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Chapter 20: Quantities

Overview

Quantities are calculated by many different methods. The type of quantity, its unit of measurement, and how it is shown in the plans will dictate the method used to calculate it. Since this is a CADD manual, this chapter will go through the procedures used to calculate quantities using plan and cross section drawings. A detailed description of each item to be calculated, the means of calculation, and the accuracy needed is reserved for another publication.



These methods will only work if you use D&C Manager to draw or set the symbology of the elements you need to quantify.

This chapter is broken into two sections. Calculations in plan view and calculations in cross sections. D & C Manager will be used to calculate items in the plan drawing and XS Reports will be used to calculate items in the cross section drawing.

Quantities in Plan Drawings

Three different types of quantities can be calculated in the plan drawing: each, linear, and area. All of these will be calculated using the computation tool in Design & Computation manager. Most of the items that need to be calculated are set up in CFLHD's Design & Computation Manager database. So, if you followed these standards while drawing each element, quantity calculations will be easy. See the chapter on D&C Manager for more information on drawing elements.

The D&C manager can be selected by picking Plan View Quantities on Project Manager, or by selecting Design and Computation Manager icon on the GEOPAK Main menu.



Figure 20-1: D&C Manager Icon

If you use Project Manager, GEOPAK will automatically set Design & Computation Manager in Compute mode. If you select Design &



Computation Manager from the GEOPAK Main menu, you will need to shift it to Computation mode by picking the Compute button in the menu bar.



Figure 20-2: Compute Icon

This will pop up the following two dialog boxes.

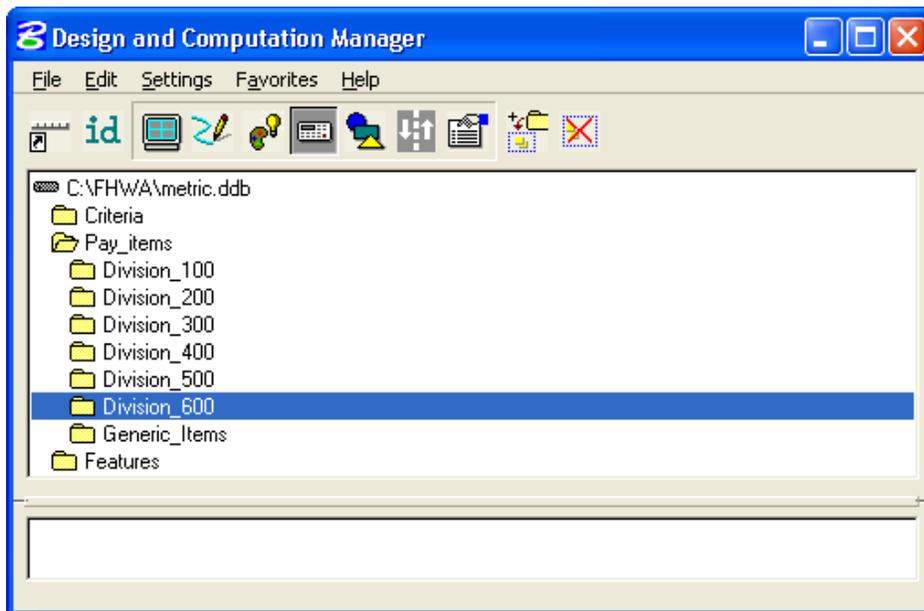


Figure 20-3: Select Item for Computation

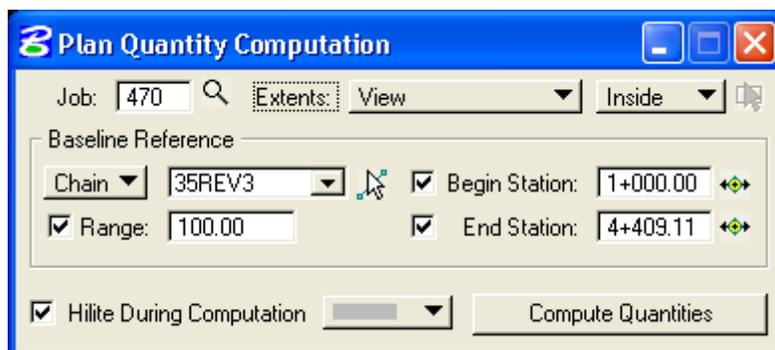


Figure 20-4: Compute Dialog



The first dialog box will allow you to select the items to be calculated. The second dialog box sets up the parameters for calculating and reporting the quantities. The following workflows will explain the processes for calculating quantities in each of the three types: each, linear, and area.

Examples of quantities to be calculated in units of each are, manholes, trees, lights, survey monuments, etc. The following workflow will guide you through the calculation process.

Workflow 1: Calculating “By Each” Quantities

1. *Select item or items that you want calculated using the D & C Manager item list. Double-clicking on the item to be calculated will populate collection box at the bottom.*

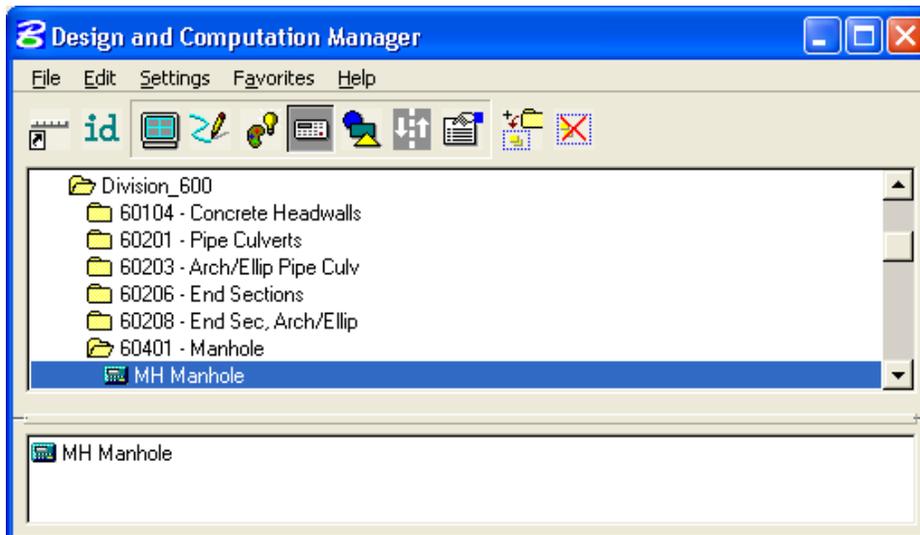


Figure 20-5: Item Selection

2. *Make sure the Job Number and Chain Name are correct. Set the Extents to View, Fence, or Active Design File. Pick Compute Quantities.*

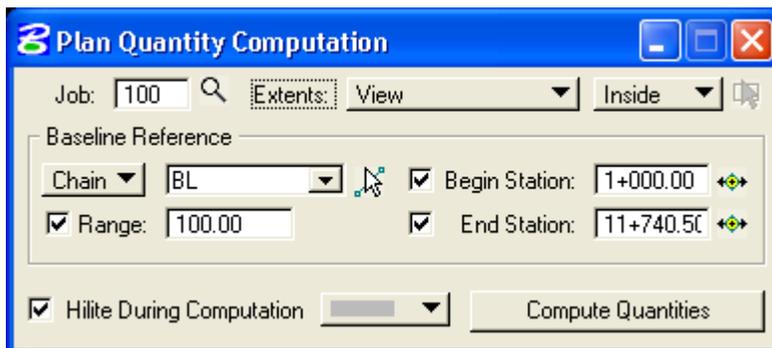


Figure 20-6: Compute Dialog



3. This will bring up the following dialog box:

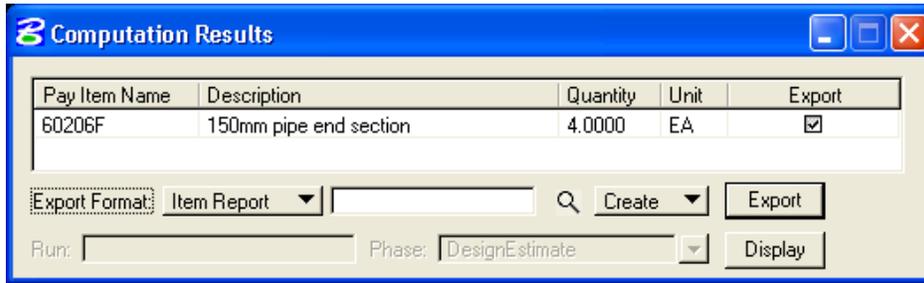


Figure 20-7: Computation Results Dialog

4. To get an itemized calculation (Station and Offset to each item), change the Export Format from Item Report to Comp Book, then give it an output file name to look like the following:



Figure 20-8: Computation Results Dialog for Comp Book

5. Pick Export. The following report will be created:

Date: 12/10/2004 2:11:14 PM					Page No.	1
File Name: C:\FHWA\pipe.cmp						
Item: 60206F						
Desc: 150mm pipe end section					Unit: EA	
Baseline	Station	Offset	Northing	Easting	Quantity	
BL	1+844.08	-9.93	623688.6999	197464.3486	1.00	
BL	1+840.01	23.69	623660.1813	197446.0967	1.00	
BL	2+016.04	-11.69	623611.1293	197617.2084	1.00	
BL	1+992.12	22.47	623590.5959	197580.7046	1.00	
Item Total:		4	Unit: EA		4.00	

Figure 20-9: Output

Examples of linear quantity calculations are fence, gutter, guardrail, etc. The following Workflow will guide you through the calculation process.

Workflow 2: Calculating "Linear" Quantities

1. Select item or items that you want calculated using the D & C Manager item list.

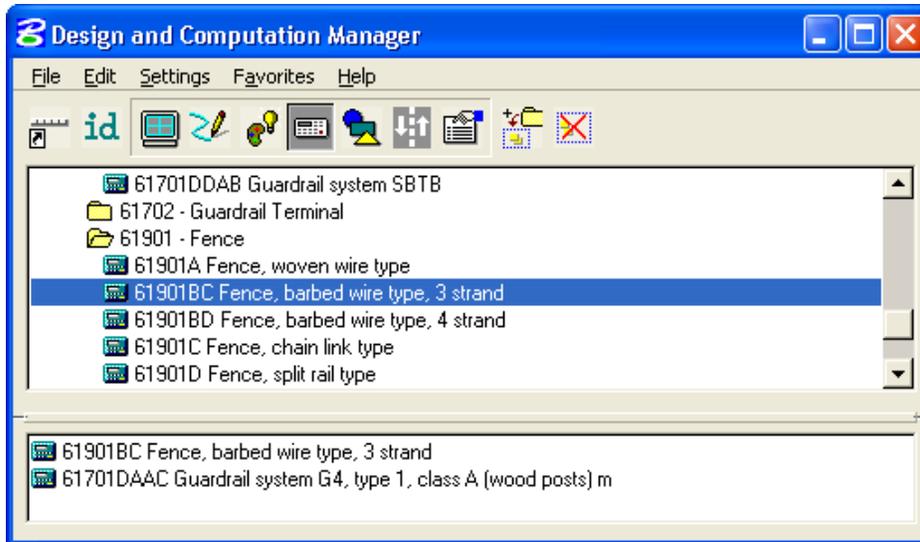


Figure 20-10: Multiple Item Selection

2. *Make sure the Job Number and Chain Name are correct. Set the Extents to View, Fence, or Active Design File. Pick Compute Quantities.*

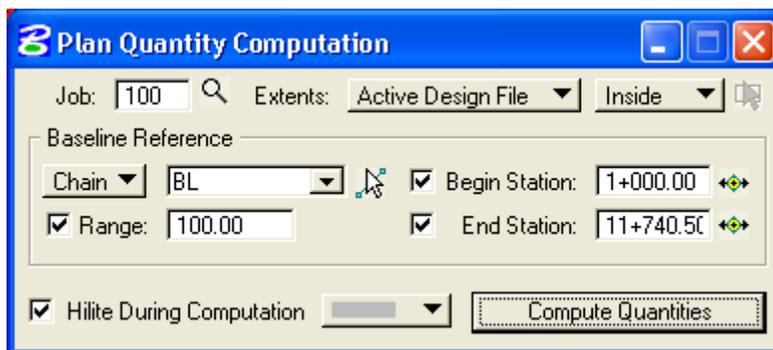


Figure 20-11: Compute Dialog

3. *This will bring up the following dialog box:*

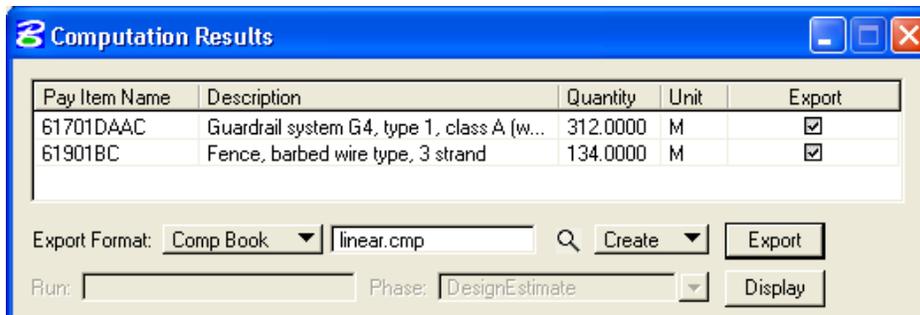


Figure 20-12: Computation Results

4. *Set Export Format to Comp Book and add a file name. Pick Export, get the following output file:*



LINEAR MEASUREMENT COMPUTATION												
Date: 12/10/2004 2:29:58 PM												
Pay Item No. 61701DAAC Unit:M File Name: linear.cmp												
Pay Item Name: Guardrail system G4, type 1, class A (wood posts) m												
Baseline	[B E G I N]		[E N D]		[O R I G I N A L]			[F I N A L]			Over/Under Run	Remarks
	Station	Offset	Station	Offset	Gross Length	Deduct	Net Length	Gross Length	Deduct	Net Length		
BL	1+530.30	-22.19	1+846.36	-40.26	312.00	0.00	312.00					
Totals Unit:M					312.00	0.00	312.00					

LINEAR MEASUREMENT COMPUTATION												
Date: 12/10/2004 2:29:58 PM												
Pay Item No. 61901BC Unit:M File Name: linear.cmp												
Pay Item Name: Fence, barbed wire type, 3 strand												
Baseline	[B E G I N]		[E N D]		[O R I G I N A L]			[F I N A L]			Over/Under Run	Remarks
	Station	Offset	Station	Offset	Gross Length	Deduct	Net Length	Gross Length	Deduct	Net Length		
BL	1+870.30	17.80	2+003.26	20.51	134.00	0.00	134.00					
Page Totals Unit:M					134.00	0.00	134.00					
Totals Unit:M					134.00	0.00	134.00					

Figure 20-13: Output



Notice, in the example above, multiple quantities were calculated at once. You can add the items that you need calculated in the collection box by double clicking on it. If you want to remove an item from the collection box, simply double click on it in the box.

Examples of area quantities that are calculated in the plan view are, sidewalk and concrete pavement. Since GEOPAK uses shapes to calculate areas, area quantities are not quite as simple as the “By Each” and “linear” quantities, but once you get used to it, it is a time saver. The following Workflow will guide you through the process.

Workflow 3: Calculating “Area” Quantities

1. Highlight the item you want to calculate, then pick the Shape button on the menu bar.

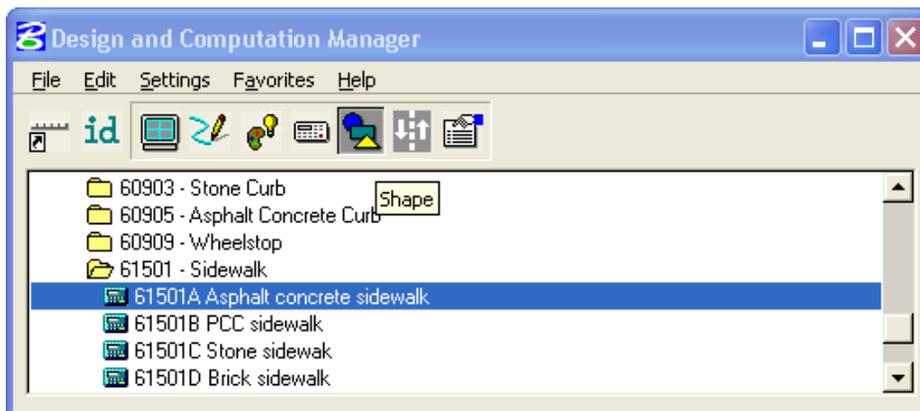


Figure 20-14: Place Shape Icon

2. The following dialog box will come up.



Figure 20-15: Place Shape Dialog

The correct level symbology will be automatically input. The Automatic button has three choices: Semi-auto, Automatic, and exclusive. Semi-auto will allow you to pick the items you want to create the shape with, Automatic will create a shape around a point that you pick inside your area, and exclusive will create a shape where you want to exclude an area such as a planter in the sidewalk.

3. The two methods that you can use are Automatic and Exclusive. Exclusive is used when there is a deduction from the area, for example a planter in the middle of a sidewalk. Automatic is used when there is no need for deduction. The easiest method is Automatic; the tolerance and radius values can be adjusted if automatic is not working. Pick Draw and pick a data point in the middle of the area that you want the shape in. GEOPAK will draw the shape. When you pick draw with Exclusive, GEOPAK will prompt you to pick a data point inside the outside shape. Once you pick that data point, GEOPAK will highlight the outer shape and then prompt you to pick inside the inner shape to deduct. Once that data point is selected, GEOPAK will draw the shape with the hole in it.
4. Go back to Plan Quantity Computation dialog box, Pick Compute Quantities and the following dialog box will appear.

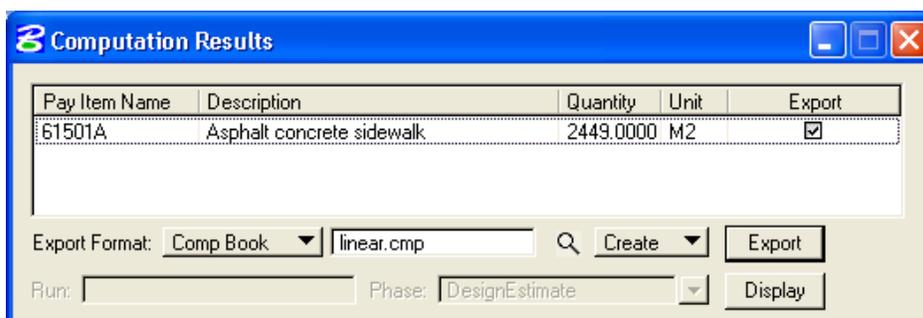


Figure 20-16: Compute Dialog

5. Change the Output to Item Report and pick Compute. The following report is what will be produced.



Pay Items List			
Date:12/10/2004 2:53:57 PM		File Name:area.cmp	
Item No.	Description	Unit	Quantity
61501A	Asphalt concrete sidewalk	M2	2449.000

Figure 20-17: Output

GEOPAK can also calculate volumes and weights of items such as pavement and base course. But because the pavement and base course have edge tapers, these quantities are more accurately calculated using a spreadsheet or in the earthwork run.

Quantities in Cross Sections

Besides Earthwork, surfacing, pavement removal, and topsoil, the cross sections are used to calculate seeding and clearing. The earthwork and topsoil calculations will be covered in another chapter. This chapter will provide workflows that show you how to calculate the other two quantities.

Workflow 4: Calculating “Clearing” Quantities

1. *Open your cross section file and access the XS Reports dialog box. This can be done by pressing the Reports & XS Quantities button in the bottom right hand corner of Project Manager, or by pressing Applications>GEOPAK ROAD>Cross Sections>Reports,*

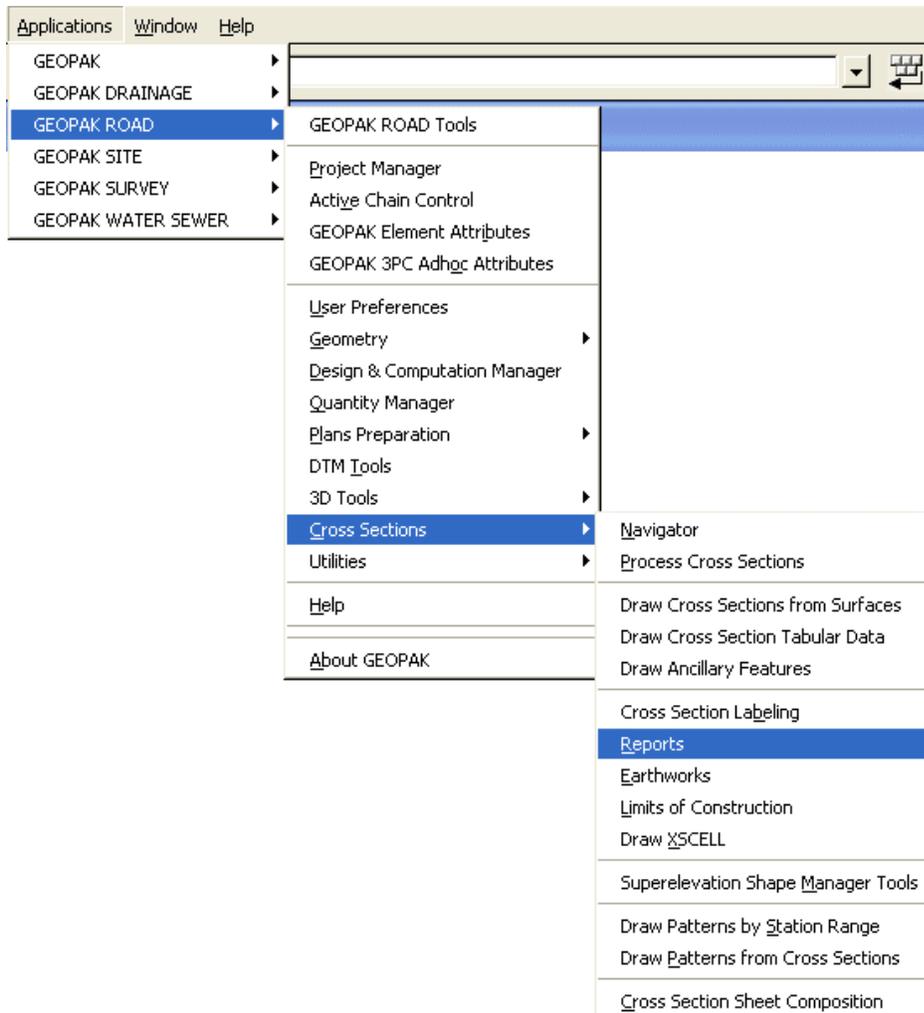


Figure 20-18: Accessing Reports

or by pressing the XS Reports button on the main cross-section palette.



Figure 20-19: Reports Icon

2. *This will bring up the following dialog box.*

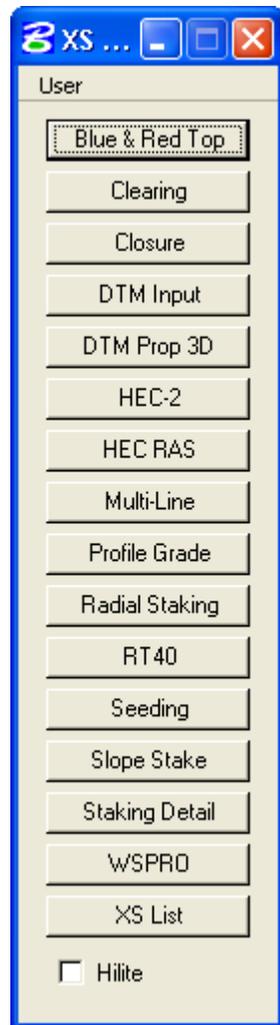


Figure 20-20: Reports Dialog

Press User>Preferences to bring up the following dialog box.

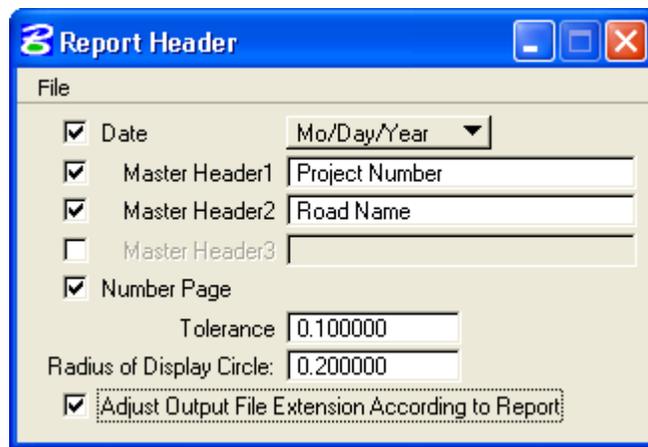


Figure 20-21: Report Settings



3. *This information will be put at the top of the quantity report. Include the Project Number in the Master Header 1 space, and the Road Name in the Master Header 2 space.*
4. *Press the Clearing button in the XS Report dialog box.*



Figure 20-22: Clearing Button

5. *This will bring up the following dialog box. Make sure you check the Beg Station and End Station to ensure that they are the stations you want. For multiple station ranges, the report may need to be run multiple times. The symbology for the Existing Ground will not change ($lv = 56$, $co = 4$, $wt = 0$, $style = 2$), and the symbology for the Proposed Ground should allow GEOPAK to trace completely across from the left catch point, over the top of pavement to the right catch point. To view the selected symbology, pick the symbology button  next to either Existing Ground Line or Proposed Finished Grade. Cut slope rounding, Additional Clearing in Cut, and Additional Clearing in Fill should match what is shown in the typical sections. Each project may have different values. However, typical values are 3.0 m or 10 ft. for Cut Slope Rounding and the Additional Clearing in Cut and Fill should be set at 1.0 m or 3 ft. The increment is set at 500 m or 1000 ft.*



Figure 20-23: Clearing Report Dialog

The Except Width can be used to subtract out the existing pavement width. CFLHD typically does not subtract the existing pavement out, but this can be used if needed. Press the Except Width button to get the following dialog box

Begin Station	End Station	Width
1+080	116+58.85r2	6.00

Figure 20-24: Exception Width

6. Fill in the beginning station, ending station, and width, then press the add button .
7. Type in the filename for your output, then press Apply. The following output file is produced.



07/30/2004

Project Number
Road Name
CLEARING REPORT

Page# 1

```

CUT SLOPE ROUNDING           =      3.0000 Ft
ADDITIONAL CLEARING IN CUT    =      1.0000 Ft
ADDITIONAL CLEARING IN FILL   =      1.0000 Ft
MINIMUM CLEARING WIDTH       =      0.0000 Ft
SUBTOTALS EVERY 500.0000 Ft. BEGINNING AT STATION 10+80.00 METHOD INCR
ADDITIONAL CLEARING LEFT SIDE = 0.00      Ft
ADDITIONAL CLEARING RIGHT SIDE = 0.00      Ft

```

STATION	CLEARING LT	DISTANCE RT	EXCEPTION WIDTH	AREA SF	SUBTOTAL SF	AREAS ACRES
11+50.00 R 1	5.57	7.28			0	
11+60.00 R 1	7.21	7.13	0.00	136		
			0.00	306		
(file condensed to fit information into example)						
19+40.00 R 1	34.56	7.95	0.00	843		
19+60.00 R 1	36.97	8.19	0.00	877		
19+80.00 R 1	39.24	8.60	0.00	961		
20+00.00 R 1	38.81	9.44			12495	0.2868 (ACCU SF 21184.0000)
DEDUCTED	ACRES	=	0.0000			
TOTAL	SF	=	21184.0000			
TOTAL	ACRES	=	0.4863			

Figure 20-25: Output

Workflow 5: Calculating "Seeding" Quantities

1. Follow steps 1 through 4 in workflow 4.
2. Press the Seeding button on the XS Report dialog box.



Figure 20-26: Seeding Button

3. This will bring up the following seeding dialog box. The elements are the same as the clearing report with some additional needed information. The Candidate Seeding Element section needs the symbology of the slopes that will be seeded (typically the cut, fill, and ditch foreslopes). These are the slopes that will be seeded. The Max allowable slope can vary on each project. This slope will be determined during the project, but for preliminary quantity calculations, you should use 1V:2H as the max allowable slope.



Figure 20-27: Seeding Report Dialog

- Pick the *Additional Distance* button to bring up the following dialog box.

Figure 20-28: Additional Distance

- Fill in the appropriate values. They should be the same as the *Cut Slope Rounding* and *Additional clearing in fill* values used in the clearing report. Type in the output file you want GEOPAK to write the quantities into and press *Apply*. GEOPAK will produce the following file.



07/30/2004

Project Number
Road Name
SEEDING REPORT

NUMBER OF LEFT CUT SLOPES TO BE BYPASSED = 0
 NUMBER OF LEFT FILL SLOPES TO BE BYPASSED = 0
 NUMBER OF RIGHT CUT SLOPES TO BE BYPASSED = 0
 NUMBER OF RIGHT FILL SLOPES TO BE BYPASSED = 0
 ROUNDING DISTANCE FROM CUT SLOPE STAKE = 3.00 Ft
 MAXIMUM ALLOWABLE SLOPE FOR SEEDING/SODDING 1.0000 / 2.0000 Rise over Run
 ADDITIONAL SEEDING LEFT SIDE = 0.00 Ft
 ADDITIONAL SEEDING RIGHT SIDE = 0.00 Ft
 ADDITIONAL SEEDING IN CUT = 1.00 Ft
 ADDITIONAL SEEDING IN FILL = 1.00 Ft
 SUBTOTALS EVERY 500.0000 Ft BEGINNING AT STATION 10+80.00 METHOD INCR
 SCALING FACTOR = 1.00000 WITH LABEL [SF]

STATION	SLOPE DISTANCE		AVERAGE SLOPE DIST		A R E A		SF BOTH	SUBTOTAL LT	A R E A		SF BOTH
	LT	RT	LT	RT	LT	RT			RT	SF	
11+50.00 R 1	0.00	0.00						0			0
	(0.00)		1.37	0.60	14	6	20				
11+60.00 R 1	2.73	1.20									
	(3.93)		3.95	1.34	79	27	106				
11+80.00 R 1	5.17	1.48									
	(6.65)		9.31	1.33	186	27	213				
(file condensed to fit information into example)											
	(5.95)		2.25	3.90	45	78	123				
19+80.00 R 1	2.25	4.10									
	(6.35)		2.25	4.53	45	91	136				
20+00.00 R 1	2.25	4.95						1675	1617		3293
	(7.20)										
TOTAL	LEFT		RIGHT		BOTH						
SF=	4203.0000		3235.0000		7441.0000						
ACRES=	0.0965		0.0743		0.1708						

Figure 20-29: Output