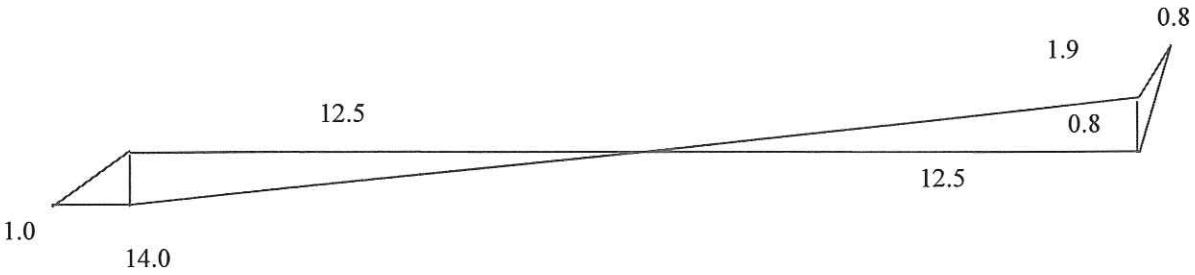
AREA CALCULATIONS

STA 0+00º (SEE BELOW)

Station 0 + 00º area calculations 2 ways

Station	CF Left	CF rd left	CL	CF Right	CF rd right
	F	F		C	C
0+00	1.0	0.8	0.0	0.8	1.9
	14.0	12.5	0.0	12.5	13.3



Area by triangles

$1/2(0.8 * 12.5) + 1/2(1.0 * 1.5) =$ 5.3 fill

$1/2(0.8 * 12.5) + 1/2(1.9 * 0.8) =$ 5.8 fill – 0.2 * 1.5 = 5.6

Area by coordinates

Cut

x	y	xy	yx	area
100	100			
112.5	100	10000	11250	
113.3	101.9	11463.75	11330	
112.5	100.8	11420.64	11463.75	
100	100	11250	10080	
		44134.39	44123.75	
				5.32

Fill

x	y	xy	yx	area
100	100			
87.5	100	10000	8750	
86	99	8662.5	8600	
87.5	99.2	8531.2	8662.5	
100	100	8750	9920	
		35943.7	35932.5	
				5.6

ALL OTHER STATIONS ARE SOLVED BY 5-LEVEL FORMULA

$$\text{AREA} = \frac{(cb + f_L d_L + f_R d_R)}{2}$$

EXAMPLE

STATION $1+00^{0}_{-}$

C	C	C	C	C
8^{9}_{-}	9^{8}_{-}	10^{1}_{-}	11^{2}_{-}	11^{9}_{-}
16^{0}_{-}	8^{0}_{-}	0	8^{0}	18^{8}_{-}

$$\text{AREA}_{CUT} = \frac{10^{1}_{-}(16^{0}_{-}) + 9^{8}_{-}(16^{0}_{-}) + 11^{2}_{-}(18^{8}_{-})}{2} = 264^{5}_{-}\ FT^2$$

Station	L	CF Left	CF rd left	CL	CF Right	CF rd right	End area Fill	End area cut
0+00		1.0	0.8	0.0	0.8	1.9	5.6	5.3
		14.0	12.5	0.0	12.5	13.3		
	100							
1+00		8.9	9.8	10.1	11.2	11.9		264.5
		16.0	8.0	0.0	8.0	18.8		
	100.1							
2+00.1		14.9	16.4	17.7	18.8	21.5		608.1
		22.5	8.0	0.0	8.0	30.0		
	61.8							
2+61.9		11.9	13.3	14.8	16.0	19.2		460.1
		19.5	8.0	0.0	8.0	26.5		
	96.8							
3+58.7		2.7	2.5	1.2	0.0	0.0	25.6	
		12.8	8.0	0.0	8.0	8.0		
	69							
4+27.7		23.2	14.9	12.3	9.7	6.1	501.4	
		42.9	8.0	0.0	8.0	17.2		
	69.1							
4+96.8		26.0	37.2	38.6	36.0	25.2	1975.6	
		45.0	8.0	0.0	8.0	46.1		
	97.4							
5+94.2		9.8	12.9	14.7	16.8	32.7	717.4	
		22.8	8.0	0.0	8.0	53.9		
	82.5							
6+76.7		4.0	3.8	2.3	1.1	1.0		90.9
		21.2	17.5	0.0	17.5	18.8		
	99.2							
7+75.9		11.4	11.8	13.3	15.0	15.9		993.0
		41.7	30.0	0.0	30.0	46.4		
	96							
8+71.9		9.8	10.1	12.1	10.0	8.7		752.5
		39.3	30.0	0.0	30.0	38.2		
	24.9							
8+96.8		22.9	21.2	14.2	6.8	6.3		1105.0
		52.8	30.0	0.0	30.0	35.1		

VOLUMES CALCULATED BY AVERAGE END AREA FORMULA

$$VOL = \frac{\text{END AREA}_1 + \text{END AREA}_2}{2} \times \frac{HD}{27\ FT^3/YD^3}$$

TRANSITION STATION VOLUME CALCULATED BY RUN OUT DISTANCE

$$VOL = \frac{\text{END AREA (RO)}}{3 \times 27}$$

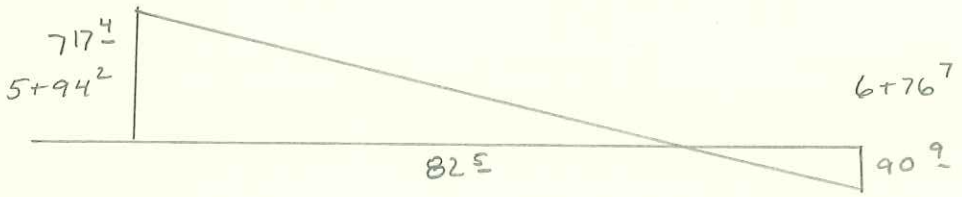
$$RO = \frac{HD\ (A_S)}{A_S + A_C} \quad \text{OR} \quad \frac{HD\ (A_C)}{A_S + A_C}$$

EXAMPLE

STATION $5+94^2$ TO STATION $6+76^7$

AREA CUT = 90^9

AREA FILL = 717^4



VOL FILL =

$$RO_{FILL} = \frac{82^5 (717^4)}{717^4 + 90^9} = 73^2$$

$$VOL_{FILL} = \frac{717^4 (73^2)}{3 \times 27} = 648^3\ YD^3$$

VOL CUT =

$$RO_{CUT} = \frac{82^5 (90^9)}{717^4 + 90^9} = 9^3$$

$$VOL_{CUT} = \frac{9^3 (90^9)}{3 \times 27} = 10^4\ YD^3$$

CHECK ON RO $\quad 9^3 + 73^2 = 82^5$

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EARTHWORK

HOMEWORK 5 KEY

Station	L	CF Left	CF rd left	CL	CF Right	CF rd right	End area Fill	End area cut	RO	Vol Fill	Vol Cut
0+00		1.0	0.8	0.0	0.8	1.9	5.6	5.3	2.1		
		14.0	12.5	0.0	12.5	13.3				0.1	499.6
	100										
1+00		8.9	9.8	10.1	11.2	11.9		264.5			
		16.0	8.0	0.0	8.0	18.8					1617.5
	100.1										
2+00.1		14.9	16.4	17.7	18.8	21.5		608.1			
		22.5	8.0	0.0	8.0	30.0					1222.5
	61.8										
2+61.9		11.9	13.3	14.8	16.0	19.2		460.1	91.7		
		19.5	8.0	0.0	8.0	26.5				1.6	520.8
	96.8										
3+58.7		2.7	2.5	1.2	0.0	0.0	25.6		5.1		
		12.8	8.0	0.0	8.0	8.0				673.4	
	69										
4+27.7		23.2	14.9	12.3	9.7	6.1	501.4				
		42.9	8.0	0.0	8.0	17.2				3169.7	
	69.1										
4+96.8		26.0	37.2	38.6	36.0	25.2	1975.6				
		45.0	8.0	0.0	8.0	46.1				4857.4	
	97.4										
5+94.2		9.8	12.9	14.7	16.8	32.7	717.4		73.2		
		22.8	8.0	0.0	8.0	53.9				648.6	10.4
	82.5										
6+76.7		4.0	3.8	2.3	1.1	1.0		90.9	9.3		
		21.2	17.5	0.0	17.5	18.8					1991.2
	99.2										
7+75.9		11.4	11.8	13.3	15.0	15.9		993.0			
		41.7	30.0	0.0	30.0	46.4					3103.1
	96										
8+71.9		9.8	10.1	12.1	10.0	8.7		752.5			
		39.3	30.0	0.0	30.0	38.2					856.5
	24.9										
8+96.8		22.9	21.2	14.2	6.8	6.3		1105.0			
		52.8	30.0	0.0	30.0	35.1					
								Sums		9350.8	9821.6

VOLUME CUT = $9821^{6}_{=}$ 10% UNUSABLE = (0.9)($9821^{6}_{=}$) = $8839^{4}_{=}$ YDS^3

VOLUME FILL = $9350^{8}_{=}$ YDS^3

VOLUME ADJUSTMENTS

VOLUME CUT = $8839^{4}_{=}$ YDS^3 75% EARTH 25% ROCK

FROM CHURCH TABLES, SHRINKAGE IS -9%

ADJUSTED CUT VOLUME = $8839^{4}_{=}$ * 0.91 = $8043^{9}_{=}$ YDS^3

REQUIRED EMBANKMENT = $9350^{8}_{=}$ YDS^3

SHORT BY: $9350^{8}_{=}$ - $8043^{9}_{=}$ = $1306^{9}_{=}$ YDS^3

BORROW IS GRAVEL AVE GRADATION

FROM CHURCH PAPER, SHRINK IS -8% AND SWELL = +20%

REQUIRED FROM PIT: = PIT VOL (0.92) = $1306^{9}_{=}$ = $1420^{5}_{=}$ YDS^3

HAUL YARDS = $1420^{5}_{=}$ (1.20) = $1704^{6}_{=}$ YDS^3 ≈ 1705 YDS^3

TRUCK = 10 YDS^3

REQUIRED TRUCKS = 1705 / 10 = $170.^{5}_{=}$ TRUCKS

$170.^{5}_{=}$ TO NEAREST 0.5

#2

$HD = 45'$

$$\text{PIT FACE AREA} = \frac{(cb + \frac{1}{2}Ldl + \frac{1}{2}Rdr)}{2}$$

$$= \frac{65(46) + 66(71) + 63(65)}{2}$$

$$= 5885\tfrac{5}{2}\ FT^2$$

$$\text{PIT BACK AREA} = \frac{22(35) + 16(36) + 20(45)}{2}$$

$$= 1123\ FT^2$$

$$\text{PIT VOLUME} = \frac{5885\frac{5}{2} + 1123}{2} \times \frac{45}{27} = 5840\tfrac{4}{9}\ YDS^3$$

REQUIRED MATERIAL IS 1250 CU. YDS COMPACTED
MATERIAL IS ANDESITE

FROM CHURCH PAPER, SHRINK IS +43%

$$\text{VOLUME}_{EXCAVATED} \times 1.43 = 1250\ YDS^3$$

$$\text{VOLUME}_{EXCAVATED} = 874.1\ YDS^3$$

$$\% \text{ PIT VOLUME} = \frac{874\frac{1}{9}}{5840\frac{4}{9}} \times 100\% = 15\%$$