

Appendix B

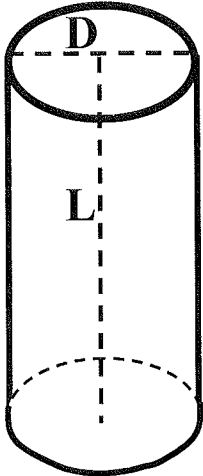
Inspector Math Tip Sheets

VOLUMES OF A SHAFT

EQUATIONS

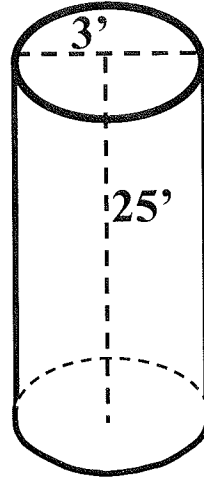
EXAMPLES

SHAFT



Shaft diameter= D
Shaft length= L
 $\pi = 3.142$

$$V = \frac{\pi D^2}{4} \times L$$



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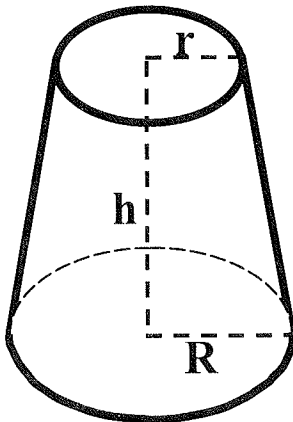
$$V = \frac{3.142 \times 9}{4} \times 25$$

$$V = \frac{28.28}{4} \times 25$$

$$V = 7.07 \times 25$$

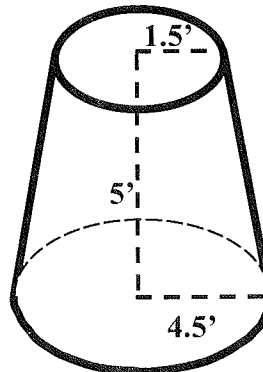
$$V = 176.75 \text{ ft}^3 \text{ or } 176.75/27 = 6.55 \text{ cyds}$$

BELL



h: height
R,r: radius of bases
V: volume
 $\pi = 3.142$

$$V = \pi(R^2 + rR + r^2)h/3$$



$$V = \pi(R^2 + rR + r^2)h/3$$

$$V = 3.142(20.25' + 6.75' + 2.25')5'/3$$

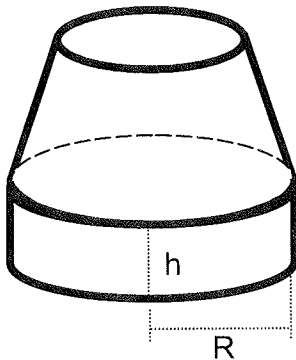
$$V = 3.142 (29.25)5/3$$

$$V = 91.90 \times 5 / 3$$

$$V = 459.5/3$$

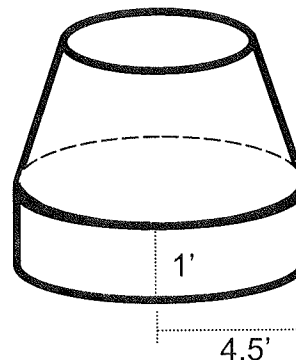
$$V = 153.16 \text{ ft}^3 \text{ or } 153.16/27 = 5.67 \text{ cyds}$$

TOE OF BELL



h: height
R: radius of base
V: volume
 $\pi = 3.142$

$$V = \pi R^2 h$$



$$V = \pi R^2 h$$

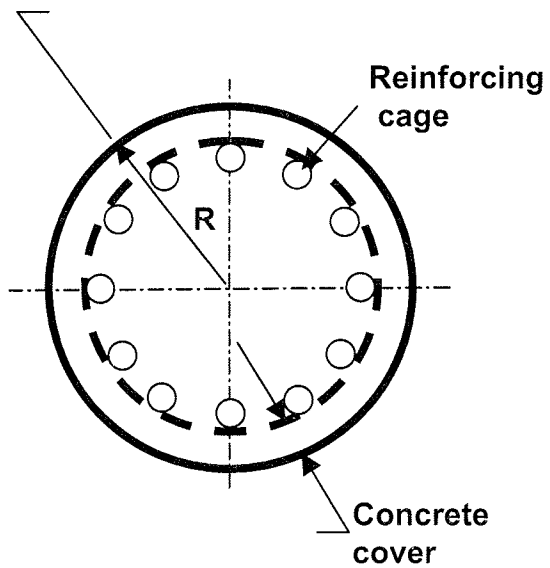
$$V = 3.142 \times 20.25 \times 1$$

$$V = 63.62 \times 1$$

$$V = 63.62 \text{ ft}^3 \text{ or } 63.62 / 27 = 2.36 \text{ cyds}$$

CIRCUMFERENCES

CIRCUMFERENCE OF SHAFT/REINFORCING CAGE



$D = \text{diameter} = 2 \text{ times } R \text{ (radius)}$

$\pi = 3.142$

CIRCUMFERENCE OF SHAFT (C) = πD

CIRCUMFERENCE OF CAGE

$C = \pi (D - 2 \times \text{Req'd Concrete Cover})$

SI CONVERSION FACTORS				
APPROXIMATE CONVERSIONS FROM SI UNIT				
Symbol	When You Know	Multiply By	To Find	Symbol
<u>LENGTH</u>				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
<u>AREA</u>				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
<u>VOLUME</u>				
ml	millimeters	0.034	fluid ounces	fl oz
l	liters	0.264	gallons	gal
m ³	cubic meters	35.71	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
<u>MASS</u>				
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
<u>TEMPERATURE</u>				
°C	Celsius	1.8 C + 32	Fahrenheit	°F
<u>WEIGHT DENSITY</u>				
g/cc	grams per cubic centimeter	62.4	poundforce/cubic foot	pcf
kN/m ³	kilonewton/cubic meter	6.36	poundforce/cubic foot	pcf
<u>FORCE and LOAD</u>				
N	newtons	0.225	poundforce	lb
kN	kilonewtons	225	poundforce	lb
kg	kilogram (force)	2.205	poundforce	lb
MN	meganewtons	112.4	tons (force)	t
<u>PRESSURE and STRESS*</u>				
kPa*	kilopascals	0.145	poundforce/square inch	psi
kPa	kilopascals	20.9	poundforce/square inch	psi
MPa	megapascals	10.44	tons per square foot	tsf
kg/cm ²	kilograms per square cm	1.024	tons per square foot	tsf

*Notes: 1 kPa = kN/m² = one kilopascal = one kilonewton per square meter.

For dimensionless graphs and equations, a reference stress of one atmosphere can be used, such that $\sigma_a = p_{atm} = 1 \text{ bar} = 100 \text{ kPa} \approx 1 \text{ tsf} \approx 1 \text{ kg/cm}^2$.

Shaft Areas and Volumes

Per Linear Foot				Per Linear Meter			
Shaft Diameter (in.)	Volume (yd ³)	Side Shear Area (ft ²)	Bearing Area (ft ²)	Shaft Diameter (cm)	Volume (m ³)	Side Shear Area (m ²)	Bearing Area (m ²)
12	0.03	3.14	0.79	30	0.07	0.94	0.07
14	0.04	3.67	1.07	35	0.10	1.10	0.10
16	0.05	4.19	1.40	40	0.13	1.26	0.13
18	0.07	4.71	1.77	45	0.16	1.41	0.16
20	0.08	5.24	2.18	50	0.20	1.57	0.20
22	0.10	5.76	2.64	55	0.24	1.73	0.24
24	0.12	6.28	3.14	60	0.28	1.88	0.28
26	0.14	6.81	3.69	65	0.33	2.04	0.33
28	0.16	7.33	4.28	70	0.38	2.20	0.38
30	0.18	7.85	4.91	75	0.44	2.36	0.44
32	0.21	8.38	5.59	80	0.50	2.51	0.50
34	0.23	8.90	6.31	85	0.57	2.67	0.57
36	0.26	9.42	7.07	90	0.64	2.83	0.64
38	0.29	9.95	7.88	95	0.71	2.98	0.71
40	0.32	10.47	8.73	100	0.79	3.14	0.79
42	0.36	11.00	9.62	105	0.87	3.30	0.87
44	0.39	11.52	10.56	110	0.95	3.46	0.95
46	0.43	12.04	11.54	115	1.04	3.61	1.04
48	0.47	12.57	12.57	120	1.13	3.77	1.13
50	0.51	13.09	13.64	125	1.23	3.93	1.23
52	0.55	13.61	14.75	130	1.33	4.08	1.33
54	0.59	14.14	15.90	135	1.43	4.24	1.43
56	0.63	14.66	17.10	140	1.54	4.40	1.54
58	0.68	15.18	18.35	145	1.65	4.56	1.65
60	0.73	15.71	19.63	150	1.77	4.71	1.77
62	0.78	16.23	20.97	155	1.89	4.87	1.89
64	0.83	16.76	22.34	160	2.01	5.03	2.01
66	0.88	17.28	23.76	165	2.14	5.18	2.14
68	0.93	17.80	25.22	170	2.27	5.34	2.27
70	0.99	18.33	26.73	175	2.41	5.50	2.41
72	1.05	18.85	28.27	180	2.54	5.65	2.54
74	1.11	19.37	29.87	185	2.69	5.81	2.69
76	1.17	19.90	31.50	190	2.84	5.97	2.84
78	1.23	20.42	33.18	195	2.99	6.13	2.99
84	1.43	21.99	38.48	210	3.46	6.60	3.46
90	1.64	23.56	44.18	225	3.98	7.07	3.98
96	1.86	25.13	50.27	240	4.52	7.54	4.52
102	2.10	26.70	56.75	255	5.11	8.01	5.11
108	2.36	28.27	63.62	270	5.73	8.48	5.73
114	2.63	29.85	70.88	285	6.38	8.95	6.38
120	2.91	31.42	78.54	300	7.07	9.42	7.07
126	3.21	32.99	86.59	315	7.79	9.90	7.79
132	3.52	34.56	95.03	330	8.55	10.37	8.5