INTRODUCTION TO CIVIL ENGINEERING
CIVE 105
FIRST DESIGN PROBLEM

Design projects in this class are intended to introduce the student to some of the more routine, and I hope interesting, aspects of civil engineering. The first example is the design of a storm water retention basin which needs to be constructed to handle the runoff from a new shopping mall site about to be put under construction. The details of the project are on the attached document.

Design is not always a simple practice and the initial reaction to a problem is seldom the best solution. Do not assume that you can look at this problem, whip out a quick solution to it, write that all down in half a page and move on. You may certainly do that, but you will very likely fail the assignment if you do.

Design of engineering solutions typically involves some research. In this case you will need to research the different types of storm water basins available and select the type most suited for this project. Then you will need to calculate the rate at which water is building up inside your proposed retention basin and how much total water will end up being inside the basin during a 100-year storm event. Remember that water is draining out all the time it is raining so the maximum volume inside the basin is going to be a lot less than the total volume of rain that falls on the site.

From those data you can then calculate a total volume that the basin needs to contain and you can design some horizontal and vertical dimensions that will achieve that volume of retention and still drain completely at the end of the storm. With any useful design, even a preliminary design, such as this one, a sketch of the project showing the dimensions, and other useful details, is required. Consider the concept that you will be presenting your design to a potential client and you want the client to believe that you are capable of doing all the final calculations better than anyone else if he or she hires your team.

Some of those issues are addressed as follows.

The volume of runoff per unit of time is calculated based on the depth of water accumulating per unit of time (say 2” per hour, for example) over the entire area of the collection basin or drainage basin (say a 1 acre construction site, for example) you would multiply the depth of water in feet by the area of the drainage basin in square feet to yield a volume in cubic feet of runoff per unit of time. In this case you also need to multiply that number by a small reduction factor because not all of the water that falls on the site will end up being runoff, according to the problem statement. Once you know the rate of runoff you can compare that to the drainage rate of water leaving the basin, provided in the problem statement, to determine the rate of accumulation of water inside the basin. That accumulation rate times the storm duration will yield a total maximum volume that the basin will need to retain.

Once you know the maximum volume required you can start to think about how the detention basin should be shaped (square is seldom a good design and note that side slopes in the basin
must be no steeper than 3 feet horizontal to one foot vertical). Make sure you consider how the water will drain completely out of the basin at the end of the storm.

Once that is all done, you can draw a sketch of the final plan (in AutoCAD or some other drawing program) for insertion into the design report.

**A design report is required from each student on this project, written in accordance with the instructions in the problem statement, and in accordance with the writing guide document previously provided to you.**

If there are questions that arise as the work progresses, talk to your professor, email your professor, or talk to another faculty member in the department for guidance.

The first draft of your design report is due next week at the beginning of this class. Note that just because it is a draft that does not mean that it can be done poorly. I will be correcting it for you and returning it to you for further work, but you will still be graded on the quality of what you have accomplished. All of the elements of the final report should be addressed in the draft to some degree. You will not be able to do much with the designs by then, except possibly to identify options based on some research, which should be completed by then. Certainly, the problem should be clearly stated and defined within the first week and some criteria for evaluating the options should be identified. The rest of the sections may still be a bit sketchy.

I will try not to be too harsh in grading the first draft the first time, but will expect them to get better and better as we go through the semester. There will be a total of five or six designs to be done this semester.

**Note: you must earn at least a “b” or better on this first paper or you will not pass this course, regardless of how well you do on the rest of the course elements. The third draft is expected to be the final draft. I expect everyone to have achieved a grade of “b” or better by that time. We will be moving on by that time and you will be doing further drafts at the same time as other work if you do not get it right by the third time. Putting some energy into the early drafts will make the subsequent work much, much easier.**

Note that first or second drafts may be graded with numerical grades based on a total of 10 points for excellent work. Do not be confused by that. A numerical grade is not a letter grade for a reason. You must attain the letter grade of b or better to pass the course and a numerical grade, however it may be construed otherwise, is never going to be equal to that required letter grade. A 10 on both the first and second drafts can still leave the third draft at a letter grade less than b if sufficient corrections are not made to the second draft.