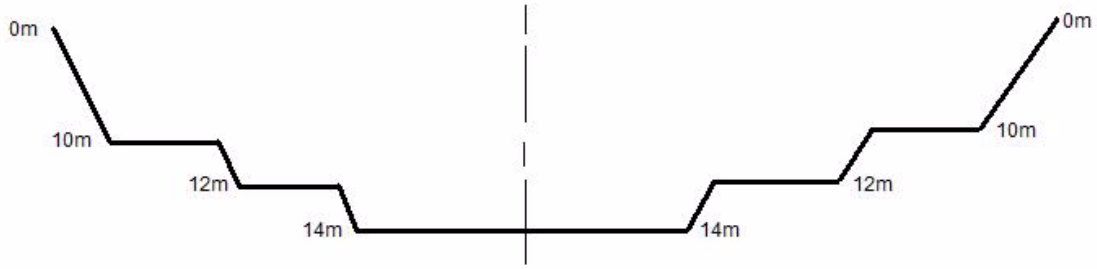
Computation of Volumes with Complex Templates

By Pat Sanders

Joe Burnett came back from the Shanghai training seminar with an interesting question. How can you compute volume quantities when you have a cross-section design template like the following:

FIGURE 1. *Our "Channel Challenge"*



You can't design this in CHANNEL DESIGN, as it has more than one turning basin on each side.

You can't design it in the PLANNED LINE EDITOR. The editor allows you to enter template points (depth and distance pairs), but it only allows you to enter 11 points. Our profile has 12 points (if I ignore the centerline point). The reason for the 11 point limit in the PLANNED LINE EDITOR is that CHANNEL DESIGN is limited to 11 template points, so we also limited the PLANNED LINE EDITOR to 11 template points.

You could create the templates in CROSS SECTIONS AND VOLUMES (CSV). It allows you to create templates with over 20 depth-distance pairs. Just click in the Template column and then open the Template Editor. When you finish entering your depth-distance pairs to define your template, save the info to a Template (TPL) file. The name of the TPL file then appears in the Template column.

If every cross section uses the same template, you only have to make one, then use the 'Fill Column' icon to assign that template to every subsequent section. However, if your channel width varies throughout the project, you will have to make several templates, and possibly a separate template for each section. Not fun.

The other problem is that many of the volume methods in CSV only support a simple channel. (Simple Channel = Left slope, Center Channel, Right Slope…… or Left slope, Left-of-Center Channel, Right-of-Center Channel, Right Slope). The only methods that can handle this complex channel are:

- Standard HYPACK (prismoidal method)
- AEA No Segments
- Beach

FIGURE 2. *Creating a user defined template in CSV*

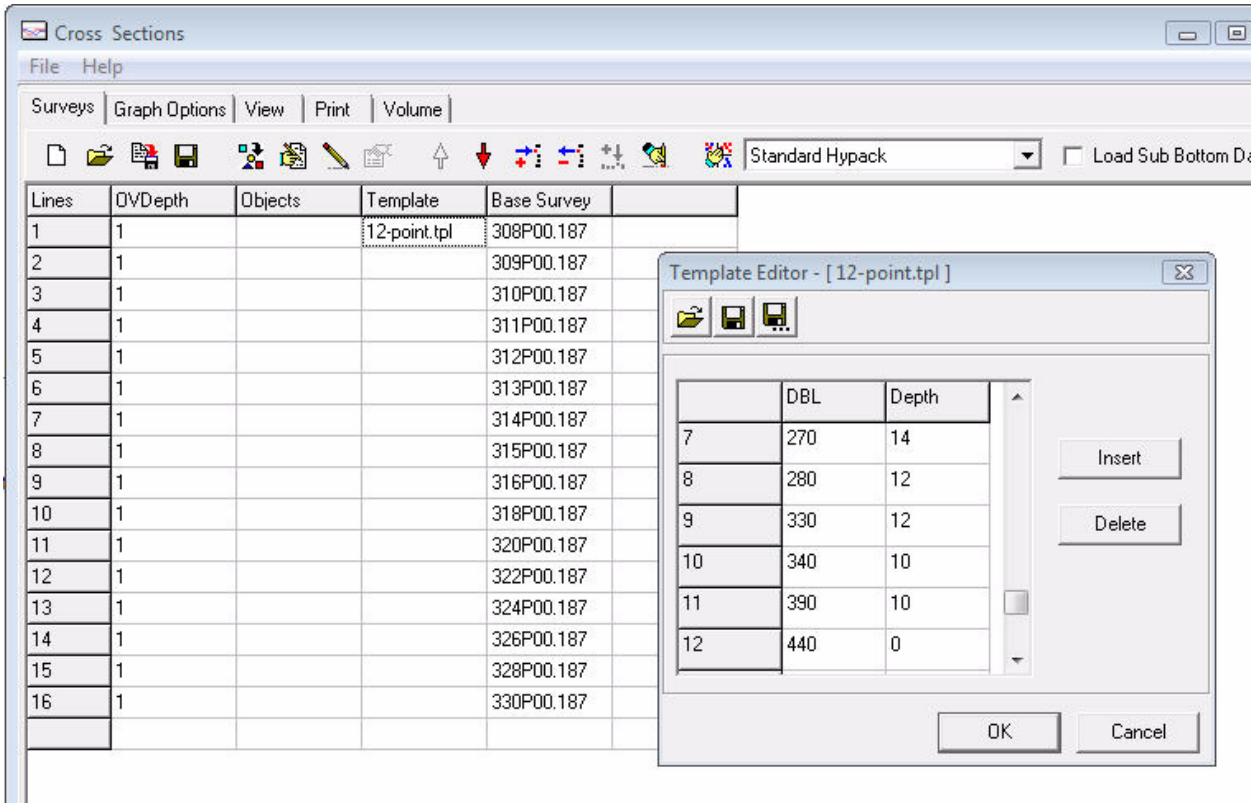
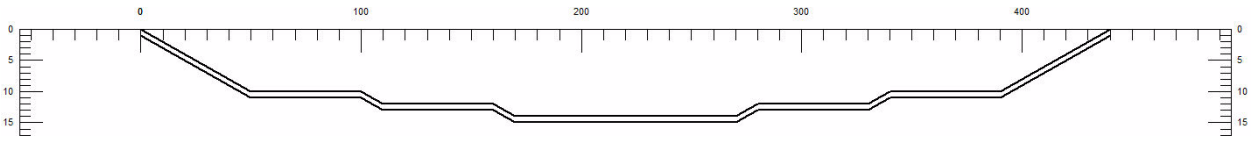


FIGURE 3. *The resulting template shown in the View tab of CSV*

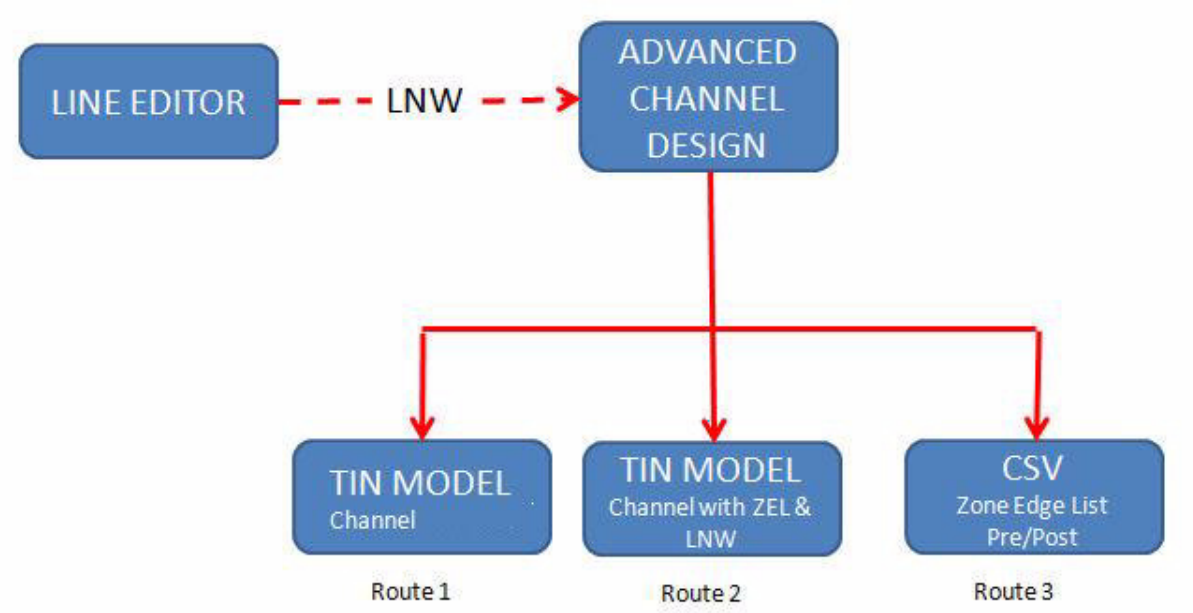


If you have the situation where the channel width varies, or if you want to do volumes in the TIN MODEL, then we are going to have to use the ADVANCED CHANNEL DESIGN program.

VOLUMES CALCULATION OPTIONS

There are three different routes that we can take….

FIGURE 4. *Three Methods to Compute Volumes in our Channels*



In the TIN MODEL, we have two options:

- **Route 1:** Ignore the planned line file (LNW) and just generate volumes above and below the entire CHN.
- **Route 2:** Use the planned line file (LNW) and report the volumes for each ZEL category between planned line pairs.

If you do not include a section file as a planned line file, you don't have the option to use the ZEL (Zone Edge Listing) information. So, if you want to take Route 2, you need to include both a CHN file and the LNW file when building the TIN model.

In CSV, there is only one option:

- **Route 3:** Calculating volume by zones.
  a. When creating zones in ADVANCED CHANNEL DESIGN, input your Planned Line File (LNW) and then save a Zone Edge List (ZEL) file.
  b. Once inside CSV, select the Zone Edge Listing PreDredge (one data set) or Post-Dredge (Pre vs. Post) volumes computation methods.
  c. In the Template column, tell it you want to enter a file. Enter the name of the Zone Edge List (ZEL) file and fill the column.

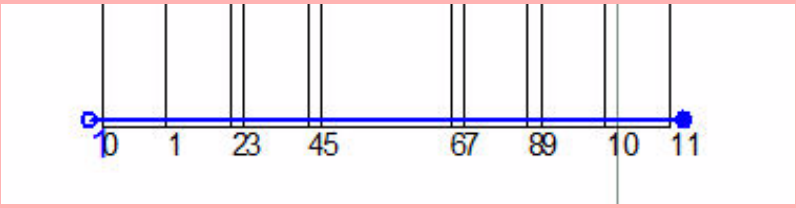
Hint 1: When using an LNW file in ADVANCED CHANNEL DESIGN and calculating volumes using either Route 2 or Route 3, it's best to make sure the planned lines extend beyond the outside border of the CHN file and that a planned line does not lie exactly on the edge of the channel.

For example, the planned line (1) shown in blue in Figure 5 lies exactly on the outside border of our CHN file. This can cause some problems when we try to determine the mathematical intersections of each sub-zone with the planned line.

FIGURE 5. *Planned Line Overlays Channel Edge*

It's best if you extend your CHN file slightly so that the LNW file has exact intersection points, as shown in Figure 6. It won't affect the volume computation as TIN MODEL will only report the volume between planned lines.

FIGURE 6. *Channel Extends Beyond the Line File.*



If you are calculating volumes using Route 1, the intersections are not a concern.

PREPARATION: ADVANCED CHANNEL DESIGN (ACD)

CREATING ZONES

I entered my node points and made my planar faces in ACD. You can review the documentation if you want more details. In the Zones window, I created nine zones and assigned each one a different name and color. I then assigned each face to its appropriate zone. (Figure 7)

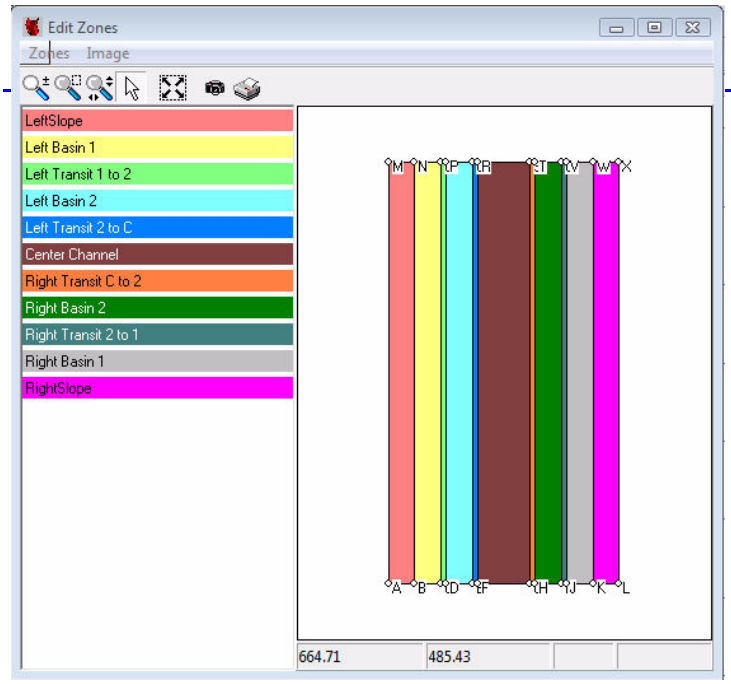


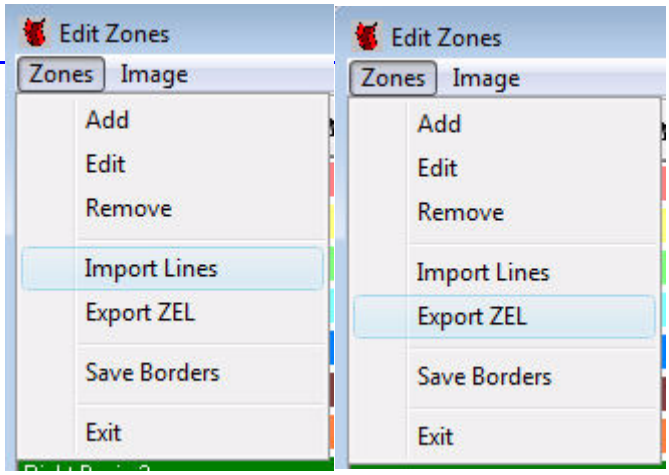
FIGURE 7. *Creating a Channel Template (*.CHN) for Zone Volumes Calculations*

If I'm going to use the zones in TIN MODEL (Route 1 or Route 2), I can just save the CHN file and continue on to the TIN MODEL program.

If I'm going to use the zones in CSV (Route 3), I need to import my planned lines and create a Zone Edge List (ZEL) file.

GENERATING THE ZONE EDGE LIST

FIGURE 8. *Importing Planned Lines to Generate a Zone Edge List*



1. In the Zones window, select 'ZONES>IMPORT LINES'. Your lines will be drawn to the screen.
2. Select 'ZONES>EXPORT ZEL'. You'll be asked for the name of your Zone Edge Listing file.

Although you don't need the CHN file when doing volumes in CSV, you went to a lot of work to make it and you will want to save it to a CHN file before exiting ACD. (Enough abbreviations for you?).

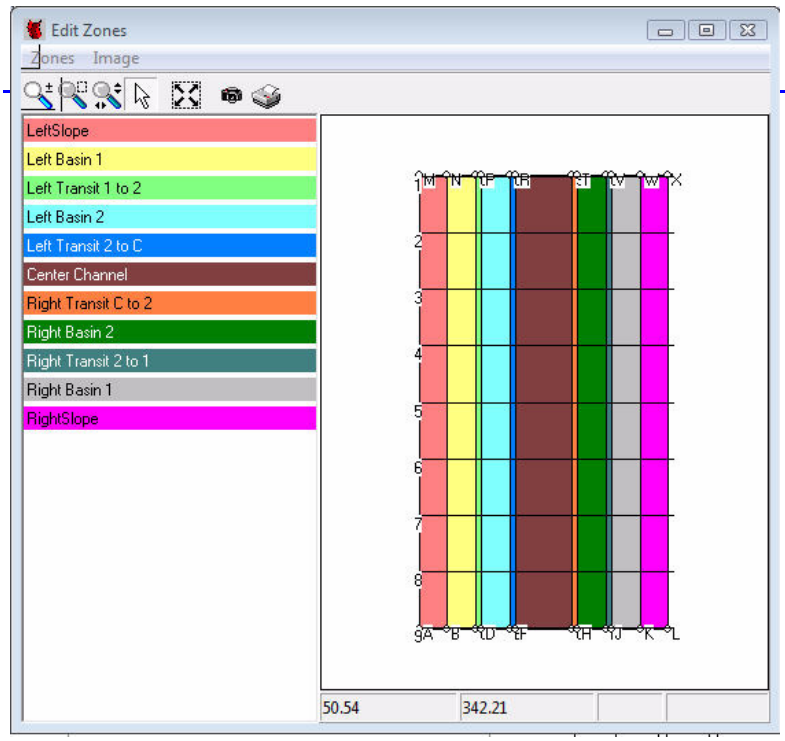
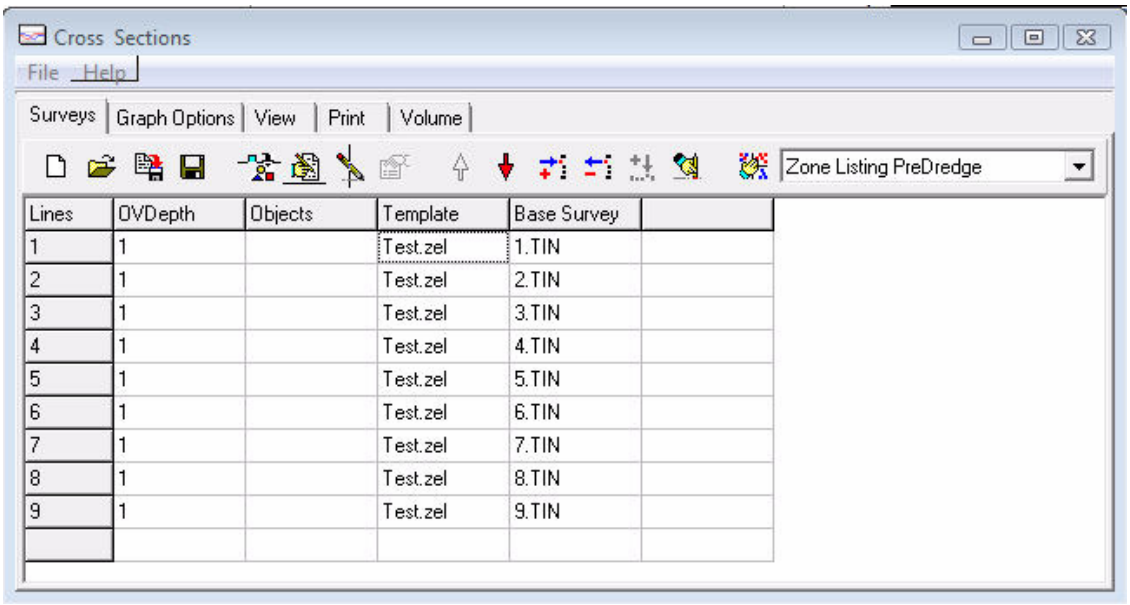


FIGURE 9. *Zones window after we have imported our LNW file*

When you export a ZEL file, the program goes along each planned line to determine where it passes from one zone to another, or where there is a depth transition point in a zone. That information is written to the ZEL file and can then be used in CSV.

ROUTE 3: CROSS SECTIONS AND VOLUMES:

FIGURE 10. *Entering the Zone Edge List File in CSV*



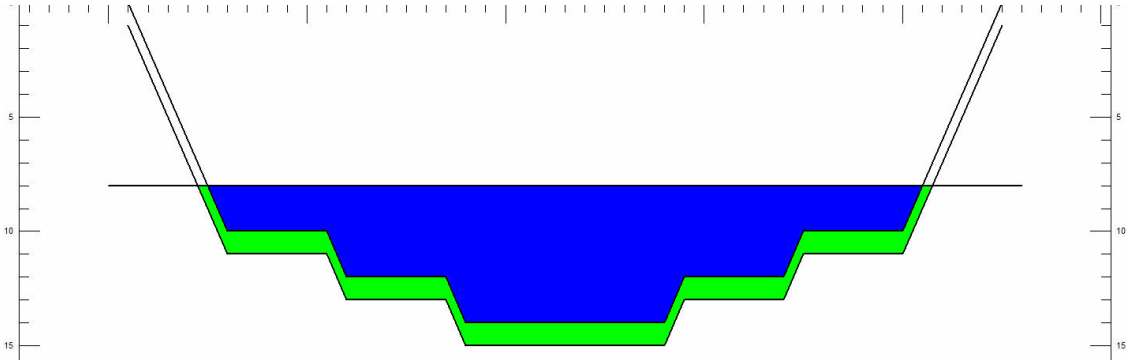
Lines	OVDepth	Objects	Template	Base Survey
1	1		Test.zel	1.TIN
2	1		Test.zel	2.TIN
3	1		Test.zel	3.TIN
4	1		Test.zel	4.TIN
5	1		Test.zel	5.TIN
6	1		Test.zel	6.TIN
7	1		Test.zel	7.TIN
8	1		Test.zel	8.TIN
9	1		Test.zel	9.TIN

CSV is pretty straight-forward.

1. Select one of the two Zone Listing methods (PreDredge or PostDredge)
2. In the Template Column, enter the name of your Zone Edge List (ZEL) file.
3. Fill the Template Column with that name.

4. Go to the View window to check your sections!

FIGURE 11. *Resulting Sections*



The report, it will break down the quantities for each of the zones created in ACD.

FIGURE 12. *Zone Volumes Report in CSV*

Cross Sections

File Help

Surveys | Graph Options | View | Print | Volume

Volume Report Plan: Method: Zone Listing 9/28/2009 9:22:13 AM
Areas: Sq Meters, Volumes: Cu Meters

	Design	Overdepth	Contour OD
LeftSlope	8000	10000	8000
Left Basin 1	80000	40000	40000
Left Transit 1 to 2	24000	8000	8000
Left Basin 2	160000	40000	40000
Left Transit 2 to C	40000	8000	8000
Center Channel	480000	80000	80000
Right Transit C to 2	40000	8000	8000
Right Basin 2	160000	40000	40000
Right Transit 2 to 1	24000	8000	8000
Right Basin 1	80000	40000	40000
RightSlope	8000	10000	8000
Totals	1104000	292000	288000

1	LeftSlope	Left Basin 1	Left Transit 1 to 2	Left Basin 2	Left Transit 2 to C
Design					
Area	10	100	30	200	50
Overdepth					
Area	13	50	10	50	10
Contour Overdepth					
Area	10	50	10	50	10

2	LeftSlope	Left Basin 1	Left Transit 1 to 2	Left Basin 2	Left Transit 2 to C
Distance	100	100	100	100	100
Design					
Area	10	100	30	200	50
Volume	1000	10000	3000	20000	5000
Acc Volume	1000	10000	3000	20000	5000
Overdepth					
Area	13	50	10	50	10
Volume	1250	5000	1000	5000	1000
Acc Volume	1250	5000	1000	5000	1000
Contour Overdepth					
Area	10	50	10	50	10
Volume	1000	5000	1000	5000	1000
Acc Volume	1000	5000	1000	5000	1000

I'll finish up TIN MODEL in Part II, coming soon….