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Nanditha's Individual Contribution Page

Fall 2010 Contributions

This semester I am working with Andrew Sargent on the Drain Channel. We are working on writing a code in MathCAD so the design can be automated as part of the Design Tool. Thus far we have gathered information and feedback from Monroe and the engineers in Honduras about what the basic geometry of the channel should be, where it is positioned and how water flows in and out of it. We also determined what assumptions can be made to help us determined the size of the cross-section and depth of the channel, and how to code it, and calculated the equations to be used. We are working on the iterative function that will determine the headloss based on the flow rate out of the drain valves, which in term will determine all other dimensions. Once this is finished, we can begin coding the actual channel into the proper location.

The first approach we took to coding the channel was drawing a channel with a wedge below, unioning the two objects, subtracting out the inside to make it a hollow channel, then rotating the object down so it was sloped and build up the walls. This method turned out to have a number of problems and was extremely complicated. May helped us create a Loft function in MathCAD and we revised our approach to define two 10-point cross-sections of either end of the channel. Then these two cross sections are lofted together to form the channel. The channel is now completely drawn and ready for testing. It is drawn with a conservative approach so that the rectangular portion is drawn to the calculated values of headloss with the triangular wedge shaped portion adding extra depth for an over-design. This can be something future teams can work on.

Spring 2010 Contributions

This semester, I have been working with Massielle Begazo focusing on different aspects of the launder. First, we had to fix the coupling in the wall separating the sedimentation tank and the exit channel. Last semester it was incorrectly drawn so that there was no socket on one of the ends. These changes were made in the coupling script. Then, we had to add the coupling script into the sedlaunder script in the Sed Tank with Pieces file so that it would draw in the correct part of the plant. I had some trouble with this due to the way the launder was drawn and rotated, but we were able to figure it out.

The next task I worked on related to what holds up the launders on the inlet channel side of the tank. We emailed with the engineers in Honduras and talked to Monroe about some ideas. For the time being, that project has been put on the back burner. However, I shortened the length of the launder so that it does not span the entire width of the sed tank. This way it can be slid out of the coupling and removed if necessary. I also added a cap to the inlet channel side. I also made a minor change to the sed tank by adding space between the top of the lamella and the launder, which adjusted the height of the tank and the height of the water in the tank as well. This is so we can add something in to hold up the launder and also to allow for some error in construction. These changes have been documented on the Launder Design Program page.

Since the midterm, the majority of my work has been debugging code written earlier in the semester or from last semester. There were problems with the launder and the length had to be adjusted again. Also, we inserted a PVC cap at the inlet channel end of the launder so that water would not flow out that way since the pipe no longer spans the entire length of the sed tank. We had similar problems orienting and arraying this correctly as with the coupling. Another issue that arose was with the change of the Basic Inputs, the pipe schedule changed and created problems for the cap and coupling functions, so some of the functions used to determine the diameters of these items had to be changed so they would work for any schedule.

Another thing I updated was the launder control pieces. Since we corrected the coupling earlier in the semester to have sockets on both ends, the control piece that stops water flow into the launder from the exit channel had to be changed to reflect that. This is in the "Launder Cap" MathCAD file.

The biggest task we worked on for the past couple weeks was updating the coupling script. Previously, the script would just draw the coupling wherever the user placed it, usually into a section of wall. However, then the user would have to manually subtract out the wall that the coupling overlapped with. We redesigned the script in a new file called "couplingsubtract" so it will automatically remove the appropriate pieces of the wall. The coupling function now requires several more inputs, including the layer of the wall, the layer of the coupling, and a point on the wall to subtract to allow this.

Fall 2009 Contributions

This semester, I am continuing as a member of the Design Team. The project I have been working on this semester is designing control pieces to shut off flow from the inlet chimneys into the sedimentation tank. I added information about this to the Inlet Channel Design Program.

The first part of this task involved reviewing the coupling script in the MathCAD file "coupling" and fixing the code written to draw the socket diameters.

Once this was changed, I moved on to drawing the piece that would fit into this coupling and stop water from flowing into it. This piece consists of a PVC pipe, a cap to cover the top of the PVC pipe, and a tube extending out of the cap to allow for easy handling and for air to escape. To draw the pipe and the long tube, I used existing information in the pipe database to determine the appropriate inner and outer diameters based on the pipe schedules. The algorithm to draw the cap, however, required a lot of research. I spent a lot of time looking into different types of PVC caps online via McMaster and other resources. I ran into trouble in finding information on the thickness of the cap walls and the inner height of the caps because McMaster would not provide me with the information and was finally able to get the information from Spears Manufacturing. I merged this information into the Pipe Database so that a nominal pipe size now has a cap height and cap diameter associated with it that can be called by the functions CapHeight(NominalPipeSize) and CapDiameter(NominalPipeSize). Now, caps can be drawn at accurate sizes for any pipe size. I updated this on the Pipe Database Design Program.

The completed script for the control piece in the MathCAD file "ChimneyStops" is now debugged and ready to be reviewed so it can be merged into the general Final Designs\AutoCAD scripts. My next step is designing the caps to control flow between the launder pipe and the exit channel using the Orifice equation.

Since the midterm, I have written the code to draw control pieces for the launder side of the sedimentation tank. I created a separate file to draw only PVC caps, "pvccap", similar to the Pipe MathCAD file, so that caps can be drawn for any purpose. I also, drew the control piece that would be used to re-fill the sedimentation tank, after it had been drained. This script is in the MathCAD file "LaunderCap". This control piece consisted of a short stub of pipe attached to a cap with a hole in it. The constraints for this control piece are that the pipe have the same outer diameter as the launder and that the size of the orifice in the cap has to be such that the flow rate through the control piece and into the sedimentation tank is not higher than the flow rate out of the other sedimentation tanks and through the exit channel. This is important so that the other sedimentation tanks are not emptied when the drained one is re-filled, and so an equal water level is maintained in each. This was calculated using the Orifice Equation and the information is included on the Launder Design Program page.

In addition, the coupling for the launder through the wall separating the sedimentation tank and the exit channel needed to be drawn. However, the script had to be altered from the coupling script used for the inlet chimneys, because the constraint for the launder coupling is the inner diameter of the coupling socket (equal to the outer diameter of the launder), rather than the inner diameter of the coupling pipe. This is also included in the "coupling" MathCAD file.

Summer 2009 Contributions

I am a member of the Automated Design Tool Team. As a new member of AguaClara, I have spent the past few weeks learning a lot about the plant, what it looks like, it's different components, and getting a basic idea of how it works. I have also learned how to use MathCAD to do calculations and coding with different variables.

Andrew Sargent and I are on the sub-team working on the Automated Materials List. The goal is to have to have the list output to the user the total amount of materials needed and their prices based on the plant specifications entered by the user. My partner and I used the Variable Naming Guide as a starting point to find the variables needed to calculate the necessary areas, lengths, and volumes, and searched through many of the plant's component's MathCAD files to find the right variables. I calculated the total volume of concrete needed to construct sections of the plant including the entrance tank, the sedimentation tank, the floc tank, the entrance and inlet channel tanks. I also calculated the total amount of ferrous cement needed to construct the inlet slopes in the sedimentation tank and updated the code to calculate the volume of the floc baffles and the number corrugated sheets needed to construct the lamella. Together, Andrew and I were able to calculate the total volume of concrete required to construct the plant. In addition to the concrete, we calculated the length of pipe needed for the weirs, sed plate frame, and launders.

We created the Materials List to explain what the Automated Materials List was and list the Program Inputs and Outputs. We updated the Variable Naming Guide with all the variables we had created to describe the different volumes and pipe lengths of the plant. Also, an important part of our task was organizing the MathCAD file so it was more understandable and sectioned off into the different types of materials.

Since the mid-term we have primarily been working on fine-tuning equations and making our work more understandable to the user. Based on feedback from Matt, Monroe, and Heather, we updated many of our MathCAD equations. I gained a better understanding of the geometry of the inlet drop chimneys and was able to calculate the volume of those, as well as correct the equations for the inlet and exit channel tanks, floc baffles, and floculation tank. We learned that the foundation should not be included in the volume of the plant's channels and tanks so we updated those equations to reflect that. We continued to work on improving our new wiki page to give the user a better understanding of how the materials list is calculated and what it's purpose is.

Most importantly, we updated and formatted the Variable Naming Guide so that the Design Tool now outputs our 18 variable Materials List. This is the final product of this task. Since then, we have emailed the engineers in Honduras to receive feedback on our work and to learn what would be helpful to change and what can be added in the future to make the Materials List most useful to the user.

On the side, I have also been in contact with the Cornell Alumni Magazine about getting publicity and raising funds for AguaClara.

Overall, this summer was a great learning experience for me. Working on the Materials List allowed me to learn about the geometry and functions of the majority of the components of the plant, and I feel like I have a greater understanding of the AguaClara project as a whole.

Pages Created/Updated

Drain Channel Design Program

Launder Channel Design Program

Inlet Channel Design Program

Materials List Design Program

Automated Materials List Outputs