WEST VIRGINIA
DIVISION OF HIGHWAYS

APPENDIX

CONSTRUCTION
MANUAL

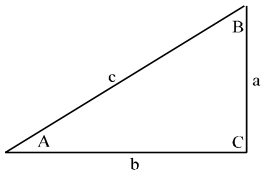
2002

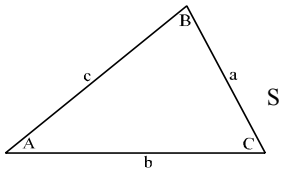
Table of Contents

A.1 — Trigonometric Functions

Angle	Sin	Cos	Tan	Angle	Sin	Cos	Tan
0	0.000	1.000	0.000	46	0.719	0.695	1.04
1	0.017	0.999	0.017	47	0.731	0.682	1.07
2	0.035	0.999	0.035	48	0.743	0.699	1.11
3	0.052	0.999	0.052	49	0.755	0.656	1.15
4	0.070	0.998	0.070	50	0.766	0.643	1.19
5	0.087	0.996	0.087	51	0.777	0.629	1.23
6	0.105	0.995	0.105	52	0.788	0.616	1.28
7	0.112	0.993	0.123	53	0.799	0.602	1.33
8	0.139	0.990	0.141	54	0.809	0.588	1.38
9	0.156	0.988	0.158	55	0.819	0.574	1.43
10	0.174	0.985	0.176	56	0.829	0.559	1.48
11	0.191	0.982	0.194	57	0.839	0.545	1.54
12	0.208	0.978	0.213	58	0.848	0.530	1.60
13	0.225	0.974	0.231	59	0.857	0.515	1.66
14	0.242	0.970	0.249	60	0.866	0.500	1.73
15	0.259	0.966	0.268	61	0.875	0.485	1.80
16	0.276	0.961	0.287	62	0.883	0.469	1.88
17	0.292	0.956	0.306	63	0.891	0.454	1.96
18	0.309	0.951	0.325	64	0.898	0.438	2.05
19	0.326	0.946	0.344	65	0.906	0.423	2.14
20	0.342	0.940	0.364	66	0.914	0.407	2.25
21	0.358	0.934	0.384	67	0.921	0.391	2.36
22	0.375	0.927	0.404	68	0.927	0.375	2.48
23	0.391	0.921	0.424	69	0.934	0.358	2.61
24	0.407	0.914	0.445	70	0.940	0.342	2.75
25	0.423	0.906	0.466	71	0.946	0.326	2.90
26	0.438	0.898	0.488	72	0.951	0.309	3.08
27	0.454	0.891	0.510	73	0.956	0.292	3.27
28	0.469	0.883	0.532	74	0.961	0.276	3.49
29	0.485	0.875	0.554	75	0.966	0.259	3.73
30	0.500	0.866	0.577	76	0.970	0.242	4.01
31	0.515	0.857	0.601	77	0.974	0.225	4.33
32	0.530	0.848	0.625	78	0.978	0.208	4.70
33	0.545	0.839	0.649	79	0.982	0.191	5.14
34	0.559	0.829	0.675	80	0.985	0.174	5.67
35	0.574	0.819	0.700	81	0.988	0.156	6.31
36	0.588	0.809	0.727	82	0.990	0.139	7.12
37	0.602	0.799	0.754	83	0.993	0.122	8.14
38	0.616	0.788	0.781	84	0.995	0.105	9.51
39	0.629	0.777	0.810	85	0.996	0.087	11.43
40	0.643	0.766	0.839	86	0.998	0.070	14.30
41	0.656	0.755	0.869	87	0.999	0.052	19.08
42	0.699	0.743	0.900	88	0.999	0.035	28.64
43	0.682	0.731	0.933	89	0.999	0.017	57.28
44	0.695	0.719	0.966	90	1.000	0.000	Infinity
45	0.707	0.707	1.000				

A.2 — Trigonometric Solution of Triangles

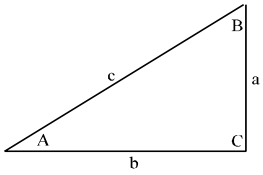


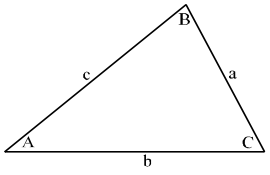


$$S = \frac{a + b + c}{2}$$

Given	Sought	Formulae		
RIGHT-ANGLED TRIANGLES				
a,c	A,B,b	$\sin A = \frac{a}{c}$	$\cos B = \frac{a}{c}$	$b = \sqrt{c^2 - a^2}$
	Area	$\text{Area} = \frac{a}{2}\sqrt{c^2 - a^2}$		
a,b	A,B,c	$\tan A = \frac{a}{b}$	$\tan B = \frac{b}{a}$	$c = \sqrt{a^2 + b^2}$
	Area	$\text{Area} = \frac{ab}{2}$		
A,a	B,b,c	$B = 90° - A$	$b = a \cot A$	$c = \frac{a}{\sin A}$
	Area	$\text{Area} = \frac{a^2 \cot A}{2}$		
A,b	B,a,c	$B = 90° - A$	$a = b \tan A$	$c = \frac{b}{\cos A}$
	Area	$\text{Area} = \frac{b^2 \tan A}{2}$		
A,c	B,a,b	$B = 90° - A$	$a = c \sin A$	$b = c \cos A$
	Area	$\text{Area} = \frac{c^2 \sin A \cos A}{2}$ or $\frac{c^2 \sin 2A}{4}$		

A.2 — Trigonometric Solution of Triangles
(Continued)





$$s = \frac{a + b + c}{2}$$

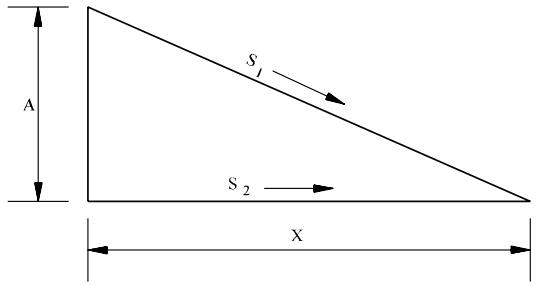
Given	Sought	Formulae
		OBLIQUE-ANGLED TRIANGLES
a,b,c	A	$\sin\frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}}$, $\cos\frac{1}{2}A = \sqrt{\frac{s(s-a)}{bc}}$, $\tan\frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$
	B	$\sin\frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}}$, $\cos\frac{1}{2}B = \sqrt{\frac{s(s-b)}{ac}}$, $\tan\frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{s(s-b)}}$
	C	$\sin\frac{1}{2}C = \sqrt{\frac{(s-a)(s-b)}{ab}}$, $\cos\frac{1}{2}C = \sqrt{\frac{s(s-c)}{ab}}$, $\tan\frac{1}{2}C = \sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$
	Area	$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$
a,A,B	b,c	$b = \frac{a\sin B}{\sin A}$ $\quad c = \frac{a\sin C}{\sin A} = \frac{a\sin(A+B)}{\sin A}$
	Area	$\text{Area} = \frac{1}{2}ab\sin C = \frac{a^2\sin B\sin C}{2\sin A}$
a,b,A	B	$\sin B = \frac{b\sin A}{a}$
	c	$c = \frac{a\sin C}{\sin A} = \frac{b\sin C}{\sin B} = \sqrt{a^2 + b^2 - 2ab\cos C}$
	Area	$\text{Area} = \frac{1}{2}ab\sin C$
a,b,C	A	$\tan A = \frac{a\sin C}{b - a\cos C}$ $\quad \tan\frac{1}{2}(A-B) = \frac{a-b}{a+b}\cot\frac{1}{2}C$
	c	$c = \sqrt{a^2 \div b^2 - 2ab\cos C} = \frac{a\ \sin\ C}{\sin\ A}$
	Area	$\text{Area} = \frac{1}{2}ab\sin C$
$a^2 = b^2 + c^2 - 2bc\cos A$, $b^2 = a^2 + c^2 - 2ac\cos B$, $c^2 = a^2 + b^2 - 2ab\cos C$		

A.3 — Slope Equations

GIVEN: Dimensions A and B
Slopes S_1 and S_2 in feet per foot

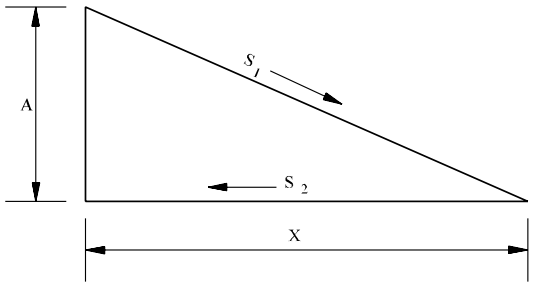
FIND: Horizontal distance X
Area

CASE I



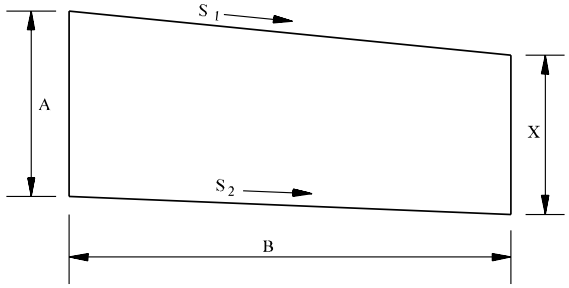
$X = \frac{A}{S_1 - S_2}$ Area $= \frac{AX}{2}$

CASE II



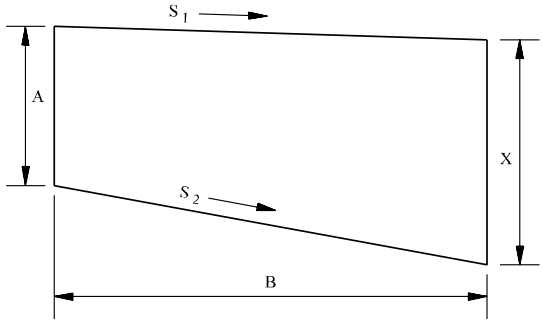
$X = \frac{A}{S_1 + S_2}$ Area $= \frac{AX}{2}$

CASE III



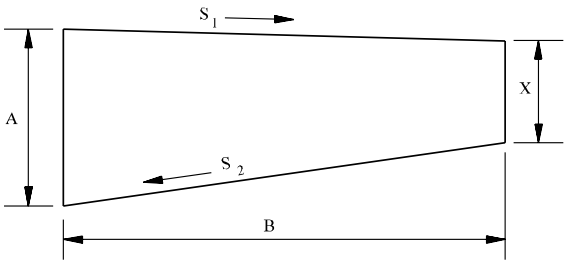
$X = A - (S_1 - S_2)\,B$ Area $= \frac{A + X}{2}\,(B)$

CASE IV



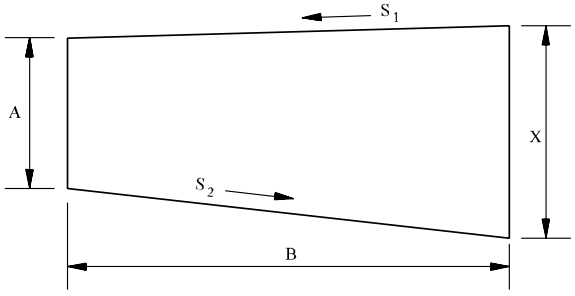
$X = A - (S_1 - S_2)\,B$ Area $= \frac{A + X}{2}\,(B)$

CASE V



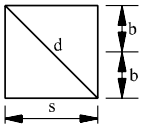
$X = A - (S_1 + S_2)\,B$ Area $= \frac{A + X}{2}\,(B)$

CASE VI



$X = A + (S_1 + S_2)\,B$ Area $= \frac{A + X}{2}\,(B)$

A.4 — Area of Plane Figures



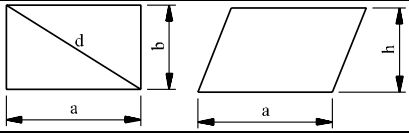
Square

Diagonal = $d = s\sqrt{2}$.

Area = $s^2 = 4b^2 = 0.5d^2$.

Example: s = 6; b = 3. Area = $(6)^2 = 36$ Ans.

d = 6 x 1.414 = 8.484 Ans.

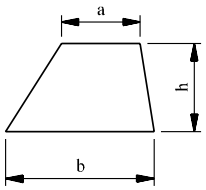


Rectangle and Parallelogram

Area = ab or $b\sqrt{d^2 - b^2}$

Example: a = 6; b = 3.

Area = 3 x 6 = 18 Ans.

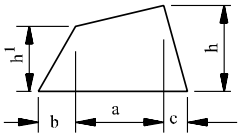


Trapezoid

$$\text{Area} = \frac{1}{2}\,h\,(a + b)$$

Example: a = 2; b = 4; h = 3

$$\text{Area} = \frac{1}{2} \times 3\,(2 + 4) = 9 \text{ Ans.}$$

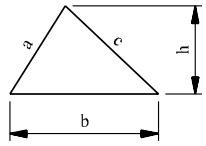


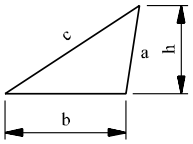
Trapezium

$$\text{Area} = \frac{1}{2}\left[a\left(h + h^1\right) + bh^1 + ch\right]$$

Example: a = 4; b = 2; c = 2; h = 3; $h^1 = 2$.

$$\text{Area} = \frac{1}{2}\left[4(3 + 2) + (2 \times 2) + (2 \times 3)\right] = 15 \text{ Ans.}$$





Triangles

Both formulas apply to both figures

$$\text{Area} = \frac{1}{2}\ bh.$$

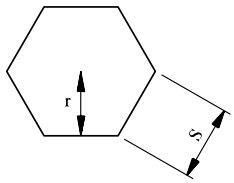
Example: h =3; b = 5.

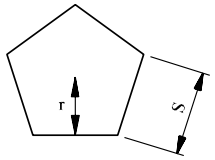
$$\text{Area} = \frac{1}{2}\,(3 \times 5) = 7\frac{1}{2} \text{ Ans.}$$

$$\text{Area} = \sqrt{S(S - a)(S - b)(S - c)} \text{ when } S = \frac{a + b + c}{2}$$

Example: a = 2; b = 3; c = 4.

$$S = \frac{2 + 3 + 4}{2} = 4.5;\ \text{Area} = \sqrt{4.5\,(4.5 - 2)(4.5 - 3)(4.5 - 4)} = 2.9 \text{ Ans.}$$





Regular Polygons

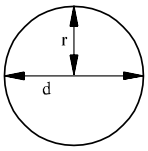
$$\text{Area} \begin{cases} 5 \text{ sides} = 1.720477\,S^2 = 3.63271\,r^2 \\ 6 \text{ sides} = 2.598150\,S^2 = 3.46410\,r^2 \\ 7 \text{ sides} = 3.633875\,S^2 = 3.37101\,r^2 \\ 8 \text{ sides} = 4.828427\,S^2 = 3.31368\,r^2 \\ 9 \text{ sides} = 6.181875\,S^2 = 3.27573\,r^2 \\ 10 \text{ sides} = 7.694250\,S^2 = 3.24920\,r^2 \\ 11 \text{ sides} = 9.365675\,S^2 = 3.22993\,r^2 \\ 12 \text{ sides} = 11.196300\,S^2 = 3.21539\,r^2 \end{cases}$$

n = number of sides; r = short radius; S = length of side; R = long radius.

$$\text{Area} = \frac{n}{4}S^2 \cot\frac{180°}{n} = \frac{n}{2}R^2 \sin\frac{360°}{n} = nr^2 \tan\frac{180°}{n}$$

A.4 — Area of Plane Figures
(Continued)

Circle



$\pi = 3.1416$; A = area d = diameter; p = circumference or periphery; r = radius.

$p = \pi d = 3.1416d$. $p = 2\sqrt{\pi A} = 3.54\sqrt{A}$

$p = 2\pi r = 6.2832r$ $p = \frac{2A}{r} = \frac{4A}{d}$

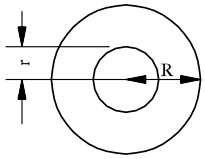
$d = \frac{p}{\pi} = \frac{p}{3.1416}$ $d = 2\sqrt{\frac{A}{\pi}} = 1.128\sqrt{A}$

$r = \frac{p}{2\pi} = \frac{p}{6.2832}$ $r = \sqrt{\frac{A}{\pi}} = 0.564\sqrt{A}$

$A = \frac{\pi d^2}{4} = 0.7854d^2$ $A = \frac{p^2}{4\pi} = \frac{p^2}{12.57}$

$A = \pi r^2 = 3.1416r^2$ $A = \frac{pr}{2} = \frac{pd}{4}$

Circular Ring



$Area = \pi\left(R^2 - r^2\right) = 3.1416\left(R^2 - r^2\right)$

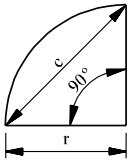
$Area = 0.7854(D^2-d^2) = 0.7854(D-d)(D+d)$

Area = difference in areas between the inner and outer circles.

Example: R = 4; r = 2.

$Area = 3.1416(4^2-2^2)=37.6992$ Ans.

Quadrant

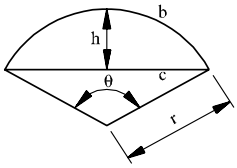


$Area = \frac{\pi r^2}{4} = 0.7854r^2 = 0.3927c^2$

Example: r = 3; c = chord.

$Area = 0.7854 \times 3^2 = 7.0686$ Ans.

Segment



b = length of arc θ = angle in degrees $c = chord = \sqrt{4\left(2hr - h^2\right)}$

$Area = \frac{1}{2}\left[br - c\left(r - h\right)\right] = \pi r^2 \frac{\theta}{360} - \frac{c\left(r - h\right)}{2}$

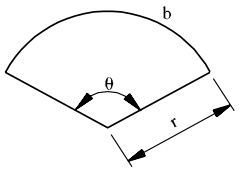
When θ is greater than 180°, then $\frac{c}{2} \times$ difference between r and h is added to the fraction $\frac{\pi r^2 \theta}{360}$

Example: r = 3; $\theta = 120°$; h = 1.5

$Area = 3.1416 \times 3^2 \times \frac{120}{360} - \frac{5.196\left(3 - 1.5\right)}{2} = 5.5278$ Ans.

A.4 — Area of Plane Figures
(Continued)

Sector



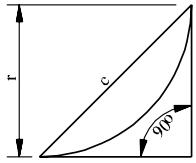
$$\text{Area} = \frac{br}{2} = \pi r^2 \frac{\theta}{360°}$$

θ = angle in degrees; b = length of arc.

Example: r = 3; θ = 120°

$$\text{Area} = 3.1416 \times 3^2 \times \frac{120}{360} = 9.4248 \text{ Ans.}$$

Spandrel

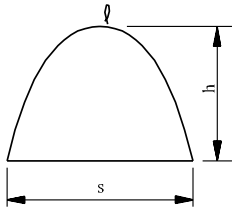


$\text{Area} = 0.2146r^2 = 0.1073c^2$

Example: r = 3

$\text{Area} = 0.2146 \times 3^2 = 1.9314$ Ans.

Parabola



ℓ = length of curved line = periphery – s

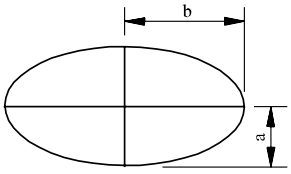
$$\ell = \frac{s^2}{8h}\left[\sqrt{c(1+c)} + 2.0326 \times \log\left(\sqrt{c} + \sqrt{1+c}\right)\right] \text{ in which } c = \left(\frac{4h}{s}\right)^2$$

$$\text{Area} = \frac{2}{3} sh$$

Example: s = 3; h = 4

$$\text{Area} = \frac{2}{3} \times 3 \times 4 = 8 \text{ Ans.}$$

Ellipse



Area = π a b = 3.1416ab

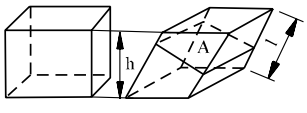
$$\text{Circum.} = 2\pi\sqrt{\frac{a^2 + b^2}{2}} \text{ (close approximation)}$$

Example: a = 3; b = 4.

Area = 3.1416 x 3 x 4 = 37.6992 Ans.

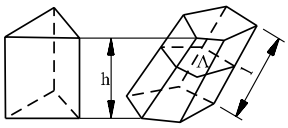
$$\text{Circum.} = 2 \times 3.1416\sqrt{\frac{(3)^2 + (4)^2}{2}} = 6.2832 \times 3.5355 = 22.21 \text{ Ans.}$$

A.5 — Surface and Volume of Solids



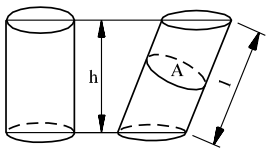
Parallelopiped

S = perimeter, P, perp. to sides x lat. length, l:	Pl
V = area of base, B, x perpendicular height, h:	Bh
V = area of section, A, perp. to sides x lat. length, l:	Al



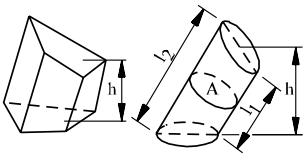
Prism, Right or Oblique, Regular or Irregular

S = perimeter, P, perp. to sides x lat. length, l:	Pl
V = area of base, B, x perpendicular height, h:	Bh
V = area of section, A, perp. to sides x lat. length, l:	Al



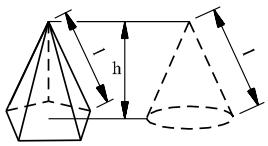
Cylinder, Right or Oblique, Circular or Elliptic, etc.

S = perimeter of base, P, x perp. height, h:	Ph
S = perimeter, P_1, perp. to sides x lat. length, l:	$P_1 l$
V = area of base, B, x perpendicular height, h:	Bh
V = area of section, A, perp. to sides x lat. length, l:	Al



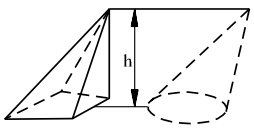
Frustum of any Prism or Cylinder

V = area of base, B, x perp. distance, h, from base to center of gravity of opposite face:	Bh
For cylinder:	$\frac{1}{2} A(l_1 + l_2)$



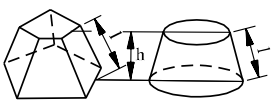
Pyramid or Cone, Right and Regular

S = perimeter of base, P, x $\frac{1}{2}$ slant height, l:	$\frac{1}{2}$ Pl
V = area of base, B, x $\frac{1}{8}$ perp. height, h:	$\frac{1}{8}$ Bh



Pyramid or Cone, Right or Oblique, Regular or Irregular

V = area of base, B, x $\frac{1}{3}$ perp. height, h:	$\frac{1}{3}$ Bh
V = $\frac{1}{3}$ volume of prism or cylinder of same base and perpendicular height	
V = $\frac{1}{2}$ volume of hemisphere of same base and perpendicular height	



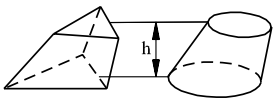
Frustum of Pyramid or Cone, Right and Regular, Parallel Ends

S = (sum of perimeter of base, P, and top, p) x $\frac{1}{2}$ slant height, l:	$\frac{1}{2}$ l (P+p)
V =(sum of areas of base, B, and top, b + square root of their products) x $\frac{1}{3}$ perp. height, h:	$\frac{1}{3}$ h(B+b+$\sqrt{Bb}$)

S = Lateral or Convex Surface *V = Volume*

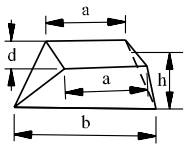
A.5 — Surface and Volume of Solids

(Continued)



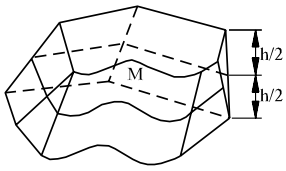
Frustum of any Pyramid or Cone, Parallel Ends

V = (sum of areas of base, B, and top, b + square root of their products) x $\frac{1}{8}$ perp. height, h: $\frac{1}{8}h(B+b+\sqrt{Bb})$



Wedge, Parallelogram Face

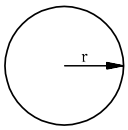
V = $\frac{1}{6}$ (sum of three edges, a b a, x perpendicular height, h x perpendicular width, d): $\frac{1}{6}dh(2a+b)$



Prismatoid

V = $\frac{1}{6}$ perp. height, h (sum of areas of base, B, and top b, +4 x area of section, M, parallel to bases and midway between them): $\frac{1}{6}h(B+b+4M$

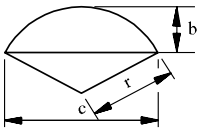
The Prismatoid formula applies also to any of the foregoing solids with parallel bases, to pyramids, cones, and spherical sections, and to many solids with irregular surfaces.



Sphere

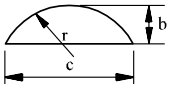
$S = 4\pi r^2 = \pi d^2 = 3.14159265\, d^2$

$V = \frac{4}{3}\pi r^3 = \frac{1}{6}\pi d^3 = 0.52359878\, d^3$



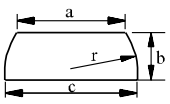
Spherical Sector

$S = \frac{1}{2}\pi r(4b + c)$ $V = \frac{2}{3}\pi r^3 b$



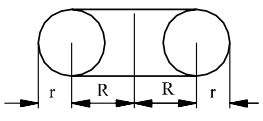
Spherical Segment

$S = 2\pi r b = \frac{1}{4}\pi(4b^2 + c^2)$ $V = \frac{1}{3}\pi b^2(3r - b) = \frac{1}{24}\pi b(3c^2 + 4b^2)$



Spherical Zone

$S = 2\pi r b$ $V = \frac{1}{24}\pi b(3a^3 + 3c^2 + 4b^2)$



Circular Ring

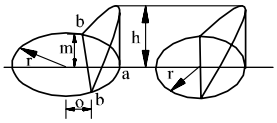
$S = 4\pi^2 Rr$ $V = 2\pi^3 Rr^2$

S = Lateral or Convex Surface *V = Volume*

A.5 — Surface and Volume of Solids

(Continued)

Ungula of Right, Regular Cylinder



Base = Segment, b a b

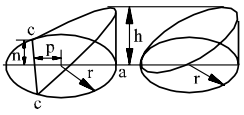
$S = (2\ r\ m\text{-}o \times \text{arc, b a b})\ \dfrac{h}{r - o}$

$V = \left(\dfrac{2}{3}m^3 - o \times \text{area, b a b}\right)\dfrac{h}{r - o}$

Base = Half Circle

$S = 2rh$

$V = \dfrac{2}{3}r^2 h$



Base = Segment, c a c

$S = (2\ r\ n + p \times \text{arc, c a c})\ \dfrac{h}{r + p}$

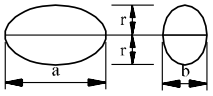
$V = \left(\dfrac{2}{3}n^3 + p \times \text{area, cac}\right)\dfrac{h}{r + p}$

Base = Circle

$S = r\ \pi\ h$

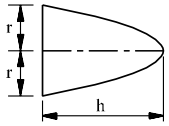
$V = \dfrac{1}{2}r^2\ \pi\ h$

Ellipsoid



$V = \dfrac{1}{3}\pi\ r\ a\ b$

Paraboloid

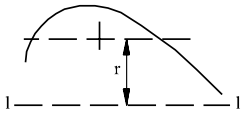


$V = \dfrac{1}{2}\pi\ r^2 h$

Ratio of corresponding volumes of a Cone, Paraboloid, Sphere, and Cylinder of equal height:

$\dfrac{1}{3} : \dfrac{1}{2} : \dfrac{2}{3} : 1$

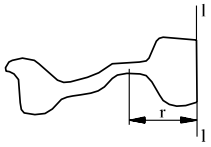
Bodies Generated by Partial or Complete Revolution



l = length of a curve
A = area of a plane } rotating about an axis l - l on one side and in plane of axis

r = distance of center of gravity of line or plane from axis 1-1 and for any angle of revolution, a°

$\dfrac{2\ r\ \pi\ a°}{360}$ = length of arc described by center of gravity.



$S = \text{length of curve} \times \text{length of arc about axis} = l\ \dfrac{2\ r\ \pi\ a°}{360}$

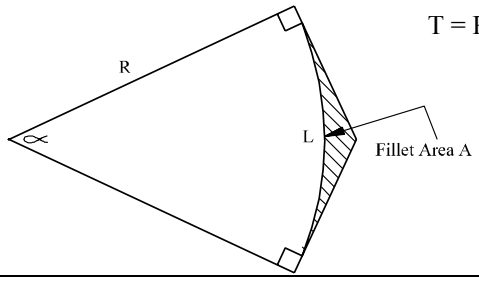
For complete revolution, $S = 2r\ \pi\ l$

$V = \text{area of plane} \times \text{length of arc about axis} = A\ \dfrac{2\ r\ \pi\ a°}{360}$

For complete revolution, $V = 2\ r\ \pi\ A$

S = Lateral or Convex Surface *V = Volume*

A.6 — Methods of Estimating Area of Fillets, Aprons and Approaches



$T = R \text{ Tan } \frac{\alpha}{2}$

ESTIMATING FILLETS & RETURN

FILLET AREA

$$\text{Area A} = 2 \text{ x } \frac{1}{2} \text{ x R x R Tan } \frac{\alpha}{2} - \pi R^2 \frac{\alpha}{360^\circ}$$

$$= R^2 \left[\text{Tan } \frac{\alpha}{2} - (0.008727 \text{ x } \alpha) \right]$$

Area 90° Fillet = $0.2146 \text{ x } R^2$

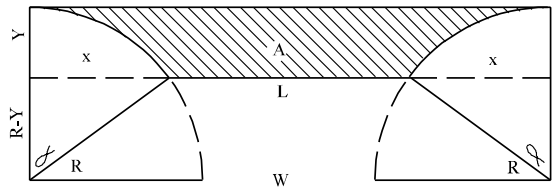
Length of Return

$$L = 2 \pi R \text{ x } \frac{\alpha}{360^\circ}$$

$$= 0.01745 \text{ x R x } \alpha$$

Length of 90° Return

$$L = 1.5708 \text{ x R}$$

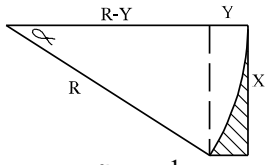


ESTIMATING AREA 90° APRON

$L = (2R + W) - 2X$ $\quad \text{Cos } \alpha = \frac{R - Y}{R}$

$X = \sqrt{2RY - Y^2}$ $\quad$ A = Area

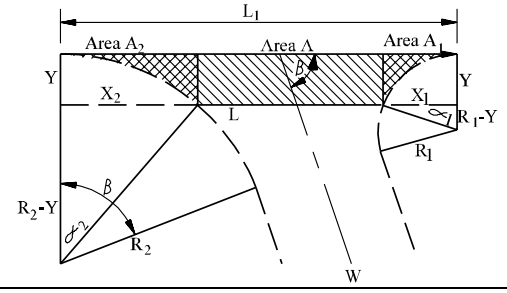
$A = (2R + W)Y + X(R-Y) - 0.01745 \ R^2\alpha$



A = Area

$$A = XY - \left[\pi R^2 \frac{\alpha}{360^\circ} - \frac{1}{2} \text{ x } (R - Y) \right]$$

$$= XY + \frac{X(R - Y)}{2} - 0.08727 \ R^2 \alpha$$



ESTIMATING AREA APRON OTHER THAN 90°

$\text{Cos } \alpha_1 = \frac{R_1 - Y}{R_1}$ $\quad \text{Cos } \alpha_2 = \frac{R_2 - Y}{R_2}$

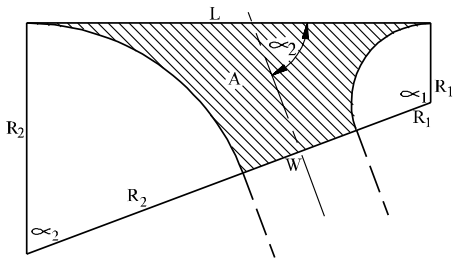
$X_1 = \sqrt{2R_1Y - Y^2}$ $\quad X_2 = \sqrt{2R_2Y - Y^2}$

$L_1 = (R_2 - R_1) \text{ Tan } \beta$ $\quad L = L_1 - (X_1 + X_2)$

$A = LY$

$$A_1 = X_1 Y + \frac{X_1(R_1 - Y)}{2} - 0.008727 R_1^2 \ \alpha_1$$

$$A_2 = X_2 Y + \frac{X_2(R_2 - Y)}{2} - 0.008727 R_2^2 \ \alpha_2$$



ESTIMATING AREA APPROACH OTHER THAN 90°

$\alpha_1 = 180^\circ - \alpha_2$

$L = (R_2 - R_1) \text{ Tan } \alpha_2$

$$\text{Area A} = \frac{(R_1 + R_2)L}{2} - 0.008727(R_1^2 \ \alpha_1 + R_2^2 \ \alpha_2)$$

NOTES:

$\pi = 3.1416$ $\quad \frac{\pi}{180} = 0.01745$

$\frac{\pi}{2} = 1.5708$ $\quad \frac{\pi}{360} = 0.008727$

A.7 — Conversion Factors – Length Measurements

Units	Inches	Feet	Yards	Rods	Miles	Meters
1 Inch	1	0.08333	0.027778	0.005051	0.0000157828	0.0254
1 Foot	12	1	0.3333	0.060606	0.00018939	0.304801
1 Yard	36	3	1	0.181818	0.000568182	0.914402
1 Rod (Surveyor's Measure)	198	16.5	5.5	1	0.003125	5.029216
1 Mile (U.S. Statute)	63360	5280	1760	320	1	1609.347
1 Meter	39.37	3.280833	1.093611	0.198838	0.00062137	1
1 Link	7.92	0.66	0.22	0.04	0.000125	0.201168
1 Chain (Surveyor's)	792	66	22	4	0.0125	20.117
1 Station	1200	100	33.33	6.060606	0.0189394	30.4801
1 Furlong	7920	660	220	40	0.125	201.168
1 Mile (International Nautical)	72913	6076.103	2025.366	368.248	1.15078	1852
1 Millimeter	0.03937	0.003281	0.001094	0.000199	—	0.001
1 Centimeter	0.3937	0.032808	0.010936	0.001988	—	0.01
1 Kilometer	—	3280.833	1093.611	198.836	0.621370	1000

A.8 — Conversion Factors – Area Measurements

Units	Square Inches	Square Feet	Square Yards	Square Rods	Acres	Square Miles	Square Meters
1 Sq. Inch	1	0.006944	0.0007716	—	—	—	0.00064516
1 Sq. Foot	144	1	0.11111	0.0036731	—	—	0.09290341
1 Sq. Yard	1296	9	1	0.033058	0.0002066	—	0.8361307
1 Sq. Rod	39204	272.25	30.25	1	0.00625	—	25.29295
1 Acre	—	43560	4840	160	1	0.0015625	4046.873
1 Sq. Mile	—	—	3097600	102400	640	1	2589998
1 Sq. Meter	1550	10.76387	1.195985	0.0395367	0.0002471	—	1
1 Sq. Link	62.7264	0.4356	0.0484	0.0016	0.00001	—	0.040468
1 Sq. Chain	627264	4356	484	16	0.1	—	404.689
1 Square	14400	100	11.1111	0.367309	0.0022956	—	9.29034
1 Section	—	—	3097600	102400	640	1	2589998
1 Sq. Centimeter	0.1549997	0.0010764	0.0001196	—	—	—	0.0001
1 Hectare	—	107638.7	11959.85	395.367	2.471044	0.003861	10000
1 Sq. Kilometer	—	—	1195985	39536.7	247.1044	0.3861006	1000000

A.9 — Conversion Factors – Volume Measurements

Units	Cubic Inches	Cubic Feet	Cubic Yards	Pints (Liquid)	Quarts (Liquid)	Gallons (U.S.)	Liters (1000 cc)
1 Cubic Inch	1	0.000579	0.0000214	0.034632	0.017316	0.004329	0.016387
1 Cubic Foot	1728	1	0.037037	59.844	29.922	7.4805	28.31625
1 Cubic Yard	46656	27	1	1615.8	807.9	201.975	764.54
1 Pint (Liquid)	28.875	0.016710	0.000619	1	0.5	0.125	0.473168
1 Quart (Liquid)	57.75	0.033420	0.001238	2	1	0.25	0.946333
1 Gallon (U.S.)	231	0.1336805	0.004951	8	4	1	3.78533
1 Liter (100 cc)	61.025	0.035316	0.001308	2.11336	1.056682	0.264178	1
1 Gil	7.21876	0.004177	0.000155	0.25	0.125	0.03125	0.118292
1 Pint (Dry)	33.6003	0.019445	0.000720	1.163647	0.581823	0.145456	0.550599
1 Quart (Dry)	67.200625	0.038889	0.001440	2.32730	1.163646	0.290912	1.10120
1 Quart (Imperial)	69.35503	0.040135	0.001486	2.4019	1.200953	0.300238	1.13650
1 Gallon (Imperial)	277.4201	0.16054	0.0059457	9.60762	4.80381	1.20095	4.54609
1 Peck	537.605	0.311114	0.011523	18.61835	9.309177	2.327294	8.809586
1 Bushel (U.S.)	2150.42	1.2444	0.046089	74.47341	37.23670	9.3092	35.238329
1 Board Foot	144	0.08333	0.003086	4.987012	2.493506	0.623376	2.3597
1 Cord	221184	128	4.74074	7660.051	3830.025	957.506	3624.48
1 Petroleum Barrel	9701.975	5.614569	0.207947	336	168	42	158.9839
1 Barrel (U.S.	7276.370	4.21086	0.15596	252	126	31.5	119.237895
1 Cubic Meter	61023.38	35.314445	1.307943	2113.4	1056.7	264.176	1000
1 Cubic Centimeter	0.061024	0.0000353	—	0.002113	0.001057	0.0002642	0.001

A.10 — Conversion Factors – Weight Measurements

Units	Ounces	Pounds	Tons (Short)	Tons (Long)	Kilograms	Tons (Metric)
1 Ounce	1	0.0625	—	—	0.028349	—
1 Pound	16	1	0.0005	0.0004464	0.4535924	0.00045359
1 Ton (Short)	32000	2000	1	0.892857	907.18486	0.907185
1 Ton (Long)	35840	2240	1.12	1	1016.047	1.016047
1 Kilogram	35.27396	2.204622	0.0011023	0.0009842	1	0.001
1 Ton (Metric)	35273.96	2204.62	1.10231	0.98421	1000	1
1 Hundredweight (Short)	1600	100	0.05	0.044643	45.3592	0.045359
1 Hundredweight (Long)	1792	112	0.056	0.05	50.8023	0.050802
1 Grain	0.0022857	—	—	—	—	—
1 Gram	0.0352739	0.002204	—	—	0.001	—
1 Milligram	—	—	—	—	0.000001	—

A.11 — Conversion Table – Inches to Decimals of a Foot

Inch	0	1″	2″	3″	4″	5″
0	0	0.0833	0.1667	0.2500	0.3333	0.4167
1/32	0.0026	0.0859	0.1693	0.2526	0.3359	0.4193
1/16	0.0052	0.0885	0.1719	0.2552	0.3385	0.4219
3/32	0.0078	0.0911	0.1745	0.2573	0.3411	0.4245
1/8	0.0104	0.0938	0.1771	0.2604	0.3438	0.4271
5/32	0.0130	0.0964	0.1797	0.2630	0.3464	0.4297
3/16	0.0156	0.0990	0.1823	0.2656	0.3490	0.4323
7/32	0.0182	0.1016	0.1849	0.2682	0.3516	0.4349
1/4	0.0208	0.1042	0.1875	0.2708	0.3542	0.4375
9/32	0.0234	0.1068	0.1901	0.2734	0.3568	0.4401
5/16	0.0260	0.1094	0.1927	0.2760	0.3594	0.4427
11/32	0.0288	0.1120	0.1953	0.2786	0.3620	0.4453
3/8	0.0313	0.1146	0.1979	0.2812	0.3646	0.4479
13/32	0.0339	0.1172	0.2005	0.2839	0.3672	0.4505
7/16	0.0365	0.1198	0.2031	0.2865	0.3698	0.4531
13/32	0.0391	0.1224	0.2057	0.2891	0.3724	0.4557
1/2	0.0417	0.1250	0.2083	0.2917	0.3750	0.4583
17/32	0.0443	0.1276	0.2109	0.2943	0.3778	0.4609
9/16	0.0469	0.1302	0.2135	0.2969	0.3802	0.4635
19/32	0.0495	0.1328	0.2161	0.2995	0.3828	0.4661
5/8	0.0521	0.1354	0.2188	0.3021	0.3854	0.4688
21/32	0.0547	0.1380	0.2214	0.3047	0.3880	0.4714
11/16	0.0573	0.1406	0.2240	0.3073	0.3906	0.4740
23/32	0.0599	0.1432	0.2266	0.3099	0.3932	0.4766
3/4	0.0625	0.1458	0.2292	0.3125	0.3958	0.4792
25/32	0.0651	0.1484	0.2318	0.3151	0.3984	0.4818
13/16	0.0677	0.1510	0.2344	0.3177	0.4010	0.4844
27/32	0.0703	0.1536	0.2370	0.3203	0.4036	0.4870
7/8	0.0729	0.1563	0.2396	0.3229	0.4063	0.4896
29/32	0.0755	0.1589	0.2422	0.3255	0.4089	0.4922
15/16	0.0781	0.1615	0.2448	0.3281	0.4115	0.4948
31/32	0.0807	0.1641	0.2474	0.3307	0.4141	0.4974

A.11 — Conversion Table – Inches to Decimals of a Foot

Inch	6″	7″	8″	9″	10″	11″
0	0.5000	0.5833	0.6667	0.7500	0.8333	0.9167
1/32	0.5026	0.5859	0.6693	0.7526	0.8359	0.9193
1/16	0.5052	0.5885	0.6719	0.7552	0.8385	0.9219
3/32	0.5078	0.5911	0.6745	0.7578	0.8411	0.9245
1/8	0.5104	0.5938	0.6771	0.7604	0.8438	0.9271
5/32	0.5130	0.5964	0.6797	0.7630	0.8464	0.9297
3/16	0.5156	0.5990	0.6823	0.7656	0.8490	0.9323
7/32	0.5182	0.6016	0.6849	0.7682	0.8516	0.9349
1/4	0.5208	0.6042	0.6875	0.7708	0.8542	0.9375
9/32	0.5234	0.6068	0.6901	0.7734	0.8568	0.9401
5/16	0.5260	0.6094	0.6927	0.7760	0.8594	0.9427
11/32	0.5286	0.6120	0.6953	0.7786	0.8620	0.9453
3/8	0.5313	0.6146	0.6979	0.7813	0.8646	0.9479
13/32	0.5339	0.6172	0.7005	0.7839	0.8672	0.9505
7/16	0.5365	0.6198	0.7031	0.7865	0.8698	0.9531
13/32	0.5391	0.6224	0.7057	0.7891	0.8724	0.9557
1/2	0.5417	0.6250	0.7083	0.7917	0.8750	0.9583
17/32	0.5443	0.6276	0.7109	0.7943	0.8776	0.9609
9/16	0.5469	0.6302	0.7135	0.7969	0.8802	0.9635
19/32	0.5495	0.6328	0.7161	0.7995	0.8828	0.9661
5/8	0.5521	0.6354	0.7188	0.8021	0.8854	0.9688
21/32	0.5547	0.6380	0.7214	0.8047	0.8880	0.9714
11/16	0.5573	0.6406	0.7240	0.8073	0.8906	0.9740
23/32	0.5599	0.6432	0.7266	0.8099	0.8932	0.9766
3/4	0.5625	0.6458	0.7292	0.8125	0.8958	0.9792
25/32	0.5651	0.6484	0.7318	0.8151	0.8984	0.9818
13/16	0.5677	0.6510	0.7344	0.8177	0.9010	0.9844
27/32	0.5703	0.6536	0.7370	0.8209	0.9036	0.9870
7/8	0.5729	0.6563	0.7396	0.8229	0.9063	0.9896
29/32	0.5755	0.6589	0.7422	0.8255	0.9089	0.9922
15/16	0.5701	0.6615	0.7448	0.8281	0.9115	0.9948
31/32	0.5807	0.6641	0.7474	0.8307	0.9141	0.9974

A.12 — Conversion Factors – Miscellaneous

Multiply	By	To Obtain
Pounds per foot	1.48816	Kilograms per meter
Pounds per square foot	4.88241	Kilograms per square meter
Pounds per square inch	0.07031	Kilograms per square cm
Pounds per square inch	0.0007031	Kilograms per square mm
Pounds per cubic foot	16.0184	Kilograms per cubic meter
Radians	57.29578	Degrees, angular
Horsepower	550	Ft-Lbs per second
Horsepower	2544	B.T.U.'s per hour
Horsepower	745.5	Watts
B.T.U.	251.98	Calories, gram
B.T.U	777.98	Ft-Lbs
Feet per second	0.68182	Miles per hour
Miles per hour	88	Feet per minute
Miles per hour	1.46667	Feet per second
Pounds	444822	Dynes
Kilograms	980665	Dynes
Atmosphere	1.0333	Kilograms per square cm
Atmosphere	14.697	Pounds per square inch
Atmosphere	29.921	Inches of mercury (0°C at sea level)
Atmosphere	0.76	Meters of mercury (0°C at sea level)
Atmosphere	33.9	Feet of water (4°C at sea level)
Pounds of water per minute	0.016021	Cubic feet per minute
Cubic feet per minute	0.12468	Gallons per second
Fathoms	6	Feet
Degrees per foot	0.00057261	Radians per centimeter
Centimeters of mercury (at 20°C)	5.34	Inches of water (at 20°C)

A.13 — Bituminous Concrete – Coverage Per Ton

Lane Width (Feet)	Lane Length (feet) Covered By 1 Ton of Bituminous Concrete						
	½″	¾″	1″	1½″	2″	2½″	3″
8	41.6	27.8	20.9	13.9	10.4	8.4	6.9
9	37.0	24.7	18.6	12.3	9.2	7.4	6.2
10	33.3	22.2	16.7	11.1	8.3	6.7	5.6
11	30.3	20.2	15.2	10.1	7.5	6.1	5.1
12	27.8	18.5	13.9	9.2	6.9	5.6	4.6

Note: Thicknesses shown above are compacted thicknesses.

A.14— Asphalt Specific Gravity and Weight Per Gallon

Specific Gravity	Pounds Per Gallon of Asphalt					
	60°F	200°F	250°F	300°F	325°F	350°F
0.990	8.245	7.852	7.717	7.586	7.522	7.458
1.000	8.328	7.931	7.795	7.663	7.598	7.533
1.010	8.412	8.011	7.874	7.740	7.674	7.609
1.020	8.495	8.090	7.951	7.816	7.750	7.684
1.030	8.578	8.169	8.029	7.893	7.826	7.759
1.040	8.661	8.248	8.107	7.969	7.901	7.934

A.15 — Quantities Per Mile

Cement Width	8′	9′	10′	12′	14′	16′	18′	20′	22′	24′
Square Yard Per Mile	4693	5280	5867	7040	8213	9387	10,560	11,734	12,907	14,080
Tons Per Mile	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Plant Mix 80 lbs/yd^2	187.72	211.20	234.68	281.60	328.52	375.48	422.40	469.36	516.28	563.20
Plant Mix 90 lbs/yd^2	211.18	237.60	264.15	316.80	369.58	422.41	475.35	528.03	580.81	633.60
Plant Mix 100 lbs/yd^2	234.65	264.00	293.35	352.00	410.65	469.35	528.00	586.70	645.35	704.00
Plant Mix 110 lbs/yd^2	258.12	290.40	322.68	387.20	451.71	516.28	580.80	645.37	709.88	774.40
Plant Mix 120 lbs/yd^2	281.58	316.80	352.02	422.40	492.78	563.22	633.60	704.04	774.42	844.80
Plant Mix 140 lbs/yd^2	323.51	369.60	410.69	492.80	574.91	657.09	739.20	821.38	903.49	985.60
Plant Mix 160 lbs/yd^2	375.44	422.40	469.36	563.20	657.04	750.96	844.80	938.72	1032.56	1126.40
Plant Mix 180 lbs/yd^2	422.37	475.20	528.03	633.60	739.17	844.83	950.40	1056.06	1161.63	1267.20
Plant Mix 200 lbs/yd^2	469.30	528.00	586.70	704.00	821.30	938.70	1056.00	1173.40	1290.70	1408.00
Plant Mix 220 lbs/yd^2	516.23	580.80	645.37	774.40	903.43	1032.57	1161.60	1290.74	1419.77	1548.80
Plant Mix 440 lbs/yd^2	1032.46	1161.60	1290.74	1548.80	1806.86	2065.14	2323.20	2581.48	2839.54	3097.60

A.16 — Square Yards of Road Surface for Various Road Widths

Road Width	Per Lineal Foot	Per 100 Feet	Per Mile	Road Width	Per Lineal Foot	Per 100 Feet	Per Mile
6′	0.67	66.67	3,520	24′	2.67	266.67	14,080
7′	0.78	77.78	4,107	25′	2.78	277.78	14,667
8′	0.89	88.89	4,693	26′	2.89	288.89	15,253
9′	1.00	100.00	5,280	28′	3.11	311.11	16,427
10′	1.11	111.11	5,867	30′	3.33	333.33	17,600
11′	1.22	122.22	6,453	32′	3.56	355.56	18,773
12′	1.33	133.33	7,040	34′	3.78	377.78	19,947
13′	1.44	144.44	7,627	36′	4.00	400.00	21,120
14′	1.56	155.56	8,213	38′	4.22	422.22	22,293
15′	1.67	166.67	8,800	40′	4.44	444.44	23,467
16′	1.78	177.78	9,387	50′	5.56	555.56	29,333
17′	1.89	188.89	9,973	60′	6.67	666.67	35,200
18′	2.00	200.00	10,560	70′	7.78	777.78	41,067
20′	2.22	222.22	11,733	75′	8.33	833.33	44,000
22′	2.44	244.44	12,907	80′	8.89	888.89	46,933

A.17 — Linear Feet Covered Based on Tank Capacity and Width and Rate of Application

To compute the number of linear feet which will be covered by a tank of any capacity, for various widths and rates of application, use the following formula:

$$L = \frac{9C}{RW}$$

Where:

L = Number of linear feet which will be covered.
C = Capacity of tank in gallons (or quantity of asphalt in tank).
R = Rate of application in gallons per square yard.
W = Width of application in feet.

A.18 — Density and Viscosity of Water at Various Temperatures

Temperature		Density	Density	Viscosity in
°C	°F	gm/ml	lbs/cu ft	Centipoises
-10.0	14.00	0.99815	62.3128	2.6000
-5.0	23.00	0.99930	62.3846	2.1300
0.0	32.00	0.99987	62.4201	1.7921
4.0	39.20	1.00000	62.4283	1.5674
5.0	41.00	0.99999	62.4276	1.5188
10.0	50.00	0.99973	62.4114	1.3077
15.0	59.00	0.99913	62.3739	1.1404
20.0	68.00	0.99823	62.3178	1.0050
20.2	68.36	0.99819	62.3153	1.0000
25.0	77.00	0.99707	62.2453	0.8937
30.0	86.00	0.99567	62.1579	0.8007
35.0	95.00	0.99406	62.0574	0.7225
40.0	104.00	0.99224	61.9438	0.6560
45.0	113.00	0.99025	61.8196	0.5988
50.0	122.00	0.98807	61.6835	0.5494
55.0	131.00	0.98573	61.5374	0.5064
60.0	140.00	0.98324	61.3820	0.4688
65.0	149.00	0.98059	61.2165	0.4355
70.0	158.00	0.97781	61.0430	0.4061
75.0	167.00	0.97489	60.8607	0.3799
80.0	176.00	0.97183	60.6697	0.3565
85.0	185.00	0.96865	60.4711	0.3355
90.0	194.00	0.96534	60.2645	0.3165
95.0	203.00	0.96192	60.0510	0.2994
100.0	212.00	0.95838	59.8300	0.2838

A.19 — Quantities for Various Depths of Cylindrical Tanks in Horizontal Position

% Depth Filled	% of Capacity	% Depth Filled	% of Capacity	% Depth Filled	% of Capacity	% Depth Filled	% of Capacity
1	0.20	26	20.73	51	51.27	76	81.50
2	0.50	27	21.86	52	52.54	77	82.60
3	0.90	28	23.00	53	53.81	78	83.68
4	1.34	29	24.07	54	55.08	79	84.74
5	1.87	30	25.31	55	56.34	80	85.77
6	2.45	31	26.48	56	57.60	81	86.77
7	3.07	32	27.66	57	58.86	82	87.76
8	3.74	33	28.84	58	60.11	83	88.73
9	4.45	34	30.03	59	61.36	84	89.68
10	5.20	35	31.19	60	62.61	85	90.60
11	5.98	36	32.44	61	63.86	86	91.50
12	6.80	37	33.66	62	65.10	87	92.36
13	7.64	38	34.90	63	66.34	88	93.20
14	8.50	39	36.14	64	67.56	89	94.02
15	9.40	40	37.39	65	68.81	90	94.80
16	10.32	41	38.64	66	69.97	91	95.55
17	11.27	42	39.89	67	71.16	92	96.26
18	12.24	43	41.14	68	72.34	93	96.93
19	13.23	44	42.40	69	73.52	94	97.55
20	14.23	45	43.66	70	74.69	95	98.13
21	15.26	46	44.92	71	75.93	96	98.66
22	16.32	47	46.19	72	77.00	97	99.10
23	17.40	48	47.45	73	78.14	98	99.50
24	18.50	49	48.73	74	79.27	99	99.80
25	19.61	50	50.00	75	80.39		

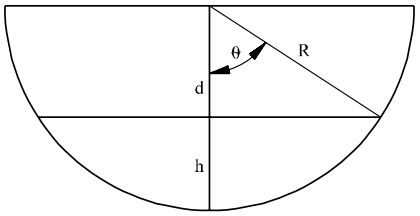
Full capacity of tank in U.S. gallons = $\dfrac{0.7854 \times D^2 \times L}{231}$

Note: ***The formula for direct computation of quantity when tank is less than half full is shown below. When more than half full, compute the full capacity of the tank as noted above; consider the shaded portion to represent the unfilled portion at the top of the tank and compute its volume as indicated below; then, deduct the volume determined for the unfilled portion from the total volume of the tank to arrive at the volume of the filled portion***

First, compute θ where $\cos\theta = \dfrac{d}{R} = \dfrac{R - h}{R}$

Then $A = \pi R^2 \dfrac{\theta}{180} - R \sin\theta(R - h)$

And $V = \dfrac{L\left[\pi R^2 \dfrac{\theta}{180} - R \sin\theta(R - h)\right]}{231}$



Where A = Cross section area of filled portion of tank in sq. in.
V = Volume of filled portion of tank in U.S. gallons
L = Length of interior of tank in inches
D = Diameter of interior of tank in inches
R = Radius of interior of tank in inches
h = Depth of liquid in inches
d = R – h, inches

Note: The volume occupied by any piping, fittings or other material inside the tank must be deducted from the volume computed by use the table or formula.

A.20 —Sample Pile-Hammer Specifications

Energy Range from 19,500 to 60,000 ft-lb.

Rated Energy Ft-Lb	Mfgr.	Type	Model	Speed, Blows Per Min	Weight of Striking Part-Lb.	Stroke at Rated Energy	Inlet-Hose Size-In.	Total Weight Lb.
60,000	McK-T	Sgl.-Act. Stm.-Air	S-20	60	20,000	36″	3	38,650
60,000	Vulcan	Sgl.-Act. Stm.-Air	020	60	20,000	36″	3	39,000
50,000	Vulcan	Dbl.-Act. Stm.-Air	200C	98	20,000	15½″	4	39,050
42,000	Vulcan	Sgl.-Act. Stm.-Air	014	60	14,000	36″	3	27,500
39,700	Delmag	Sgl.-Act. Diesel	D-22	48-52	4,850	Not Listed	—	10,054
37,500	McK-T	Sgl.-Act. Stm.-Air	S-14	60	14,000	32″	3	31,700
36,000	Vulcan	Dbl.-Act. Stm.-Air	140C	103	14,000	15½″	3	27,984
32,500	McK-T	Sgl.-Act. Stm.-Air	S-10	55	10,000	39″	2½″	22,380
32,500	Vulcan	Sgl.-Act. Stm.-Air	010	50	10,000	39″	2½″	18,750
32,000	McK-T	Sgl.-Act. Diesel	DE-40	48-52	4,000	8′ Prac. Max.	—	9,900
30,000	Link Belt	Dbl.-Act. Diesel	520	80-84	5,070	43.17″	—	12,545
26,000	McK-T	Sgl.-Act. Stm.-Air.	S-8	55	8,000	39″	2½″	18,300
26,000	McK-T	Dbl.-Act. Stm.-Air	C-8	77-85	8,000	20″	2½″	18,750
26,000	Vulcan	Sgl.-Act. Stm.-Air	C-8	50	8,000	29″	2½″	16,750
24,450	Vulcan	Dbl.-Act. Stm.-Air	30C	111	8,000	16½″	2½″	17,885
22,500	Delmag	Sgl.-Act. Diesel	D-12	48-52	2,750	Not Listed	—	5,440
22,400	McK-T	Sgl.-Act. Diesel	DE-30	48-52	2,800	8′ Prac. Max.	—	8,125
19,500	Vulcan	Sgl.-Act. Stm.-Air	06	60	6,500	36″	2	11,200

A.21 — List of WVDOH Contract Administration Forms

Form Number	Form Description
403	Subcontracting Request
409	Voucher Estimate (PRS)
410	Non-Participating Statement (PRS)
416	Contract Completion Report (PRS)
420	Contractors Performance Report (PRS)
422	Pile Driving Data and Log
423	Pile Driving Summary
427	Record of Contract
429	Starting Notice (PRS)
441	Weekly Suppliers Report
442	Inspectors Daily Report
442AGG	Aggregate
442ASP	Asphalt Pavement
442TK	Bituminous Tack or Prime
442DKR1	Class 1 Deck Removal
442DKR2	Class 2 Deck Removal
442GR	Guardrail
442FAS	High Strength Fasteners
442A	Supplemental Data
442	Inspectors Daily Report
442LX2	Latex (Checklist)
442LX1	Latex
442LME1	LME Daily Report
442LME2	LME Equipment
442LME3	LME Labor
442LLV	Load Limit Violation
442PMK	Pavement Markings
442CUL	Pipe Culvert
442REB	Reinforcing Steel
442FEN	Right-of-Way Fence
442RCT	Rotational Capacity Test
442ROT	Rotomill
442INL	Slot Inlet
442DRN	Small Drainage Structures
442SDR	Supervisors Daily Project Report
442SUR	Surface Treatment
442TR	Traffic Control
442NUT	Turn of Nut Verification
445	Request for Approval of Waste or Borrow Site
453	Inspectors Daily Utilities Report
454	Contractor's Proposed Source of Materials
455	Supplemental Agreement Change Order (PRS)
456	Force Account Work Order – Change Order (PRS)
458	Working Time Report (PRS)
467	Final Inspection Report (PRS)
472C	Evaluation of Project Progress
481	FHWA Correction Action Reply

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
SUPERVISOR'S DAILY PROJECT REPORT

AUTHORIZATION SC-2686-6 PROJECT STP-0119(125)E DR 43

CONTROLLING: LINE NO 0170 ITEM NO 401007-001 DATE 09/27/01

WEATHER	SUNNY	CLOUDY	RAIN	SNOW	TEMP		TEMP
AM	✓				47	°F	°C
PM	✓				65	°F	°C

CONTRACTOR 'S TIME BEGIN 7:00 AM END 7:00 PM

TOTAL HRS WORKED 12 TOTAL HRS WORKED ON **CONTROLLING ITEM** 12

CHARGEABLE DAY YES ☑ NO ☐ (IF NO, CHECK REASON)

PROGRESS	WEATHER	SEASONAL	HOLIDAY	UTILITIES	MATERIALS	STRIKE	DISASTER	EMERGENCY	ADDED WORK	OTHER
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

COMMENTS

DIARY NOTES
(INCLUDE PERTINENT COMMENTS AND/OR RECORD INSTRUCTIONS TO CONTRACTOR AND PROTESTS BY LINE NO IF ANY; VISITORS TO PROJECT BY NAME, TITLE, AND ORGANIZATION; ANY INSTRUCTIONS OR COMMENTS BY THESE VISITORS.)

LINE NO	

CONTINUED ON REVERSE SIDE Y ☐ N ☑

PREPARED BY Shawn a Smith
SIGNATURE

REVIEWED BY _____
SUPERVISOR'S SIGNATURE

OC 442-SDR

PRS ENTRY BY _____

DIARY NOTES CONTINUED

(INCLUDE PERTINENT COMMENTS AND / OR RECORD INSTRUCTIONS TO CONTRACTOR AND PROTESTS BY LINE NUMBER IF ANY; VISITORS TO PROJECT BY NAME, TITLE, AND ORGANIZATION; ANY INSTRUCTIONS OR COMMENTS BY THESE VISITORS)

LINE	

PRS ENTRY BY _____

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

INSPECTOR'S DAILY REPORT

AUTHORIZATION SC-2686-G DR NO 44

PROJECT STP-0119 (125) E DATE 09/27/01

FOLLOWING ATTACHMENTS ARE INCLUDED WITH THIS REPORT:

- ☐ AGGREGATE
- ☒ ASPHALT PAVEMENT
- ☐ DRAINAGE STRUCTURES
- ☐ CALCULATIONS
- ☐ GUARDRAIL
- ☒ BITUMINOUS TACK
- ☐ PIPE CULVERT
- ☐ SKETCH
- ☒ TRAFFIC CONTROL
- ☐ REINFORCING STEEL
- ☐ LATEX MOD CONCRETE
- ☒ Supp. Data

SUMMARY OF ITEMS INSPECTED THIS DATE

SEQ	LINE NO	PLAN ID	ITEM NUMBER	ITEM DESCRIPTION	RECEIVED QUANTITY & UNIT	PLACED QUANTITY & UNIT
1.	0035	RT 119	408002-001	Bituminous Material	784.64 GAL	784.64 GAL
LOCATION STATION TO STATION; OFFSET; L, R, C				0+25 to 207+00; RT		
LAB NUMBERS						
2.	0035	Rt 119	408002-001	Bituminous Material	735.60 gal	735.60 GAL
LOCATION STATION TO STATION; OFFSET; L, R, C				0+25 to 207+00 ; LT		
LAB NUMBERS						
3.	0095	RT 119	636006-001	Pilot Truck and Driver	1 DA	1 DA
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
4.	0110	RT 119	636014-001	Flagger	24 HR	24 HR
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						

* *ASTERISK EACH SEQUENCE NUMBER THAT HAS A NOTE REQUIRING* ***PRS*** *ENTRY*

THIS ITEM IS COMPLETE THIS DATE FOR LINE NUMBERS _____ _____ _____ _____ _____

INSPECTED BY Shan A Snid PROJ CHK BY _____ DATE _____

INSPECTED BY _____ DIST CHK BY _____ DATE _____

INSPECTED BY _____ DIV CHK BY _____ DATE _____

REVIEWED BY _____

OC-442 REV 02-00

DESCRIPTION OF WORK

RECORD SUFFICIENT DATA TO SHOW THAT THE WORK IS BEING PERFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THAT THE DAILY REPORT, WITH ANY ATTACHMENTS, IS AN ADEQUATE RECORD TO DOCUMENT THE QUANTITY & QUALITY OF MATERIALS AND WORKMANSHIP. INCLUDE WORKERS BY CLASSIFICATION, TYPE OF EQUIPMENT USED, AND HOURS WORKED.

LINE NO	
0035	408002-001 Bituminous Material Pay: 784.64 GL
	Sta 0+25 to Sta. 207+00 → Received and placed 784.64 gal of tack (type SS1H)
	on RT. 119 RT of ℄. prior to placemet of new asphalt. See attachment.
0035	408002-001 Bituminous Material Pay: 735.60 GL
	Sta 0+25 to Sta. 207+00 → Received and placed 735.60 gal of tack (type SS1H)
	on RT. 119 LT of ℄ prior to placemet of new asphalt. See attachment.
0095	636006-001 Pilot Truck and Driver Pay: 1 DA
	Used to guide one way traffic through work area on RT 119. See attachment.
0110	636014-001 Flagger Pay: 24 HR
	Two flaggers directed traffic through work area on RT 119. See attachment.

~~SKETCH~~ { INCLUDE MEASUREMENTS & CALCULATIONS }

WV Paving 7:00 → 7:00

3 - Operators 12 hr
4 - Laborers 12 hr
1 - Foreman 12 hr
16 - Teamsters 12 hr
2 - Flaggers 12 hr

1 - Blaw Knox PF3200 Paver
1 - Ingersoll Rand DD90 Roller
1 - GMC / Elkyre Distributer Truck
16 - Asphalt Dump Trucks
1 - Hypac C627B Roller
1 - Chevrolet Pickup Truck
1 - Massey Ferguson 241 Tractor Broom

EACH MEASUREMENT IS TO BE DENOTED AS {1} FIELD, {2} PLAN OR {3} CALCULATED

CALCULATED BY _____ SIGNATURE INSPECTOR _____ SIGNATURE

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

INSPECTOR'S DAILY REPORT SUPPLEMENTAL SEQUENCES

AUTHORIZATION SC-2686-G DR NO 44

PROJECT STP-0119(125)E DATE 09/27/01

SUMMARY OF ITEMS INSPECTED THIS DATE

SEQ	LINE NO	PLAN ID	ITEM NUMBER	ITEM DESCRIPTION	RECEIVED QUANTITY & UNIT	PLACED QUANTITY & UNIT
5.	0170	RT 119	401007-001	Scratch Course Asphalt	771.25 TN	771.25 TN
LOCATION STATION TO STATION; OFFSET; L, R, C				0+25 to 207+00; RT		
LAB NUMBERS			C1D4314 1343501			
6.	0170	RT 119	401007-001	Scratch Course Asphalt	778.81 TN	778.81 TN
LOCATION STATION TO STATION; OFFSET; L, R, C				0+25 to 207+00; LT		
LAB NUMBERS						
7.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
8.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
9.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
10.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
11.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						

OC-442 SEQ REV 02-00

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
INSPECTOR'S SUPPLEMENTAL DATA WORKSHEET

AUTHORIZATION SC-2686-G ATTACHMENT TO IDR 44
PROJECT STP-0119(125)E DATE 09/27/01

DESCRIPTION OF WORK
(RECORD SUFFICIENT DATA TO SHOW THAT WORK IS BEING PERFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THAT THE DAILY REPORT WITH ANY ATTACHMENTS IS AN ADEQUATE RECORD TO DOCUMENT THE QUANTITY AND QUALITY OF MATERIALS AND WORKMANSHIP. INCLUDE WORKERS BY CLASSIFICATION; TYPE OF EQUIPMENT USED AND HOURS WORKED).

LINE	
0170	401007-001 Scratch Course Asphalt Pay: 771.25 TN
	Sta 0+25 to Sta. 207+00 → Received and placed 771.25 TN of scratch
	course asphalt on RT. 119, right of ℄. One roller used for compaction. See
	attachment.
0170	401007-001 Scratch Course Asphalt Pay: 778.81 TN
	Sta 0+25 to Sta. 207+00 → Received and placed 778.81 TN of scratch
	course asphalt on RT. 119, left of ℄. One roller used for compaction. See
	attachment.
	Lab #'s C1D4314, 1343501

NOTES REQUIRING PRS ENTRY
(DOCUMENT INSTRUCTIONS TO CONTRACTOR; SPECIAL PROBLEMS; INVOICE OR CT NUMBERS FOR DELIVERED MATERIALS IF NOT INCLUDED ON THE ATTACHMENT(S)).

SEQ	

OC 442A

PREPARED BY Shawn A Smith
Signature

SKETCH (INCLUDE MEASUREMENTS AND CALCULATIONS)

EACH MEASUREMENT IS TO BE DENOTED AS (1) FIELD; (2) PLAN OR (3) CALCULATED

CALCULATED BY _____ INSPECTOR _____
Signature Signature

SKETCH (INCLUDE MEASUREMENTS AND CALCULATIONS)

EACH MEASUREMENT IS TO BE DENOTED AS (1) FIELD; (2) PLAN OR (3) CALCULATED

CALCULATED BY _____ INSPECTOR _____
Signature Signature

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
INSPECTOR'S BITUMINOUS TACK OR PRIME WORK SHEET

AUTHORIZATION SC-2686-G PROJECT STP-0119(125)E ATTACHMENT TO DR 44
LINE 0035 ITEM 408002-001 DATE 09/27/01

TICKET NO _____ ORIGINAL INVOICE 447756
MATERIAL TYPE SS1H SOURCE OF MATERIAL _____
SPECIFIC GRAVITY 1.0255 API DEGREES _____ WT PER GAL _____

QUANTITY RECEIVED BY THE DIVISION OF HIGHWAYS

MEASUREMENTS BY ☐ DIP STICK ☑ DIAL GAUGE ☐ WEIGH TICKETS

READINGS	GALLONS or WEIGHT	TEMPERATURES		CORRECTION FACTORS	GALLONS @ 60°
INITIAL	1800	115	°F	0.98080	1765.44
FINAL	250	115	°F	0.98080	- 245.20
				AMOUNT PLACED	1520.24

NOTE: *THE CONTRACTOR'S REPRESENTATIVE AND INSPECTOR WILL AGREE ON THE QUANTITY DELIVERED AND PAY AMOUNT.*

WV Paving
NAME OF CONTRACTOR

_____
SIGNATURE OF THE CONTRACTOR'S REPRESENTATIVE

CHECKS VERIFIED DURING WORK

☑ TRAFFIC CONTROL DEVICES AND FLAGGERS IN PLACE
☑ SURFACE CLEAN PRIOR TO BITUMINOUS APPLICATIONS
☑ TACK UNIFORMLY APPLIED WITH A TRIPLE OVERLAP

EXISTING BASE TEMPERATURE AT TIME OF PLACEMENT
(1) 52 °F @ (TIME) 7:30 AM
(2) 73 °F @ (TIME) 3:30 PM

MAKE OF DISTRIBUTOR Etnyre

RATE OF APPLICATION CALCULATIONS

TIME	GAL @ 60° F	STATION	STATION	LENGTH	WIDTH	RATE	
AM	786.64	0+25	207+00	20675'	12.5'	.03	GAL PER SY
PM	733.60	0+25	207+00	20675'	12.5'	.03	GAL PER SY

REMARKS

INSPECTOR Shan a Smith
SIGNATURE

TEMPERATURE - VOLUME CORRECTIONS FOR ASPHALTIC MATERIAL

TEMP	AE	GROUP 0	GROUP 1	TEMP	AE	GROUP 0	GROUP 1	TEMP	AE	GROUP 0	GROUP 1	TEMP	AE	GROUP 0	GROUP 1
60	1 00000	1 00000	1 00000	95	0 99135	0 98780	0 98610	130	0 98260	0.97580	0.97250	165	0 97385	0 96380	0 95890
61	0 99975	0 99965	0 9996	96	0 99110	0 98745	0 98570	131	0 98235	0 97545	0.97210	166	0 97360	0 96345	0 95850
62	0 9995	0.9993	0.9992	97	0.99085	0.98710	0 98530	132	0 98210	0.97510	0.97170	167	0.97335	0 96310	0.95810
63	0 9993	0.9990	0.9988	98	0 99060	0 98675	0.98490	133	0 98185	0.97475	0.97130	168	0.97310	0.96275	0.95770
64	0.9991	0 99865	0 9984	99	0.99035	0 98640	0 98450	134	0 98160	0 97440	0.97090	169	0 97285	0 96240	0 95730
65	0.99885	0 99830	0 99800	100	0 99010	0 98605	0 98410	135	0.98135	0 97405	0.97050	170	0 97260	0.96205	0 95690
66	0.99860	0.99795	0.99760	101	0.98985	0 98570	0.98370	136	0.98110	0.97370	0.97010	171	0.97235	0.96170	0.95650
67	0.99835	0.99760	0.99720	102	0.98960	0.98535	0.98330	137	0.98085	0.97335	0.96970	172	0.97210	0.96135	0.95610
68	0 99810	0 99725	0 99680	103	0.98935	0.98500	0 98290	138	0.98060	0 97300	0.96930	173	0 97185	0.96100	0.95570
69	0.99785	0.99690	0.99640	104	0 98910	0.98465	0.98250	139	0 98035	0.97265	0.96890	174	0.97160	0.96065	0.95530
70	0.99760	0.99655	0.99600	105	0.98885	0.98430	0.98210	140	0.98010	0.97230	0.96850	175	0.97135	0.96030	0.95490
71	0.99735	0.99620	0.99560	106	0.98860	0.98395	0.98170	141	0 97985	0.97195	0.96810	176	0.97110	0.95995	0.95450
72	0.99710	0.99585	0.99520	107	0.98835	0.98360	0.98130	142	0.97960	0.97160	0.96770	177	0.97085	0.95960	0.95410
73	0.99685	0.99550	0.99480	108	0.98810	0.98325	0.98090	143	0.97935	0.97125	0.96730	178	0.97060	0.95925	0.95370
74	0.99660	0.99515	0.99440	109	0.98785	0.98290	0.98050	144	0.97910	0.97090	0.96690	179	0.97035	0.95890	0.95330
75	0.99635	0.99480	0.99400	110	0 98760	0.98255	0.98010	145	0 97885	0.97055	0.96650	180	0 97010	0.95855	0.95290
76	0.99610	0.99445	0.99360	111	0.98735	0.98220	0.97970	146	0.97860	0.97020	0.96610	181	0.96985	0.95820	0.95250
77	0.99585	0.99410	0.99320	112	0.98710	0.98185	0.97930	147	0.97835	0.96985	0.96570	182	0.96960	0.95785	0.95210
78	0.99560	0.99375	0.99280	113	0.98685	0.98150	0.97890	148	0.97810	0.96950	0.96530	183	0.96935	0.95750	0.95170
79	0.99535	0.99340	0.99240	114	0.98660	0.98115	0.97850	149	0.97785	0.96915	0.96490	184	0.96910	0.95715	0.95130
80	0.99510	0.99305	0.99200	115	0.98635	0.98080	0.97810	150	0.97760	0.96880	0.96450	185	0.96885	0.95680	0.95090
81	0.99485	0.99270	0.99160	116	0.98610	0.98045	0.97770	151	0.97735	0.96845	0.96410	186	0.96860	0.95645	0.95050
82	0.99460	0.99235	0.99120	117	0.98585	0.98010	0.97730	152	0.97710	0.96810	0.96370	187	0.96835	0.95610	0.95010
83	0.99435	0.99200	0.99080	118	0.98560	0.97975	0.97690	153	0.97685	0.96775	0.96330	188	0.96810	0.95575	0.94970
84	0.99410	0.99165	0.99040	119	0.98535	0.97940	0.97650	154	0.97660	0.96740	0.96290	189	0.96785	0.95540	0.94930
85	0.99385	0.99130	0.99000	120	0.98510	0.97905	0.97610	155	0.97635	0.96705	0.96250	190	0.96760	0.95505	0.94890
86	0.99360	0.99095	0.98960	121	0.98485	0.97870	0.97570	156	0.97610	0.96670	0.96210	191	0.96735	0.95470	0.94850
87	0.99335	0.99060	0.98920	122	0.98460	0.97835	0.97530	157	0.97585	0.96635	0.96170	192	0.96710	0.95435	0.94810
88	0.99310	0.99025	0.98880	123	0.98435	0.97800	0.97490	158	0.97560	0.96600	0.96130	193	0.96685	0.95400	0.94770
89	0.99285	0.98990	0.98840	124	0.98410	0.97765	0.97450	159	0.97535	0.96565	0.96090	194	0.96660	0.95365	0.94730
90	0.99260	0.98955	0.98800	125	0.98385	0.97730	0.97410	160	0.97510	0.96530	0.96050	195	0.96635	0.95330	0.94690
91	0.99235	0.98920	0.98760	126	0.98360	0.97695	0.97370	161	0.97485	0.96495	0.96010	196	0.96610	0.95295	0.94650
92	0.99210	0.98885	0.98720	127	0.98335	0.97660	0.97330	162	0.97460	0.96460	0.95970	197	0.96585	0.95260	0.94610
93	0.99185	0.98850	0.98680	128	0.98310	0.97625	0.97290	163	0.97435	0.96425	0.95930	198	0.96560	0.95225	0.94570
94	0.99160	0.98815	0.98640	129	0.98285	0.97590	0.97250	164	0.97410	0.96390	0.95890	199	0.96535	0.95190	0.94530

MATERIAL	SPECIFIC GRAVITY	COEFFICIENT OF EXPANSION
AE ASPHALT EMULSION	NA	0 00025
GROUP 0 ASPHALT CEMENT	ABOVE 0 0966	0 00035
GROUP 1 CUT-BACK EMULSIFIED ASPHALT	BETWEEN 0.850 AND 0 966	0 0004

FORMULAE FOR CORRECTING TO VOLUMES AT 60° F

T = TEMPERATURE @ TIME OF READING
G = MEASURED GALLONS @ T - TEMPERATURE
F = FACTOR OF MATERIAL USED
CONVERSION TO 60° = G - [(T -60) X G X F] GALLONS

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
INSPECTOR'S TRAFFIC CONTROL WORK SHEET

AUTHORIZATION SC-2686-G
PROJECT STP-0119(125)E
ATTACHMENT TO DR 44
DATE 09/27/01

ITEM	DESCRIPTION	QUANTITY	UNITS	PLACED QTY
636-06	PILOT TRUCK AND DRIVER	1 EA	1 DA/EA	1 DA
636-11	TRAFFIC CONTROL DEVICES			
	SIGN - PORTABLE ≤ 16 SF (1.5 m²)	EA	UN/EA	UN
	SIGN - PORTABLE ≤ 16 SF (1.5 m²)	EA	UN/EA	UN
	SIGN - PERMANENT ≤ 16 SF (1.5 m²)	EA	UN/EA	UN
	SIGN - PERMANENT ≤ 16 SF (1.5 m²)	EA	UN/EA	UN
	TYPE 1 BARRICADES	EA	UN/EA	UN
	TYPE 2 BARRICADES	EA	UN/EA	UN
	TYPE 3 BARRICADES	EA	UN/EA	UN
	DRUMS	EA	UN/EA	UN
	CONES	EA	UN/EA	UN
	VERTICAL PANELS / DELINEATORS	EA	UN/EA	UN
	SUMMARY 636-11			**UN**
636-14	FLAGGER { }	2 EA	12 HR/EA	24 HR
	FLAGGER { }	EA	HR/EA	HR
	FLAGGER { }	EA	HR/EA	HR
	SUMMARY 636-14			24 **HR**
636-21	ELECTRIC ARROW { DATES }	EA	DA/EA	DA
636-25(A)	WARNING LIGHTS { DATES }	EA	DA/EA	DA
	MODEL NO(S)			
636-25(B)	WARNING LIGHTS { DATES }	EA	DA/EA	DA
	MODEL NO(S)			
636-25(C)	WARNING LIGHTS { DATES }	EA	DA/EA	DA
	MODEL NO(S)			
636-				
636-				

INSPECTOR Shawn A Smith
Signature

OC 442-TR

DAILY CHECKS

TRAFFIC CONTROL DEVICES PLACED IN ACCORDANCE WITH PLAN SHEET _____ OR CASE _____ OF THE TRAFFIC CONTROL MANUAL.

Y	N	NA	CHECKS VERIFIED PRIOR TO WORK
✓			SEQUENCE OF OPERATIONS VERIFIED
✓			ALL PERMANENT SIGNS ERECTED, MOUNTED AT CORRECT HEIGHT, CLEAN & LEGIBLE
✓			ALL ADVANCE WARNING SIGNS 48" X 48" (1.2m X 1.2m) MINIMUM
		✓	TEMPORARY SIGNS IN PLACE, CLEAN & LEGIBLE
✓			SIGNS PLACED AT CORRECT LOCATIONS, SPACED CORRECTLY, & UNOBSCURED
✓			SIGNS NOT APPLYING TO THE EXISTING CONDITIONS PROPERLY COVERED OR REMOVED
✓			FACING OF ALL SIGNS ACCEPTABLE
✓			FLAGS ATTACHED TO SIGNS WHERE REQUIRED
	✓		TYPE "B" WARNING LIGHTS IN PLACE & WORKING
		✓	ACCEPTABLE CONES, BARRICADES, DRUMS, TYPE "A" & "C" WARNING LIGHTS ON SITE
✓			ALL TYPE WARNING LIGHTS ARE ON THE APPROVED LISTING
		✓	ELECTRIC ARROW(S) ON SITE, EQUIPPED WITH AUTOMATIC DIMMING DEVICE & AT CORRECT HEIGHT
		✓	FLASH RATE OF ARROW(S) 30 FPM AND FLASH CYCLE TIME 2 SECONDS WITH APPROXIMATELY 50% "ON-TIME"
✓			PILOT TRUCK ON SITE AND PROPERLY EQUIPPED
		✓	ACCEPTABLE TEMPORARY PAVEMENT MARKING TAPE ON SITE
	✓		DEVICES LEFT UP OVER NIGHT FROM PREVIOUS DAY MISSING OR VANDALIZED

Y	N	NA	CHECKS VERIFIED DURING WORK
✓			TRAFFIC FLOWING THROUGH WORK AREA SMOOTHLY WITHOUT UNDUE DELAY (MAXIMUM 10 MINUTE DELAY)
		✓	TEMPORARY SIGNS REMAINING IN UPRIGHT POSITION
✓			FLAGGERS IN PLACE, PROPERLY EQUIPPED, ALERT & COURTEOUS
		✓	TEMPORARY PAVEMENT MARKING TAPE OF CORRECT LENGTH AND BEING PLACED AT PROPER SPACING
			TEMPORARY TAPE MANUFACTURER _____ LOT # _____
			QUANTITY PLACED _____ LF(m) TYPE _____

Y	N	NA	CHECKS VERIFIED UPON END OF WORK
		✓	TEMPORARY SIGNS REMOVED
✓			EQUIPMENT AND STOCKPILES OF MATERIAL OR DEBRIS LOCATED GREATER THAN 30' (9.1 m) FROM PAVEMENT EDGE
		✓	UNATTENDED OBSTACLES AND EXCAVATED AREAS PROTECTED BY BARRICADES WITH TYPE "A" WARNING LIGHTS
		✓	CONES REMAINING IN PLACE OVERNIGHT HAVE A MINIMUM OF 6" (152.4 mm) OF TYPE IV WHITE STRIPES
		✓	BARRICADE STRIPES SLOPE DOWN TOWARD THE SIDE OF THE BARRICADE TRAFFIC WILL PASS
	✓		ALL WARNING LIGHTS & ELECTRIC ARROW(S) OPERATIONAL

TYPE OF SIGN & MESSAGE	P	T	QUANTITY	TYPE OF SIGN & MESSAGE	P	T	QUANTITY

REMARKS (Include the Location(s) of the Sign(s)) Type "B" Warning Lights Not Working

NOTE TYPE OF SIGN P = PERMANENT T = TEMPORARY

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
INSPECTOR'S ASPHALT PAVEMENT WORKSHEET

AUTHORIZATION SC-2686-G PROJECT STP-0119(125)E ATTACHMENT TO IDR 44
LINE 0170 ITEM 401007-001 DATE 09/27/01

LOAD	TICKET	LOAD	TICKET	LOAD	TICKET	LOAD	TICKET	LOAD	TICKET
1	72628	15	72653	29	72687	43	72728	57	72766
2	72629	16	72654	30	72688	44	72732	58	72767
3	72630	17	72662	31	72690	45	72734	59	72768
4	72632	18	72663	32	72693	46	72736	60	72769
5	72636	19	72664	33	72695	47	72740	61	72770
6	72637	20	72665	34	72698	48	72742	62	72773
7	72639	21	72666	35	72700	49	72743	63	72774
8	72640	22	72667	36	72701	50	72744	64	72777
9	72641	23	72669	37	72702	51	72745	65	72781
10	72644	24	72671	38	72703	52	72761	66	
(11)	72646	25	72675	39	72710	53	72762	67	
12	72649	26	72677	40	72724	54	72763	68	
13	72650	27	72679	41	72725	55	72764	69	
14	72652	28	72686	42	72726	56	72765	70	

NOTE: IF A LOAD LIMIT VIOLATION OCCURS, CIRCLE THE LOAD NUMBER TO INDICATE THE TICKET NUMBER ON WHICH THE VIOLATION OCCURRED.

REMARKS: Load #11 Overload

TOTAL ~~MG~~ (TONS) THIS DATE: 1550.06 INSPECTOR: Shan a Small
Signature

OC 442-ASP

ROLLER PASS DATA 82.5 PCF SPEED OF ROLLER 3 MPH TYPE OF ROLLER Hyster

ROLLER PASS DATA _____ PCF SPEED OF ROLLER _____ MPH TYPE OF ROLLER _____

PLAN THICKNESS Varies

CALCULATION OF APPLICATION RATE (ONE CALCULATION PER EACH 762 m (2500 LF))

BEGIN STATION	N/A	depth varies				
END STATION	↓					
WIDTH						
Sm (SY)						
Mg (TONS)						
Mg/Sm (LB/SY)						

OBSERVED SIMILARITY TESTS (ONE OBSERVATION PER EACH 305 m (1000 LF))

LOT NUMBER	N/A	depth varies				
TEST NUMBER	↓					
Mg/Cm (LB/CY)						
STATION						

MAT THICKNESS (PRIOR TO COMPACTION) & MAT TEMPERATURE (AT TIME OF FINAL COMPACTION PASS) CHECKS (ONE CHECK PER 305 m (1000 LF))

TIME	7:35	8:20	9:00	9:50	10:30	11:55
MAT TEMPERATURE	266	268	268	269	274	274
MAT THICKNESS	2"	1 1/2"	1 1/2"	2 1/2"	3"	2 1/2"
STATION	0+50	22+10	59+90	92+00	160+50	206+00

TIME	12:50	2:10	3:35	5:05	6:25	
MAT TEMPERATURE	277	278	278	276	274	
MAT THICKNESS	1 1/2"	1 1/2"	1 1/2"	2"	2"	
STATION	200+50	140+80	81+90	32+60	5+25	

ROLLER SPEED CHECKS (FOUR CHECKS - TWO AM AND TWO PM)

TIME	10:00	11:15	2:30	4:00		
ROLLER SPEED MPH	2	3	3	2		

CHECKS ☑ VERIFIED PRIOR TO PLACEMENT

- ☑ SEQUENCE OF OPERATION VERIFIED
- ☑ TRAFFIC CONTROL DEVICES AND FLAGGERS IN PLACE
- ☑ HEEL-IN JOINTS CUT AND POTHOLES CORRECTED
- ☑ SURFACE CLEAN AND STRINGLINE PLACED
- ☑ ROLLER(S) AND PAVER(S) VERIFIED FOR COMPLIANCE
- ☑ CONTRACTOR'S DENSITY TECHNICIAN ON SITE
- ☐ LONGITUDINAL OINTS PINCHED / NOT OVERLAPPED

CHECKS ☑ VERIFIED DURING PLACEMENT

- ☑ TRUCKS COVERED AND INSULETED WITH NO OIL LEAKS OR DAMAGED BKDS
- ☑ OPERATION CONTINUOUS AND PAVER SPEED COMPATIBLE TO PLANT PRODUCTION
- ☑ VIBRATING SCREED ON AND TEXTURE OF MAT CORRECT
- ☑ CORRECT ROLLING SEQUENCE BEING USED
- ☑ STRAIGHT EDGE CHECKS BEING MADE
- ☑ COMPLIANCE WITH QUALITY CONTROL PLAN MAINTAINED
- ☑ TEMPERATURE OF MATERIAL RECORDED ON TICKETS ONCE PER HOUR MINIMUM

AIR TEMP 50 ~~°C~~ (°F) AT (TIME) 8:00 BASE TEMP 53 °C (°F) AT (TIME) 8:00

AIR TEMP _____ °C (°F) AT (TIME) _____ BASE TEMP _____ °C (°F) AT (TIME) _____

PRS ENTRY BY _____

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

INSPECTOR'S DAILY REPORT

AUTHORIZATION TC-2319-G DR NO 1910

PROJECT ACBR-0052(085)C DATE 08/27/01

FOLLOWING ATTACHMENTS ARE INCLUDED WITH THIS REPORT:

☐ AGGREGATE ☐ ASPHALT PAVEMENT ☐ DRAINAGE STRUCTURES ☐ CALCULATIONS

☐ GUARDRAIL ☐ BITUMINOUS TACK ☐ PIPE CULVERT ☐ SKETCH

☐ TRAFFIC CONTROL ☐ REINFORCING STEEL ☐ LATEX MOD CONCRETE ☐ _____

SUMMARY OF ITEMS INSPECTED THIS DATE

SEQ	LINE NO	PLAN ID	ITEM NUMBER	ITEM DESCRIPTION	RECEIVED QUANTITY & UNIT	PLACED QUANTITY & UNIT
1.	0040	NCCR	207-01	Unclassified Excavation	2.006 M3	2.006 M3
LOCATION STATION TO STATION; OFFSET; L, R, C				0+000 to 0+190 ; L, R, C		
LAB NUMBERS						
2.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
3.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
4.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						

* *ASTERISK EACH SEQUENCE NUMBER THAT HAS A NOTE REQUIRING* ***PRS*** *ENTRY*

THIS ITEM IS COMPLETE THIS DATE FOR LINE NUMBERS _____ _____ _____ _____ _____

INSPECTED BY Shan A Smith PROJ CHK BY _____ DATE _____

INSPECTED BY _____ DIST CHK BY _____ DATE _____

INSPECTED BY _____ DIV CHK BY _____ DATE _____

REVIEWED BY _____

OC-442 REV 02-00

DESCRIPTION OF WORK

RECORD SUFFICIENT DATA TO SHOW THAT THE WORK IS BEING PERFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THAT THE DAILY REPORT, WITH ANY ATTACHMENTS, IS AN ADEQUATE RECORD TO DOCUMENT THE QUANTITY & QUALITY OF MATERIALS AND WORKMANSHIP. INCLUDE WORKERS BY CLASSIFICATION, TYPE OF EQUIPMENT USED, AND HOURS WORKED.

LINE NO	
0040	207-01 Unclassified Excavation Pay = 2.006 M3

Sta 0+000 to Sta 0+080 → Contractor worked on New College Connection Road preparing the area for subgrade placement. Work incomplete.

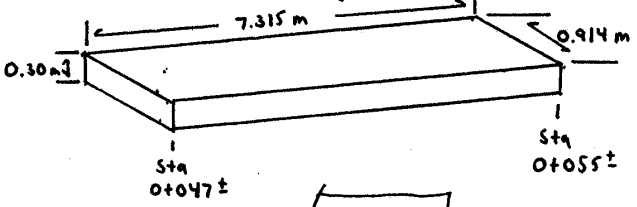
Sta. 0+047 to Sta 0+055 → Contractor removed material which was pumping on New College Connection Road left of ℄. Placed broke concrete in its place. See below for calculation.

Sta 0+140 to Sta 0+190 → Contractor used trackhoe to pull previously placed slope on New College Connection Road right of ℄. Removed material was loaded into dump truck and placed at west end of roadway for fill as needed.

Contractor conducted general clean-up of materials and debris from the New College Connection Road area.

SKETCH (INCLUDE MEASUREMENTS & CALCULATIONS)

Excavation : New College Connection Road



* Field Measured

$V = (7.315\ m)(0.914\ m)(0.300\ m) = \boxed{2.006\ m^3}$

Ahern 7:00 → 5:30 10 hrs

Men
- 1-Op, 1-Lab (7:00 → 5:30)
- 1-Op, 2-Lab (7:00 → 4:00)
- 1-Truck Driver (7:00 → 2:00)
- 1-Truck Driver (10:00 → 12:00)

Equip
- 1-Komatsu D4 Dozer
- 1-Komatsu PC200 Track Hoe
- 1-Cat IT-28B Rubber Tire Loader
- 1-Pick Up
- Hand tools

EACH MEASUREMENT IS TO BE DENOTED AS (1) FIELD, (2) PLAN OR (3) CALCULATED

CALCULATED BY Glen A Smith SIGNATURE INSPECTOR Glen A Smith SIGNATURE

PRS ENTRY BY _____

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

INSPECTOR'S DAILY REPORT

AUTHORIZATION FM-2256-C DR NO 85

PROJECT S 309-18-24.92 DATE 04/23/02

FOLLOWING ATTACHMENTS ARE INCLUDED WITH THIS REPORT:

☐ AGGREGATE ☐ ASPHALT PAVEMENT ☐ DRAINAGE STRUCTURES ☒ CALCULATIONS

☐ GUARDRAIL ☐ BITUMINOUS TACK ☐ PIPE CULVERT ☐ SKETCH

☐ TRAFFIC CONTROL ☒ REINFORCING STEEL ☐ LATEX MOD CONCRETE ☐ _____

SUMMARY OF ITEMS INSPECTED THIS DATE

SEQ	LINE NO	PLAN ID	ITEM NUMBER	ITEM DESCRIPTION	RECEIVED QUANTITY & UNIT	PLACED QUANTITY & UNIT
1.	0030	RT 18	601003-000	Class "K" Concrete	8 CY	6.64 CY
LOCATION STATION TO STATION; OFFSET; L, R, C				278+47 to 279+01 ; R		
LAB NUMBERS				C4E1612 , 1344350		
2.	0040	RT 18	602002-000	Epoxy Reinforcing Steel	0 LB	973.47 LB
LOCATION STATION TO STATION; OFFSET; L, R, C				278+47 to 279+01 ; R		
LAB NUMBERS						
3.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						
4.						
LOCATION STATION TO STATION; OFFSET; L, R, C						
LAB NUMBERS						

* *ASTERISK EACH SEQUENCE NUMBER THAT HAS A NOTE REQUIRING* ***PRS*** *ENTRY*

THIS ITEM IS COMPLETE THIS DATE FOR LINE NUMBERS _____ _____ _____ _____ _____

INSPECTED BY Shawn A Smith PROJ CHK BY _____ DATE _____

INSPECTED BY _____ DIST CHK BY _____ DATE _____

INSPECTED BY _____ DIV CHK BY _____ DATE _____

REVIEWED BY _____

OC-442 REV 02-00

DESCRIPTION OF WORK

RECORD SUFFICIENT DATA TO SHOW THAT THE WORK IS BEING PERFORMED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND THAT THE DAILY REPORT, WITH ANY ATTACHMENTS, IS AN ADEQUATE RECORD TO DOCUMENT THE QUANTITY & QUALITY OF MATERIALS AND WORKMANSHIP. INCLUDE WORKERS BY CLASSIFICATION, TYPE OF EQUIPMENT USED, AND HOURS WORKED.

LINE NO	
0030	601003-000 Class "K" Concrete Pay = 6.64 CY
	Sta. 278+47 to Sta 279+01 → Contractor set and secured metal forms for inside parapet wall, right of ℄. Used airhose to blow clean the inside of forms. Received and placed 8.0 yd^3 of class "K" concrete from Central Concrete. Placed by truck chute and vibrated. Contractor's technician on site for testing. Air = 6.25%, Slump = 2", Temp = 70° F. Lab # C4E1612 → cyl. 1344350 → mix. Contractor removed forms and hand rubbed wall. Given a broom finish. Wall was then covered with burlap, soaker hoses were placed, and covered with blankets for curing. See attachments for calculations.
0040	602002-000 Epoxy Reinforcing Steel Bars Pay = 973.47 LB
	Sta. 278+47 to Sta. 279+01 → All resteel properly tied and spaced. See attachments for calculations and sketch.

SKETCH { INCLUDE MEASUREMENTS & CALCULATIONS }

Contractor 7:00 → 5:30 10 hrs

1- Foreman 10 hrs
3- Laboren 10 hrs
2- Cement Masons 8 hrs
1- Carpenter 10 hrs
1- Operator 10 hrs
1- Iron worker 5 hrs

1- Technician 5 hrs

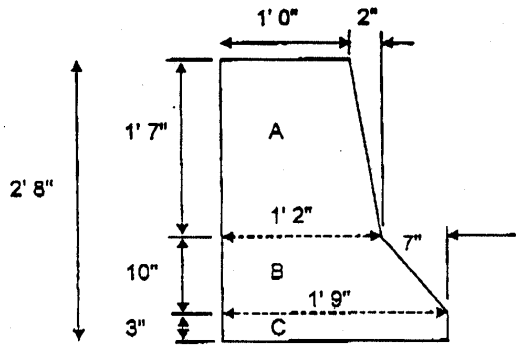
2- Pick-Ups
1- Hoe with bucket
2- Generators
Hand / Power Tools

EACH MEASUREMENT IS TO BE DENOTED AS {1} FIELD, {2} PLAN OR {3} CALCULATED

CALCULATED BY _____ INSPECTOR _____
SIGNATURE SIGNATURE

PARAPET WALL SECTION

FM 2256 C
IDR 85
4/23/02



Area Calc.

A = (1'-0" + 1'-2") /2 (1'-7")
B = (1'-2" + 1'-9")/2(10")
C = 1'-9")(3")

1.0834
A = (1.0 + 1.1667 / 2) (1.5833) = 1.715 sq. ft.

1.4584
B = 1.1667 + 1.75 / 2) (0.8333) = 1.215 sq. ft.

C = 0.25 * 1.75 = 0.438 sq. ft.
TOTAL AREA = 3.368 sq. ft.

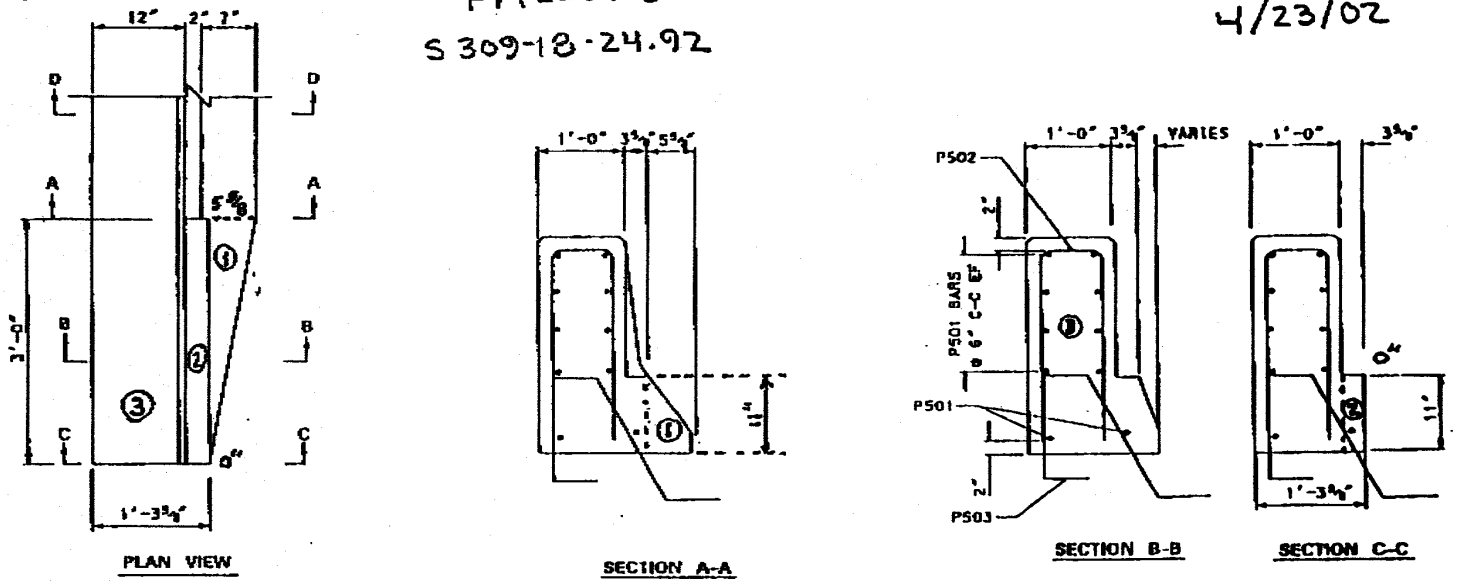
278+50R - 278+98R

LENGHT x 47.667 LF
160.541 SF
÷ 27
SubTotal 5.94 CY

Pg 1 of 2

FM2256C
S 309-18-24.92

IDR 85
4/23/02



PLAN VIEW

SECTION A-A

SECTION B-B

SECTION C-C

CONCRETE PARAPET END TREATMENT
278+47R AND 279+01R

(.2344)

① $\left(\frac{.4688' + 0'}{2}\right) \times 3' \times .9167 \div 27 = .024\ CY$

② $.9167' \times 3' \times .3021' \div 27 = .031\ CY$

③ $3' \times 1' \times 2.667' \div 27 = .296\ CY$

$.351\ CY$

$\times$ 2 ENDS

$0.70\ CY$

Pg 2 of 2

WALL - PAGE 1 5.94 CY
ENDS .70 CY
TOTAL - 6.64 CY

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
INSPECTOR'S REINFORCING STEEL WORKSHEET

AUTHORIZATION FM-2256-C PROJECT S 309-18-24.92 ATTACHMENT TO IDR 85
LINE 0040 ITEM 602002-000 DATE 04/23/02

DESCRIPTION OF STRUCTURE WHERE PLACED Inside Parapet, Right of ℄ SHEET 1 OF 1

BAR	SIZE	QUANTITY PLACED	BAR LENGTH	BAR SPACING	~~Kg PER METER~~ (POUNDS PER FOOT)	TOTAL WEIGHT Pounds
PS01E	5	10	53'-4"	8"	1.043	556.27
PS02E	5	80	5'-0"	6"	1.043	417.20
					Total =	973.47

SUMMATION BY BAR SIZE BAR # 5 ~~Kg~~ (LBS) 973.47 BAR # _____ Kg (LBS) _____ BAR # _____ Kg (LBS) _____
BAR # _____ Kg (LBS) _____ BAR # _____ Kg (LBS) _____ BAR # _____ Kg (LBS) _____
BAR # _____ Kg (LBS) _____ BAR # _____ Kg (LBS) _____ BAR # _____ Kg (LBS) _____

CALCULATED BY Shawn a Smith
Signature

INSPECTOR Shawn a Smith
Signature

CHECK ONE ☑ EPOXY COATED BARS ☐ UNCOATED BARS

PLACEMENT DETAILS FROM PLAN SHEETS 38, 39 of 62 BAR LIST FROM PLAN SHEETS 43 of 62

YES	NO	NA	CHECKS VERIFIED FOR PLACEMENT OF REINFORCING STEEL
✓			TEST COVERAGE HAS BEEN RECEIVED
✓			SIZE PLACED IS IN ACCORDANCE WITH PLAN DESIGN
✓			BARS FREE FROM INJURIOUS DEFECTS SUCH AS CRACKS AND LAMINATIONS AND DAMAGED EPOXY COATING TOUCHED UP
✓			LOOSE SCALE, LOOSE RUST, DIRT, PAINT, GREASE, OIL, AND OTHER FOREIGN MATERIAL REMOVED BY APPROVED METHODS
		✓	BARS PLACED IN THE WINTER HAVE BEEN PROTECTED BY A BRUSH COAT OF HEAT CEMENT
		✓	BRUSH COAT REMOVED, IF APPLICABLE, IN ACCORDANCE WITH SECTION 602.04
		✓	FIELD BENDING PERFORMED AS SHOWN IN THE PLANS OR AS PERMITTED BY THE ENGINEER
✓			ALL REINFORCING STEEL ACCURATELY PLACED AND FIRMLY HELD IN POSITION
✓			BARS SPACED AT 300 mm (1 FOOT) OR GREWATER IN EACH DIRECTION ARE TIED AT ALL INTERSECTIONS
✓			BARS SPACED AT LESS THAN 300 mm (1 FOOT) ARE TIED AT ALTERNATE INTERSECTIONS
✓			DISTANCE OF BARS FROM FORMS IN ACCORDANCE WITH PLANS AND MAINTAINED BY APPROVED SUPPORTS
✓			EPOXY COATED BARS SUPPORTED BY PLASTIC OR PLASTIC COATED WIRE SUPPORTS
✓			PLASTIC SUPPORTS PLACED AS NOT TO CREATE WEAK PLANES IN THE CONCRETE
✓			PLASTIC OR PLASTIC COATED TIE WIRE USED TO HOLD EPOXY COATED BARS IN PLACE
✓			SPLICING OF BARS IN ACCORDANCE WITH THE PLANS AND NO SPLICES LESS THAN 30 BAR DIAMETERS

BAR DESIGNATION	LBS PER LF	BAR DESIGNATION	LBS PER LF	BAR DESIGNATION	LBS PER LF
0.25 INCH	0.167	# 6	1.502	# 10	4.303
# 3	0.376	# 7	2.044	# 11	5.313
# 4	0.668	# 8	2.670	# 14S	7.650
# 5	1.043	# 9	3.400	# 18S	13.600

BAR DESIGNATION	kg PER m	BAR DESIGNATION	kg PER m	BAR DESIGNATION	kg PER m	BAR DESIGNATION	kg PER m
10	0.785	20	2.36	30	5.5	45	11.78
15	1.57	25	3.92	35	7.85	55	19.62

REMARKS

SKETCH (INCLUDE ACTUAL MEASUREMENTS)