis. If you cannot set up an equation correctly then the entire process after that point is wrong and probably won't be realized until a great deal of time has been spent working out a problem that was wrong to begin with. Also learned the hard way, I now take great care in making sure my equations are correct. Whether it be referring to class notes, assignment, the text or seeking help from my classmates, I have no chance of reaching the right answer if I don't have the right

equation. As equally as important, but in this case to design, is the use of charts and design aids. They provide an invaluable resource in helping to decide what type of member to use in a given situation. Using them was difficult at first mostly because there are so many of them scattered across our text as well as our notes, so flipping back and forth was challenging, especially when the chart I think I'm looking at is not the chart I'm actually looking at. But now I'm become familiar with them and not only know how to read them but also to use the values they provide.

Part IV | Problem-Solving Abilities

One of my biggest flaws as an architectural student studying structures is my difficulty in adapting to new and unfamiliar situations. Teach me how to calculate a point load on a cantilever and a distributed load on a beam but when asked to calculate a distributed load on a cantilever is where I run into mental stumbling blocks. I still have trouble with it to this day but I am getting better as I understand the concepts more. No matter what ~~is support~~ ^supports them, live load and dead load must be calculated together to find the total load. That was a concept that eluded me when we were analyzing live and dead loads in beam design. But the more load analysis I do the more I understand the necessity to calculate total load. A seemingly obvious step in the analysis, it caused great problems when it came to design as I would think the process was different. But I now know that each problem you approach begins in much the same way; all of which must include calculating total load. But the deeper I delve into structural concepts the more I understand how to solve the problems they present.

Part V | Learning Abilities

One thing I have learned about myself is the flaw mentioned above; my difficulty with new and unfamiliar situations. If a problem is not very similar to ones I have seen before, it is sometimes difficult to understand it and what it is asking me to do. In the past, I have relied solely on myself to understand and work through problems, but this semester I have overcome my psychological hurdle that comes with asking for help and realized the importance of seeking help from others. While I am still working on my ability to come to grips with the fact that I might not be capable of doing something by myself and admitting my ineptness in certain areas, I feel it has helped me a great deal this semester. In this process of reaching out to others, I have realized that I learn more when talking about it with my peers. I have learned more sitting across a dining room table with people in my class than I would have

sitting at home doing it by myself. I have also learned that I can understand ideas and processes better when I see them in their completed state. This lets me search for where values came from and in that process I learn more because you have to use what you know about structural concepts to know where to go to look for where a value or an answer came from. So the problems that were already worked out to completion in the note set were highly valuable to me in my process of understanding concepts and developing skills.

Illustrative Documentation

As part of this section I will revisit the assignments I received poor grades on. The first assignment I will cover will be Assignment 1, seen in Figure 1. The reason I did below average is due to a genuine lack of knowledge of how to do the problems. I will only show the last problem; 1.6.A which asks you to find the internal forces of a truss. I chose this because at the time I had such little knowledge of how to do it that I didn't and it made me fail the assignment.

The second assignment I will revisit is Assignment 3, seen in Figure 2. This failing grade was also due to a misunderstanding of shear and bending moment diagrams. But after reevaluating the material and trying to figure out why I wasn't able to do it in the first place, I realized my lack of understanding when dealing with distributed loads. For some reason, distributed loads have consistently given me trouble until I realized why; I never completely knew how to treat distributed loads when drawing the shear and bending moment diagrams. Because of this, I also failed Assignment 3 which is why I chose to redo it.

poor assignment - as graded

Reworked assignment with detailed narrative of how they knew what was wrong and why, and how they redid it with how they knew what to do

Conclusions

In all, this semester has proved to be a challenging yet highly valuable learning experience. I was right in my expectation that the course would be difficult, but it has also been very rewarding. I know it is not just some class I have to take that I will never think about again and coursework that I will wipe from my memory after the final exam. I will use this knowledge not just for the rest of my time in school, but the rest of my life as an architect and whereas after every class I took as a undergraduate I would re-sell my textbooks after finals, I fully intend to keep the textbook and the note set. And that is the ultimate test of whether or not the student got anything out of the class and if the student learned anything; if they keep the textbook after the class is over.