Section Cuts

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Problem Definition

Introduction

For our task this semester of automating section cuts in the design tool, we will continue to build section cuts for difference parts of the AguaClara water treatment plant. The current plant design requires section cuts with different parts distinguished with color. This requires the "SPTB" module to be added to the original Mathcad code (see Fall 2012 Section Cuts Report). However, the current code is using an AutoCAD built in command to create sections cuts, which needs someone manually operate at some point during the creating process. In order to avoid that, we plan to replace the AutoCAD built in code with the module "SPTB" which will make the whole process automated. Before loading "SPTB" module to AutoCAD, make sure you unblock the "Sectioner.dll" by doing it in property. Besides that, we plan to create more section cuts for sedimentation tank and flocculator of different views seperately. Figure 11 shows current section cut view for sedimentation tank, and our goal is to have a final section cut that looks like Figure 2 2.

Design Details

The function that we are going create in Mathcad is slightly different from those existing ones. We used the code that has been created in previous semseter to generate the plant layouts, and we were creating different section cuts based on the code written by the previous team. The critical part of our code is "SectionCut" function, and we modified it in order to avoid an unexpected layer which would be generated after running "SPTB" command. Moreover, we decided creating a command of "Enter" and used it instead of "SP" command in order to avoid unexpected error happaning while running the "SectionCut" function. Finally, we created longitudinal and transversal cross section cuts for sedimentation tank and flocculator. We did not create more cuts for the filter since the code created by previous team has generated satisfactory cross section cuts for the filter.

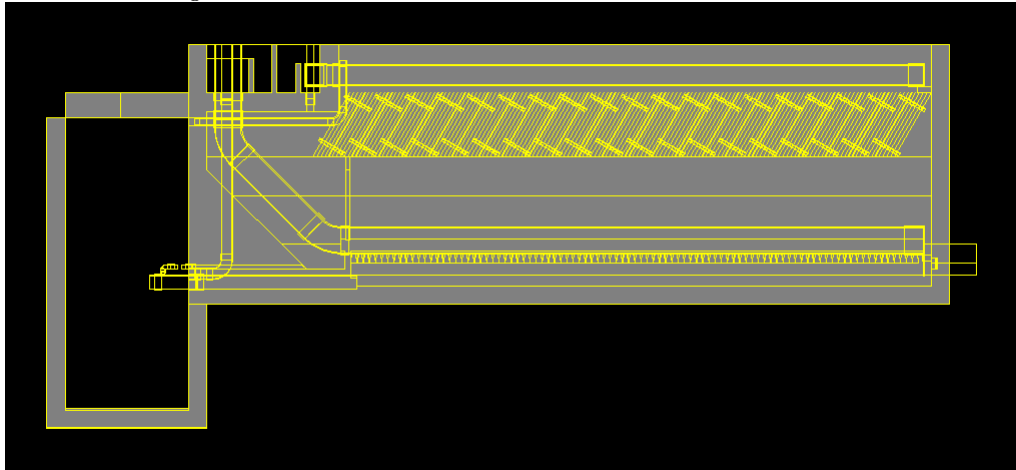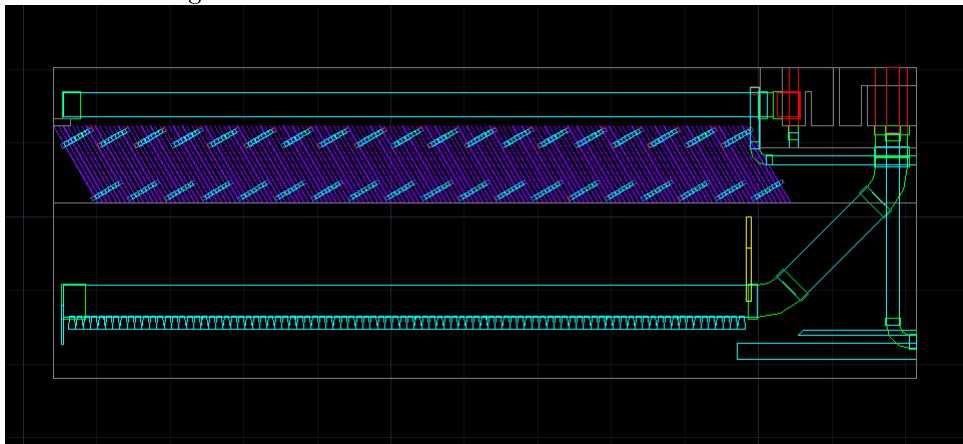Figure 1: 2D Section Cut for Sedimentation Tank 1

Figure 2: 2D Section Cut for Sedimentation Tank 2

The way to manually create a section plane is as follows:

- Command "Netload"

- Select "Sectioner.dll" module

- Define two points that will create a section plane

- Define one point of the section plane direction

- Select the plane

- Create section cut with "SPTB" command

- Select cut insert point

- Specify X & Y factor, usually use 1 for each

- Specify angle, usually use 0 deg

The longitudinal and transverse section cuts can be produced to illustrate details of plant. This is very useful for our implementation partners to construct the plants. The following list contains the command to create cross section cuts for sedimentation tank and flocculator seperately from appropriate view. Other section cuts created by previous team for the filter, entrance tank and etc. will not be listed here. These functions can be modified for other specific plants or special designs.

Longitudinal cuts (section plane which is parallel to x-axis):

- Inside of sedimentation tanks with section cut in the middle, looking to front direction (negative y direction)

- Inside of flocculator with section cut in the middle, looking to front direction (negative y direction)

Transeverse cuts(section plane which is parallel to y-axis):

- Inside of sedimentation tanks with section cut in the middle, looking to right direction (positive x direction)

- Inside of flocculator with section cut in the middle, looking to right direction (positive x direction)

Documented Progress

Problems Encountered

The first problem we encountered was that the "Sp" command (Space command) can not always be idenitfied as an "Enter" in AutoCAD command. We created

a new "Enter" command in Mathcad to replace "Sp" when we were creating section plane in "SectionCut" function. Please see Mathcad code for detail. We were also trying to create a cross section cut of the sedimentation tank without involving other parts of the plant in the final section cuts plot. We were trying to turn off or freezing the layers that we do not want in the final plot. The idea is to only have the sedimentation tank layer showing on screen by turning/freezing all other layers. We were expecting the built in section cut command would only work for the layers turning on, but the command still did the cut involving all other turned off layers. Thus this stragedy did not work as we expected.

The other way we were trying to avoid the above problem was to drag the part which we wanted to create the cut out from the plant, and then created cuts and put it back to the original point. This did work but it also took a lot of time to work on relocation. Also it was a lot of work to build up the code and mistakes could have easily been made.

We finally found that the "SPTB" command could solve the problem mentioned above by simply turning off the layers we did not want. You cannot turn off the layers before the "SPTB" code or else it will not work.

Besides what mentioned above, we were not able to netload "SPTB" to AutoCAD at first, because we did not notice that we need to unblock the module before we netload it. The way to do it is right click on "Sectioner.dll" module. Then select properities and click on unblock.

Another problem we were facing was the solid color showing on our longitudinal section cut for the sedimentation tank (Figure3). We could not solve this problem by moving out the concrete tank box beforing doing the cut, otherwise the graph would not have a sedimentation tank frame on it . The trick to do it is to turn off the layer created by "SectionCut" code. For example, if the "Section Name" is "Sedimentation Cross Section" in SectionCut function, then turn it off after the final section cut plot generated. Also, we created a "LayerOff" command in SectionCut function to avoid this, which could be simply accomplished by replacing the "LayerName" in SectionCut function with the layer name. Please see Mathcad code for detail.

Accomplishments

Firstly, we modified the code created by previous team and made them run correctly. Secondly we successfully created section cuts for different parts of plant with different parts distiguished by color. Then we successfully automated doing section cuts in AutoCAD, and the code in Mathcad could be modified for other special section cuts. At the meantime, we also overcame the problems we faced as described in "Problems Encountered" section.

Section cuts for different parts of plant. (Figure 4 - 12)

Figure 3: 2D Section Cut for Flocculator
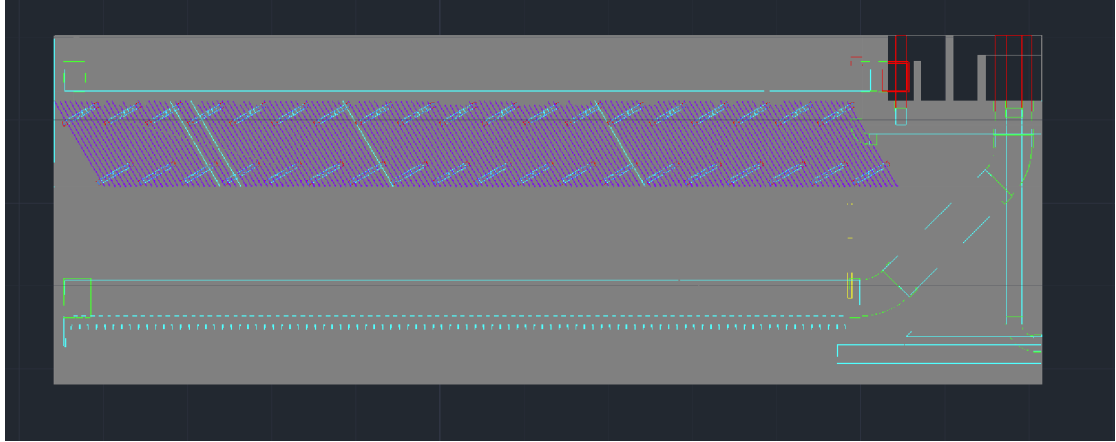
Future Work

For this semester, we have created specific layouts for the plant including entrance tank, flocculator, sedimentation tank and the filter. And we also created additional code for them to fulfill automation in some sense. However, we did not include specific dimensions on our drawings, which could be a possible approach to make the Section Cut work look better in the future. So in next semester, designers could consider labelling the section cuts with details showing their functions and dementions, which would make it more straightforward to readers.

Besides, in the future different ways of showing the pipe system should be considered. For example, we could freeze other parts of the plant and only leave the pipes going through the entrance tank and finally to the filter. That would show us how the pipe system work as well as giving a better understanding of design to the implementation partners who may be less familiar with certain aspects of the AguaClara plant. There still are work to be done in Section Cuts.

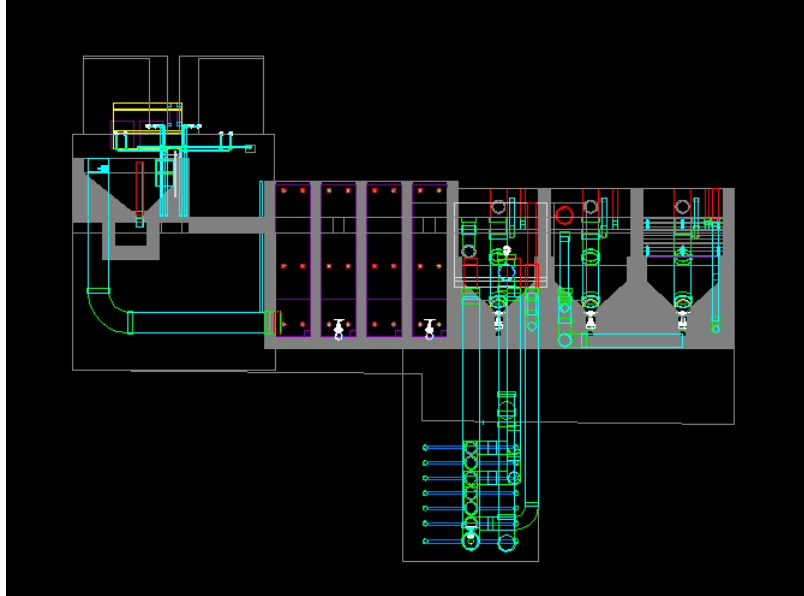Figure 4: Cross_section of plant(Looking left)
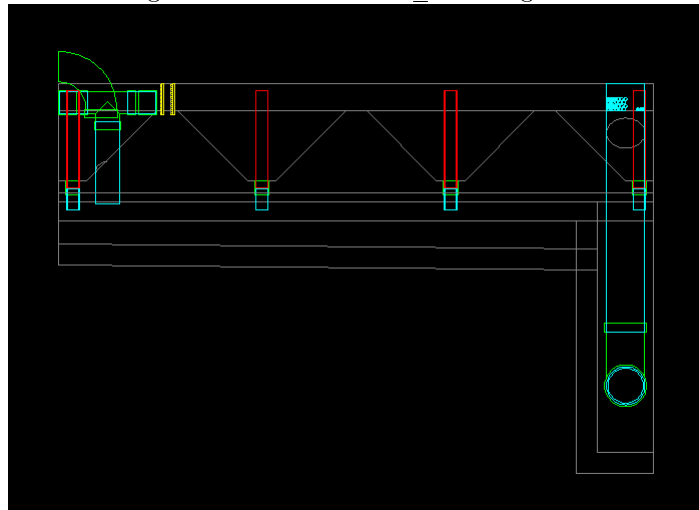
Figure 5: Entrance Tank_ Looking back
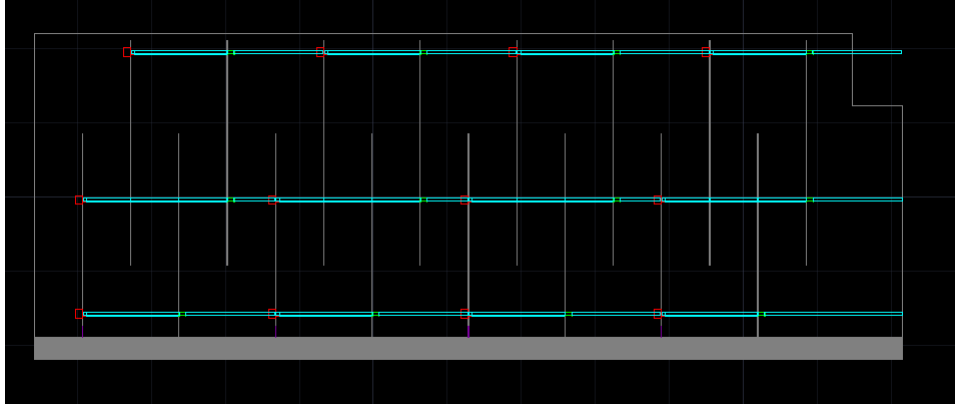
Figure 6: Flocculator(Looking front)

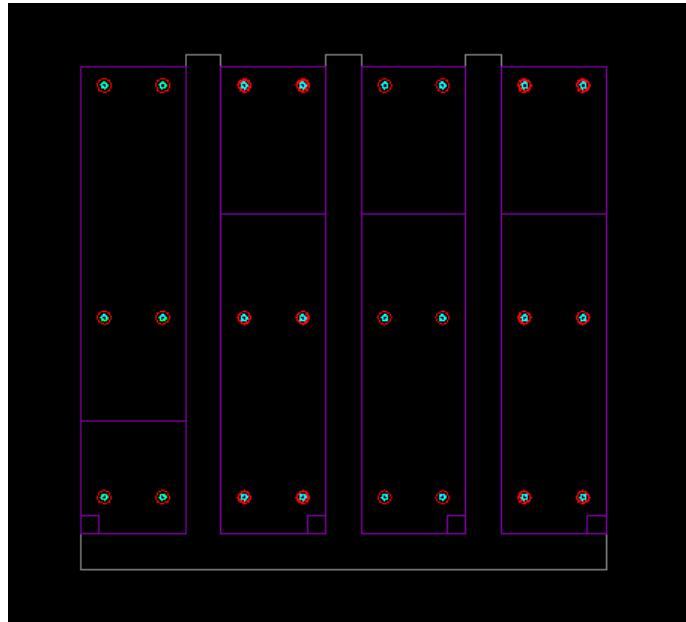Figure 7: Flocculator(Looking right)

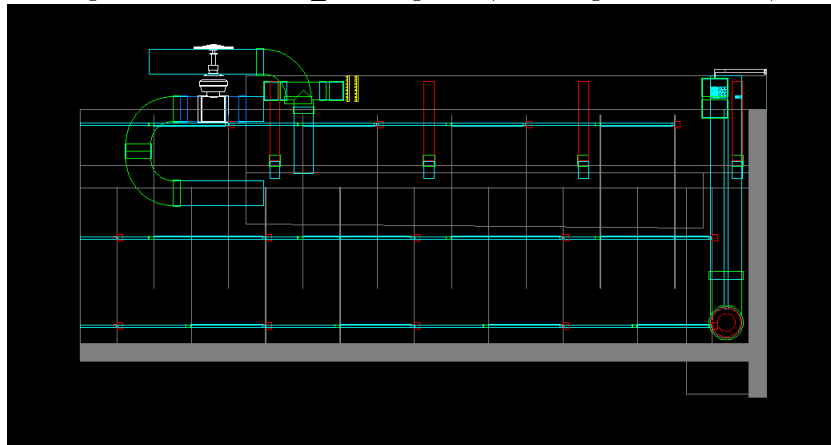Figure 8: Flocculator_Looking back(including entrance tank)
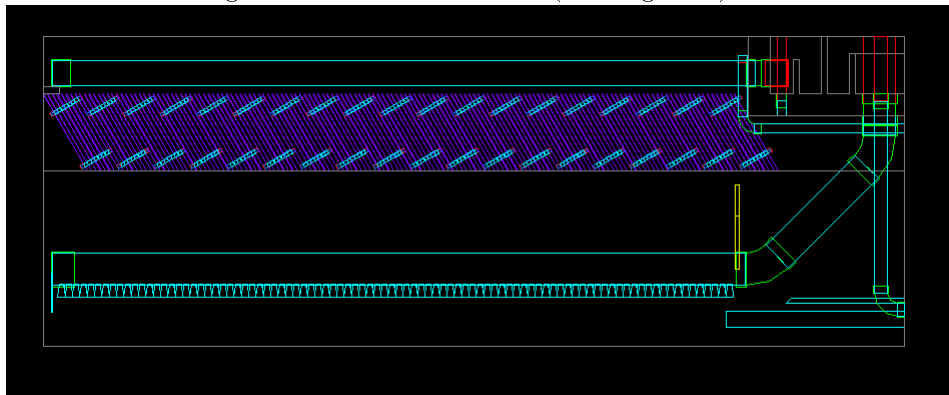

Figure 9: Sedimentation Tank(Looking front)
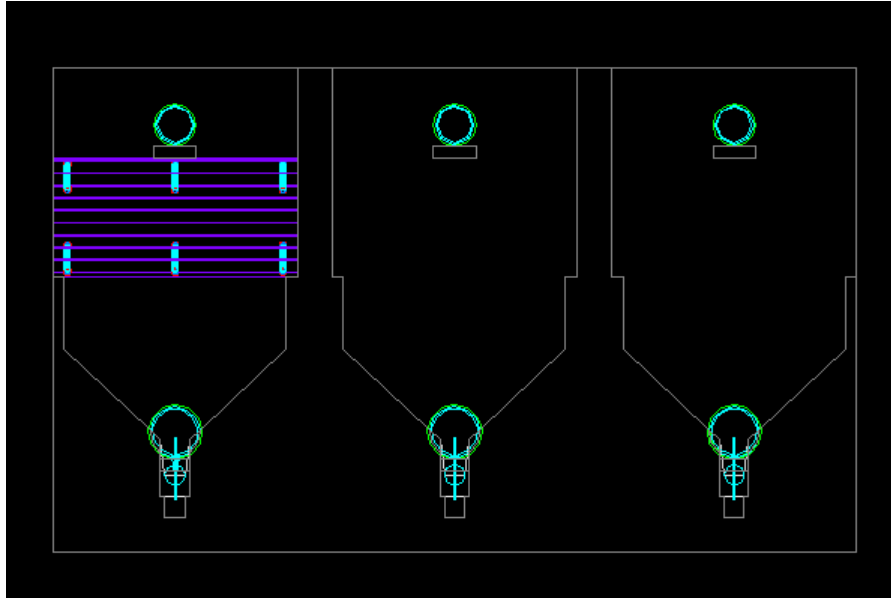
Figure 10: Sedimentation Tank(Looking right)

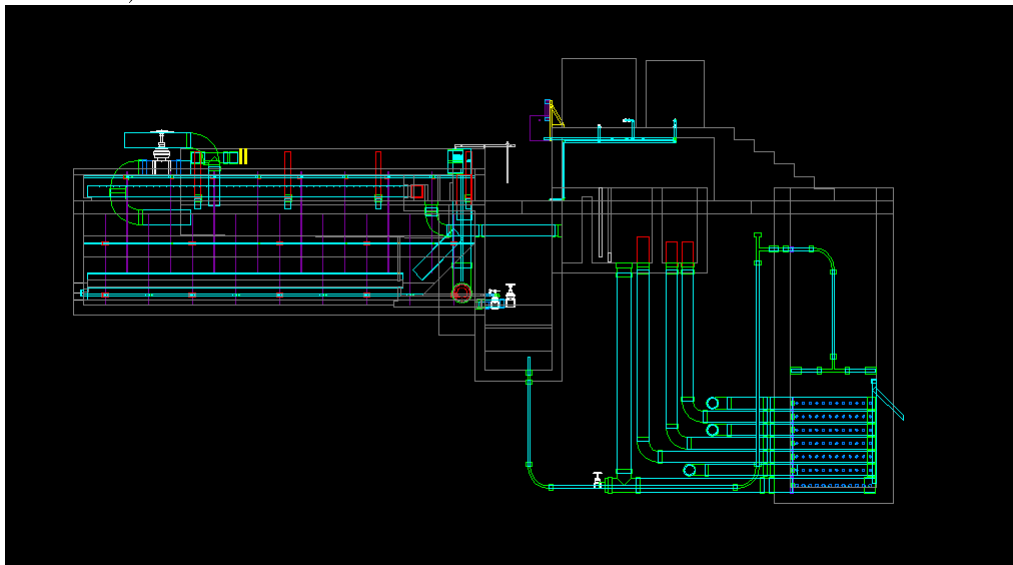Figure 11: Sedimentation Tank_Looking back(including entrance tank, filter, flocculator)

Figure 12: Filter_Looking left(cross-section)