

APPENDIX D METRIC

QUANTITY TABLES

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| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 300 | 0.77 | 0.39 | 0.73 | 0.36 |
| 375 | 1.22 | 0.61 | 1.14 | 0.57 |
| 450 | 1.76 | 0.88 | 1.65 | 0.83 |
| 600 | 3.11 | 1.56 | 2.92 | 1.46 |
| 750 | 4.87 | 2.43 | 4.58 | 2.29 |
| 900 | 7.01 | 3.50 | 6.59 | 3.29 |
| 1050 | 9.41 | 4.70 | 8.83 | 4.42 |
| 1200 | 12.10 | 6.05 | 11.36 | 5.68 |
| 1350 | 15.21 | 7.61 | 14.27 | 7.13 |
| 1500 | 18.86 | 9.34 | 17.51 | 8.76 |

TABLE D-1M

STONE FOR EROSION CONTROL WITH ST'D. ES-1 END SECTIONS

| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 300 | 0.87 | 0.44 | 0.82 | 0.41 |
| 375 | 1.28 | 0.64 | 1.21 | 0.60 |
| 450 | 1.95 | 0.97 | 1.84 | 0.92 |
| 600 | 3.44 | 1.72 | 3.24 | 1.62 |
| 750 | 5.35 | 2.67 | 5.04 | 2.52 |
| 900 | 7.68 | 3.84 | 7.25 | 3.62 |
| 1050 | 10.44 | 5.22 | 9.84 | 4.92 |
| 1200 | 13.42 | 6.71 | 12.65 | 6.32 |
| 1350 | 16.92 | 8.46 | 15.94 | 7.97 |
| 1500 | 20.80 | 10.40 | 19.58 | 9.79 |

TABLE D-2M

STONE FOR EROSION CONTROL WITH ST'D. ES-2 END SECTIONS

| PIPE ARCH SPAN RISE (mm) | 1 ½ : 1 Slope | | 2:1 Slope | |
|--------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 450 340 | 1.48 | 0.72 | 1.35 | 0.68 |
| 510 380 | 1.87 | 0.93 | 1.75 | 0.87 |
| 560 420 | 2.30 | 1.15 | 2.15 | 1.07 |
| 680 500 | 3.29 | 1.65 | 3.08 | 1.54 |
| 800 580 | 4.59 | 2.30 | 4.29 | 2.15 |
| 910 660 | 6.11 | 3.06 | 5.72 | 2.86 |
| 1030 740 | 7.75 | 3.87 | 7.25 | 3.63 |
| 1150 820 | 9.60 | 4.80 | 8.99 | 4.50 |
| 1390 970 | 13.70 | 6.85 | 12.81 | 6.40 |
| 1630 1120 | 18.52 | 9.26 | 17.31 | 8.65 |

TABLE D-3M
STONE FOR EROSION CONTROL WITH ST'D. ES-3 END SECTIONS

| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | | Increments For Each Add'l. Pipe (St'd. EW-6) | |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|-----------------------------------------------------------|----------------------------------------------------|---------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Conc. | C.M. |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters | Cu Yds | Cu Yds. |
| 300 | 0.53 | 0.26 | 0.50 | 0.25 | 0.26 | 0.22 |
| 375 | 0.83 | 0.41 | 0.79 | 0.39 | 0.40 | 0.35 |
| 450 | 1.20 | 0.60 | 1.14 | 0.57 | 0.58 | 0.51 |
| 600 | 2.13 | 1.07 | 2.02 | 1.01 | 1.01 | 0.90 |
| 750 | 3.34 | 1.67 | 3.17 | 1.59 | 1.60 | 1.41 |
| 900 | 4.84 | 2.42 | 4.60 | 2.30 | 2.34 | 2.07 |

TABLE D-4M
STONE FOR EROSION CONTROL WITH ST'D. EW-1 AND EW-6 ENDWALLS

| ELLIPTICAL PIPE SPAN RISE (mm) | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 575 365 | 1.23 | 0.62 | 1.17 | 0.59 |
| 770 490 | 2.24 | 1.12 | 2.13 | 1.06 |
| 865 550 | 2.82 | 1.41 | 2.68 | 1.34 |
| 960 610 | 3.47 | 1.73 | 3.29 | 1.65 |
| 1055 670 | 4.20 | 2.10 | 3.99 | 2.00 |
| 1150 730 | 4.99 | 2.49 | 4.73 | 2.37 |
| 1250 795 | 5.92 | 2.96 | 5.62 | 2.81 |
| 1345 855 | 6.84 | 3.42 | 6.50 | 3.25 |
| | | | | |
| | | | | |

TABLE D-5M
STONE FOR EROSION CONTROL WITH ST'D. EW-1A ENDWALLS

| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | | ST'D. EW-7 |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|-----------------------------------------------------------|--------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Increments For Each Add'l. Pipe (Conc.) |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 1050 | 8.02 | 4.01 | 7.48 | 3.74 | 3.49 |
| 1200 | 10.65 | 5.32 | 9.92 | 4.96 | 4.57 |
| 1350 | 13.44 | 6.72 | 12.52 | 6.26 | 5.75 |
| 1500 | 16.55 | 8.28 | 15.42 | 7.71 | 7.09 |
| 1650 | 19.99 | 9.99 | 18.62 | 9.31 | 8.57 |
| 1800 | 23.75 | 11.87 | 22.11 | 11.06 | 10.16 |
| 1950 | 28.13 | 14.07 | 26.19 | 13.10 | 11.94 |
| 2100 | 32.56 | 16.28 | 30.31 | 15.16 | 13.84 |
| | | | | | |
| | | | | | |

TABLE D-6M
STONE FOR EROSION CONTROL WITH ST'D. EW-2 AND EW-7 ENDWALLS

| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | | ST'D. EW-7S |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|--------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Increments For Each Add'l. Pipe (Conc.) |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 1050 | 8.34 | 4.17 | 7.80 | 3.90 | 4.03 |
| 1200 | 11.04 | 5.52 | 10.31 | 5.16 | 5.27 |
| 1350 | 13.96 | 6.98 | 13.03 | 6.52 | 6.64 |
| 1500 | 17.21 | 8.60 | 16.07 | 8.04 | 8.18 |
| 1650 | 20.77 | 10.38 | 19.40 | 9.70 | 9.90 |
| 1800 | 24.70 | 12.35 | 23.06 | 11.53 | 11.74 |
| 1950 | 29.24 | 14.62 | 27.30 | 13.65 | 13.79 |
| 2100 | 33.83 | 16.91 | 31.58 | 15.79 | 15.97 |
| | | | | | |
| | | | | | |

TABLE D-7M
STONE FOR EROSION CONTROL WITH ST'D. EW-2S AND EW-7S
ENDWALLS (30 DEGREE SKEW)

| CULVERT SIZE DIAMETER (mm) | 1 ½ : 1 Slope | | 2:1 Slope | | ST'D. EW-7S |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|--------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Increments For Each Add'l. Pipe (Conc.) |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 1050 | 9.68 | 4.84 | 9.34 | 4.67 | 4.94 |
| 1200 | 12.81 | 6.41 | 12.35 | 6.18 | 6.46 |
| 1350 | 16.18 | 8.09 | 15.60 | 7.80 | 8.13 |
| 1500 | 19.92 | 9.96 | 19.20 | 9.60 | 10.03 |
| 1650 | 24.07 | 12.03 | 23.20 | 11.60 | 12.12 |
| 1800 | 28.58 | 14.29 | 27.54 | 13.77 | 14.37 |
| 1950 | 33.81 | 16.90 | 32.57 | 16.28 | 16.89 |
| 2100 | 39.12 | 19.56 | 37.69 | 18.84 | 19.57 |
| | | | | | |
| | | | | | |

TABLE D-7A M
STONE FOR EROSION CONTROL WITH ST'D. EW-2S AND EW-7S
ENDWALLS (45 DEGREE SKEW)

| ELLIPTICAL PIPE SPAN RISE (mm) | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 1535 975 | 10.72 | 5.36 | 9.54 | 4.77 |
| 1730 1095 | 14.08 | 7.04 | 12.62 | 6.31 |
| 1920 1220 | 17.68 | 8.84 | 15.81 | 7.90 |
| 2110 1340 | 21.05 | 10.53 | 18.81 | 9.40 |
| 2305 1465 | 25.39 | 12.70 | 22.67 | 11.33 |
| 2495 1585 | 31.72 | 15.86 | 28.58 | 14.29 |
| 2609 1705 | 34.47 | 17.23 | 30.75 | 15.37 |
| | | | | |
| | | | | |

TABLE D-8M
STONE FOR EROSION CONTROL WITH ST'D. EW-2A ENDWALLS

| PIPE ARCH Span Riser (mm) | 1 ½ : 1 Slope | | 2:1 Slope | | ST'D. EW-10 |
|-------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|-----------------------------------------------------------|---------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Increments For Each Add'l. Pipe |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 425 325 | 0.82 | 0.41 | 0.77 | 0.39 | 0.39 |
| 525 375 | 1.17 | 0.58 | 1.11 | 0.55 | 0.52 |
| 600 450 | 1.60 | 0.80 | 1.52 | 0.76 | 0.68 |
| 700 500 | 2.08 | 1.04 | 1.98 | 0.99 | 0.84 |
| 875 600 | 3.11 | 1.55 | 2.95 | 1.47 | 1.16 |
| 1050 725 | 4.52 | 2.26 | 4.29 | 2.14 | 1.72 |
| 1225 825 | 6.02 | 3.01 | 5.72 | 2.86 | 2.29 |
| 1425 950 | 8.11 | 4.05 | 7.70 | 3.85 | 3.12 |
| | | | | | |
| | | | | | |

TABLE D-9M
**STONE FOR EROSION CONTROL WITH ST'D. EW-9 AND EW-10 PIPE
ARCHES**

| CULVERT SIZE (Meters) SPAN X RISE | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 0.91 x 0.91 | 7.12 | 3.56 | 6.92 | 3.46 |
| 0.91 x 1.22 | 9.82 | 4.91 | 9.82 | 4.91 |
| 1.22 x 0.91 | 9.71 | 4.86 | 9.10 | 4.55 |
| 1.22 x 1.22 | 12.82 | 6.41 | 12.51 | 6.25 |
| 1.22 x 1.52 | 16.29 | 8.15 | 16.28 | 8.14 |
| 1.22 x 1.83 | 20.03 | 10.01 | 20.64 | 10.32 |
| 1.52 x 0.91 | 12.60 | 6.30 | 11.54 | 5.77 |
| 1.52 x 1.22 | 16.09 | 8.04 | 15.22 | 7.61 |
| 1.52 x 1.52 | 19.93 | 9.96 | 19.34 | 9.67 |
| 1.52 x 1.83 | 24.14 | 12.07 | 24.07 | 12.04 |
| 1.52 x 2.13 | 28.80 | 14.40 | 29.13 | 14.57 |
| 1.83 x 1.22 | 19.85 | 9.93 | 18.42 | 9.21 |
| 1.83 x 1.52 | 24.07 | 12.04 | 22.85 | 11.42 |
| 1.83 x 1.83 | 28.77 | 14.39 | 27.96 | 13.98 |
| 1.83 x 2.13 | 33.81 | 16.91 | 33.38 | 16.69 |
| 1.83 x 2.44 | 39.11 | 19.55 | 39.45 | 19.72 |
| 2.13 x 1.22 | 23.87 | 11.93 | 21.87 | 10.94 |
| 2.13 x 1.83 | 33.68 | 16.84 | 32.04 | 16.02 |
| 2.13 x 2.44 | 45.10 | 22.55 | 44.25 | 22.12 |
| 2.13 x 3.05 | 57.41 | 28.17 | 57.77 | 28.89 |
| 2.44 x 1.22 | 28.41 | 14.20 | 25.77 | 12.89 |
| 2.44 x 1.83 | 39.08 | 19.54 | 36.60 | 18.30 |
| 2.44 x 2.44 | 51.27 | 25.64 | 49.78 | 24.89 |
| 2.44 x 3.05 | 64.56 | 32.28 | 64.38 | 32.19 |
| 2.74 x 1.22 | 33.17 | 16.59 | 29.87 | 14.93 |
| 2.74 x 1.83 | 44.78 | 22.39 | 41.40 | 20.70 |
| 2.74 x 2.44 | 57.63 | 28.81 | 55.14 | 27.57 |
| 2.74 x 3.05 | 71.85 | 35.92 | 70.55 | 35.28 |
| 2.74 x 3.66 | 87.57 | 43.79 | 87.99 | 43.99 |
| 3.05 x 1.22 | 38.48 | 19.24 | 34.44 | 17.22 |
| 3.05 x 1.83 | 51.06 | 25.53 | 46.71 | 23.36 |
| 3.05 x 2.44 | 64.58 | 32.29 | 61.01 | 30.51 |
| 3.05 x 3.05 | 79.99 | 40.00 | 77.55 | 38.78 |
| 3.05 x 3.66 | 96.84 | 48.42 | 95.99 | 47.99 |
| 3.66 x 1.83 | 64.12 | 32.06 | 57.80 | 28.90 |
| 3.66 x 2.44 | 79.60 | 39.80 | 73.68 | 36.84 |
| 3.66 x 3.05 | 96.58 | 48.29 | 91.69 | 45.85 |
| 3.66 x 3.66 | 115.36 | 57.68 | 111.82 | 55.91 |

TABLE D-10M
STONE FOR EROSION CONTROL FOR BOX CULVERT
ST'D. BS00.6 THRU BS15.0 (NO SKEW)

| CULVERT SIZE (Meters) SPAN X RISE | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 0.91 x 0.91 | 7.17 | 3.58 | 6.97 | 3.48 |
| 0.91 x 1.22 | 9.89 | 4.95 | 9.89 | 4.94 |
| 1.22 x 0.91 | 9.78 | 4.89 | 9.17 | 4.58 |
| 1.22 x 1.22 | 12.91 | 6.46 | 12.60 | 6.30 |
| 1.22 x 1.52 | 16.41 | 8.21 | 16.39 | 8.20 |
| 1.22 x 1.83 | 20.17 | 10.09 | 20.78 | 10.39 |
| 1.52 x 0.91 | 12.69 | 6.34 | 11.62 | 5.81 |
| 1.52 x 1.22 | 16.20 | 8.10 | 15.34 | 7.67 |
| 1.52 x 1.52 | 20.08 | 10.04 | 19.49 | 9.75 |
| 1.52 x 1.83 | 24.31 | 12.16 | 24.25 | 12.13 |
| 1.52 x 2.13 | 29.01 | 14.51 | 29.34 | 14.67 |
| 1.83 x 1.22 | 19.99 | 10.00 | 18.56 | 9.28 |
| 1.83 x 1.52 | 24.25 | 12.12 | 23.02 | 11.51 |
| 1.83 x 1.83 | 28.98 | 14.49 | 28.17 | 14.08 |
| 1.83 x 2.13 | 34.06 | 17.03 | 33.63 | 16.81 |
| 1.83 x 2.44 | 39.39 | 19.69 | 39.73 | 19.86 |
| 2.13 x 1.22 | 24.03 | 12.02 | 22.04 | 11.02 |
| 2.13 x 1.83 | 33.92 | 16.96 | 32.29 | 16.14 |
| 2.13 x 2.44 | 45.43 | 22.71 | 44.58 | 22.29 |
| 2.13 x 3.05 | 57.83 | 28.91 | 58.18 | 29.09 |
| 2.44 x 1.22 | 28.60 | 14.30 | 25.96 | 12.98 |
| 2.44 x 1.83 | 39.37 | 19.68 | 36.88 | 18.44 |
| 2.44 x 2.44 | 51.65 | 25.83 | 50.16 | 25.08 |
| 2.44 x 3.05 | 65.03 | 32.52 | 64.86 | 32.43 |
| 2.74 x 1.22 | 33.38 | 16.69 | 30.08 | 15.04 |
| 2.74 x 1.83 | 45.10 | 22.55 | 41.72 | 20.86 |
| 2.74 x 2.44 | 58.05 | 29.03 | 55.56 | 27.78 |
| 2.74 x 3.05 | 72.38 | 36.19 | 71.08 | 35.54 |
| 2.74 x 3.66 | 88.21 | 44.10 | 88.62 | 44.31 |
| 3.05 x 1.22 | 38.72 | 19.36 | 34.68 | 17.34 |
| 3.05 x 1.83 | 51.41 | 25.71 | 47.07 | 23.53 |
| 3.05 x 2.44 | 65.05 | 32.53 | 61.49 | 30.74 |
| 3.05 x 3.05 | 80.58 | 40.29 | 78.14 | 39.07 |
| 3.05 x 3.66 | 97.55 | 48.77 | 96.70 | 48.35 |
| 3.66 x 1.83 | 64.54 | 32.27 | 58.23 | 29.11 |
| 3.66 x 2.44 | 80.16 | 40.08 | 74.24 | 37.12 |
| 3.66 x 3.05 | 97.29 | 48.64 | 92.40 | 46.20 |
| 3.66 x 3.66 | 116.21 | 58.11 | 112.67 | 56.33 |

TABLE D-11M
STONE FOR EROSION CONTROL FOR BOX CULVERT
ST'D. BS00.6 THRU BS15.0 (15 DEGREE SKEW)

| CULVERT SIZE (Meters) SPAN X RISE | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 0.91 x 0.91 | 7.40 | 3.70 | 7.24 | 3.62 |
| 0.91 x 1.22 | 10.28 | 5.14 | 10.39 | 5.20 |
| 1.22 x 0.91 | 10.00 | 5.00 | 9.41 | 4.70 |
| 1.22 x 1.22 | 13.35 | 6.68 | 13.10 | 6.55 |
| 1.22 x 1.52 | 17.08 | 8.54 | 17.27 | 8.63 |
| 1.22 x 1.83 | 21.31 | 10.66 | 22.15 | 11.08 |
| 1.52 x 0.91 | 12.89 | 6.45 | 11.83 | 5.92 |
| 1.52 x 1.22 | 16.60 | 8.30 | 15.79 | 7.89 |
| 1.52 x 1.52 | 20.72 | 10.36 | 20.29 | 10.14 |
| 1.52 x 1.83 | 25.39 | 12.69 | 25.52 | 12.76 |
| 1.52 x 2.13 | 30.41 | 15.21 | 31.10 | 15.55 |
| 1.83 x 1.22 | 20.40 | 10.20 | 18.97 | 9.49 |
| 1.83 x 1.52 | 24.87 | 12.44 | 23.74 | 11.87 |
| 1.83 x 1.83 | 29.99 | 14.99 | 29.34 | 14.67 |
| 1.83 x 2.13 | 35.42 | 17.71 | 35.28 | 17.64 |
| 1.83 x 2.44 | 41.30 | 20.65 | 42.04 | 21.02 |
| 2.13 x 1.22 | 24.45 | 12.23 | 22.41 | 11.21 |
| 2.13 x 1.83 | 34.83 | 17.42 | 33.36 | 16.68 |
| 2.13 x 2.44 | 47.11 | 23.56 | 46.77 | 23.38 |
| 2.13 x 3.05 | 60.92 | 30.46 | 62.13 | 31.06 |
| 2.44 x 1.22 | 29.02 | 14.51 | 26.31 | 13.15 |
| 2.44 x 1.83 | 40.24 | 20.12 | 37.85 | 18.92 |
| 2.44 x 2.44 | 53.40 | 26.70 | 52.28 | 26.14 |
| 2.44 x 3.05 | 68.22 | 34.11 | 68.72 | 34.36 |
| 2.74 x 1.22 | 33.82 | 16.91 | 30.40 | 15.20 |
| 2.74 x 1.83 | 45.93 | 22.96 | 42.61 | 21.31 |
| 2.74 x 2.44 | 59.72 | 29.86 | 57.54 | 28.77 |
| 2.74 x 3.05 | 75.41 | 37.71 | 74.73 | 37.37 |
| 2.74 x 3.66 | 92.78 | 46.39 | 94.24 | 47.12 |
| 3.05 x 1.22 | 39.16 | 19.58 | 34.96 | 17.48 |
| 3.05 x 1.83 | 52.19 | 26.10 | 47.88 | 23.94 |
| 3.05 x 2.44 | 66.65 | 33.32 | 63.36 | 31.68 |
| 3.05 x 3.05 | 83.47 | 41.73 | 81.65 | 40.83 |
| 3.05 x 3.66 | 101.95 | 50.98 | 102.18 | 51.09 |
| 3.66 x 1.83 | 65.13 | 32.56 | 58.80 | 29.40 |
| 3.66 x 2.44 | 81.60 | 40.80 | 75.80 | 37.90 |
| 3.66 x 3.05 | 99.86 | 49.93 | 95.46 | 47.73 |
| 3.66 x 3.66 | 120.29 | 60.15 | 117.72 | 58.86 |

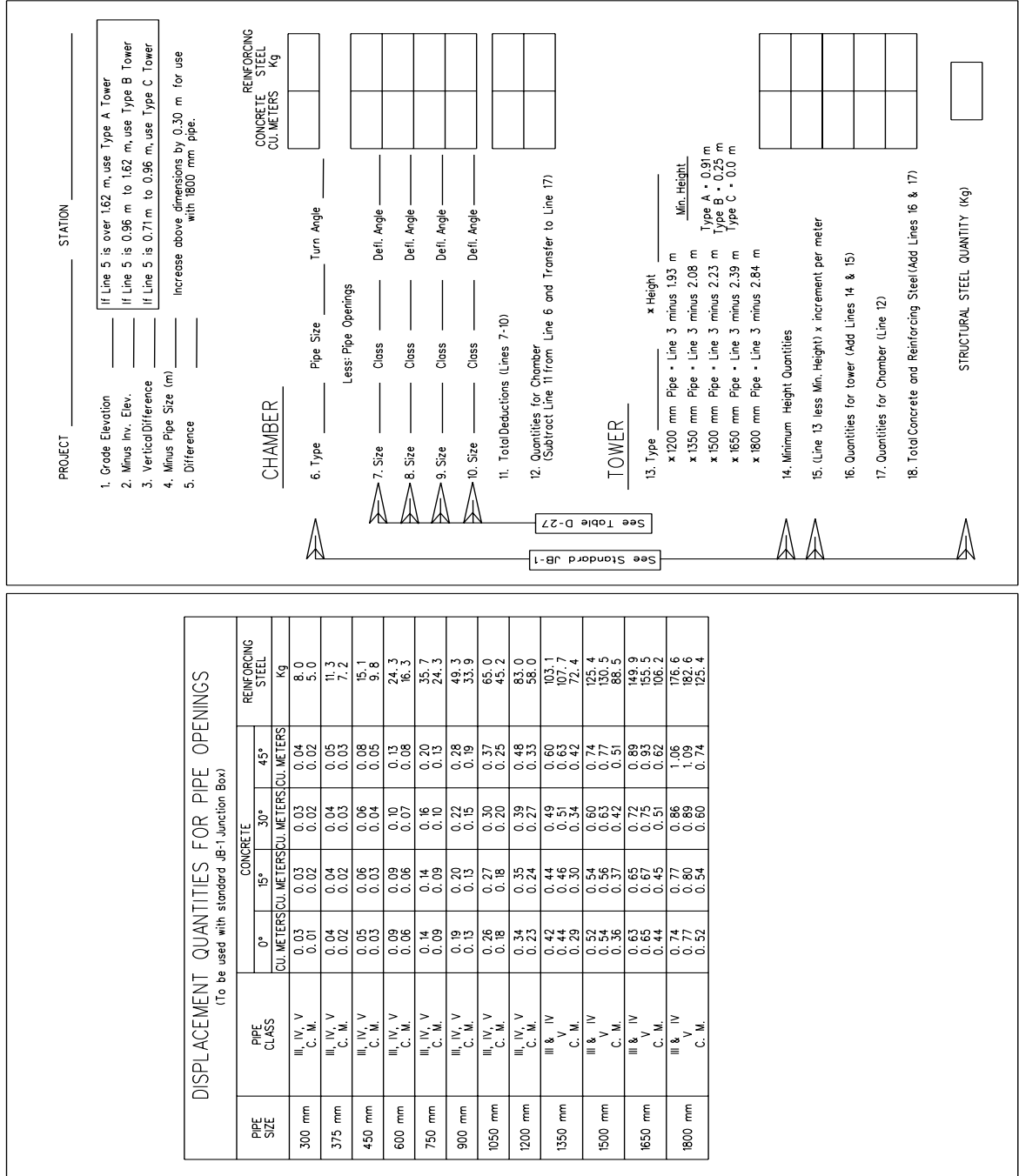
TABLE D-12M
STONE FOR EROSION CONTROL FOR BOX CULVERT
ST'D. BS00.6 THRU BS15.0 (30 DEGREE SKEW)

| CULVERT SIZE (Meters) SPAN X RISE | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------------------|--------------------------------------------------------|---------------------------|--------------------------------------------------------|
| | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal | Normal Depth (0.6m) | Increments For Each Add'l. 0.3 m Above Normal |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 0.91 x 0.91 | 7.79 | 3.89 | 7.62 | 3.81 |
| 0.91 x 1.22 | 10.80 | 5.40 | 10.91 | 5.46 |
| 1.22 x 0.91 | 10.52 | 5.26 | 9.93 | 4.96 |
| 1.22 x 1.22 | 14.05 | 7.02 | 13.80 | 6.90 |
| 1.22 x 1.52 | 17.73 | 8.87 | 18.13 | 9.07 |
| 1.22 x 1.83 | 22.36 | 11.18 | 23.19 | 11.60 |
| 1.52 x 0.91 | 13.54 | 6.77 | 12.48 | 6.24 |
| 1.52 x 1.22 | 17.54 | 8.74 | 16.66 | 8.33 |
| 1.52 x 1.52 | 21.80 | 10.90 | 21.37 | 10.68 |
| 1.52 x 1.83 | 26.69 | 13.34 | 26.82 | 13.41 |
| 1.52 x 2.13 | 31.93 | 15.96 | 32.61 | 16.30 |
| 1.83 x 1.22 | 21.44 | 10.72 | 20.01 | 10.01 |
| 1.83 x 1.52 | 26.17 | 13.09 | 25.04 | 12.52 |
| 1.83 x 1.83 | 31.55 | 15.78 | 30.90 | 15.45 |
| 1.83 x 2.13 | 37.24 | 18.62 | 37.10 | 18.55 |
| 1.83 x 2.44 | 43.38 | 21.69 | 44.13 | 22.07 |
| 2.13 x 1.22 | 25.66 | 12.83 | 23.63 | 11.81 |
| 2.13 x 1.83 | 36.65 | 18.33 | 35.18 | 17.59 |
| 2.13 x 2.44 | 49.54 | 24.77 | 49.20 | 24.60 |
| 2.13 x 3.05 | 63.95 | 31.98 | 65.16 | 32.58 |
| 2.44 x 1.22 | 30.41 | 15.21 | 27.70 | 13.85 |
| 2.44 x 1.83 | 42.33 | 21.16 | 39.94 | 19.97 |
| 2.44 x 2.44 | 56.18 | 28.09 | 55.06 | 27.53 |
| 2.44 x 3.05 | 71.70 | 35.85 | 72.20 | 36.10 |
| 2.74 x 1.22 | 35.38 | 17.69 | 31.96 | 15.98 |
| 2.74 x 1.83 | 48.27 | 24.14 | 44.96 | 22.48 |
| 2.74 x 2.44 | 62.95 | 31.42 | 60.66 | 30.33 |
| 2.74 x 3.05 | 79.32 | 39.66 | 78.64 | 39.32 |
| 2.74 x 3.66 | 97.46 | 48.73 | 98.92 | 49.46 |
| 3.05 x 1.22 | 40.90 | 20.45 | 36.70 | 18.35 |
| 3.05 x 1.83 | 54.80 | 27.40 | 50.49 | 25.24 |
| 3.05 x 2.44 | 70.12 | 35.06 | 66.84 | 33.42 |
| 3.05 x 3.05 | 87.81 | 43.91 | 86.00 | 43.00 |
| 3.05 x 3.66 | 107.17 | 53.58 | 107.40 | 53.70 |
| 3.66 x 1.83 | 68.26 | 34.13 | 61.93 | 30.96 |
| 3.66 x 2.44 | 85.77 | 42.89 | 79.97 | 39.99 |
| 3.66 x 3.05 | 105.07 | 52.54 | 100.67 | 50.34 |
| 3.66 x 3.66 | 126.55 | 63.27 | 123.98 | 61.99 |

TABLE D-13M
STONE FOR EROSION CONTROL FOR BOX CULVERT
ST'D. BS00.6 THRU BS15.0 (45 DEGREE SKEW)

| CULVERT SIZE (Meters) SPAN X RISE | 1 ½ : 1 Slope | | 2:1 Slope | |
|---------------------------------------------|---------------|------------|------------|------------|
| | No Skew | 15 Skew | 30 Skew | 45 Skew |
| | Cu. Meters | Cu. Meters | Cu. Meters | Cu. Meters |
| 0.91 x 0.91 | 1.90 | 1.97 | 2.21 | 2.69 |
| 0.91 x 1.22 | 2.65 | 2.74 | 3.08 | 3.71 |
| 1.22 x 0.91 | 2.33 | 2.41 | 2.69 | 3.29 |
| 1.22 x 1.22 | 3.12 | 3.23 | 3.50 | 4.41 |
| 1.22 x 1.52 | 3.89 | 4.03 | 4.48 | 5.71 |
| 1.22 x 1.83 | 4.69 | 4.84 | 5.40 | 6.62 |
| 1.52 x 0.91 | 2.82 | 2.92 | 3.26 | 3.98 |
| 1.52 x 1.22 | 3.78 | 3.91 | 4.37 | 5.34 |
| 1.52 x 1.52 | 4.71 | 4.87 | 5.43 | 6.65 |
| 1.52 x 1.83 | 5.67 | 5.87 | 6.54 | 8.01 |
| 1.52 x 2.13 | 6.60 | 6.83 | 7.62 | 9.32 |
| 1.83 x 1.22 | 4.46 | 4.62 | 5.15 | 6.31 |
| 1.83 x 1.52 | 5.61 | 5.81 | 6.49 | 17.93 |
| 1.83 x 1.83 | 6.86 | 7.10 | 7.90 | 9.64 |
| 1.83 x 2.13 | 8.08 | 8.35 | 9.36 | 11.38 |
| 1.83 x 2.44 | 8.91 | 9.23 | 10.30 | 12.61 |
| 2.13 x 1.22 | 5.12 | 5.30 | 5.91 | 7.24 |
| 2.13 x 1.83 | 7.77 | 8.03 | 8.96 | 10.95 |
| 2.13 x 2.44 | 10.55 | 10.92 | 12.22 | 14.87 |
| 2.13 x 3.05 | 13.37 | 13.82 | 15.49 | 18.81 |
| 2.44 x 1.22 | 5.80 | 6.00 | 6.69 | 8.20 |
| 2.44 x 1.83 | 8.70 | 9.00 | 10.04 | 12.29 |
| 2.44 x 2.44 | 11.60 | 12.01 | 13.39 | 16.40 |
| 2.44 x 3.05 | 14.50 | 15.01 | 16.74 | 20.50 |
| 2.74 x 1.22 | 6.46 | 6.69 | 7.45 | 9.13 |
| 2.74 x 1.83 | 9.69 | 10.03 | 11.19 | 13.70 |
| 2.74 x 2.44 | 12.91 | 13.37 | 15.03 | 18.38 |
| 2.74 x 3.05 | 16.53 | 17.10 | 19.13 | 23.31 |
| 2.74 x 3.66 | 20.00 | 20.69 | 23.15 | 28.18 |
| 3.05 x 1.22 | 7.14 | 7.39 | 8.24 | 10.09 |
| 3.05 x 1.83 | 10.71 | 11.09 | 12.37 | 15.14 |
| 3.05 x 2.44 | 14.28 | 14.78 | 16.48 | 20.19 |
| 3.05 x 3.05 | 17.85 | 18.48 | 20.60 | 25.24 |
| 3.05 x 3.66 | 21.41 | 22.16 | 24.73 | 30.28 |
| 3.66 x 1.83 | 12.72 | 13.17 | 14.68 | 17.98 |
| 3.66 x 2.44 | 16.95 | 17.55 | 19.58 | 23.98 |
| 3.66 x 3.05 | 21.19 | 21.94 | 24.47 | 29.97 |
| 3.66 x 3.66 | 25.43 | 26.33 | 29.36 | 35.96 |

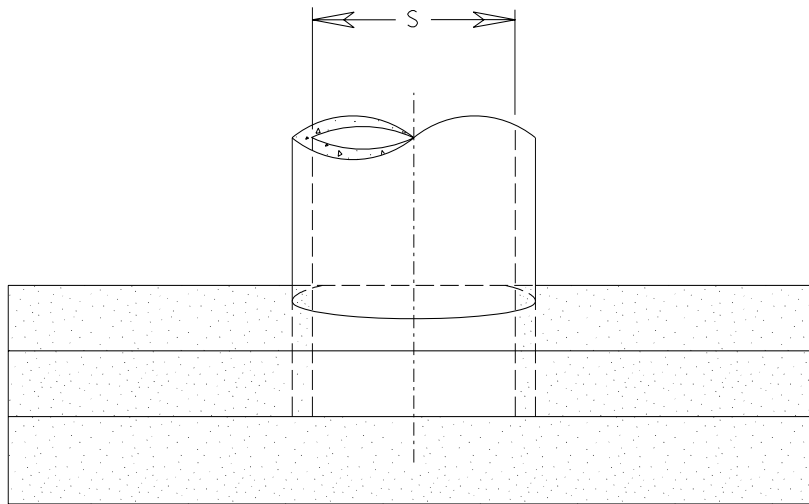
TABLE D-14M
STONE FOR EROSION CONTROL FOR MULTIPLE BOX CULVERTS
(INCREMENTS FOR EACH ADDITIONAL BARREL)



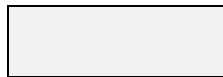
DISPLACEMENT QUANTITIES FOR PIPE OPENINGS
(To be used with standard JB-1 Junction Box)

| PIPE SIZE | PIPE CLASS | CONCRETE CU. METERS | | | | REINFORCING STEEL Kg |
|-----------|------------------|---------------------|------|------|------|----------------------|
| | | 0° | 15° | 30° | 45° | |
| 300 mm | III, IV, V C. M. | 0.03 | 0.03 | 0.03 | 0.04 | 8.0 |
| 375 mm | III, IV, V C. M. | 0.01 | 0.02 | 0.02 | 0.02 | 5.0 |
| 450 mm | III, IV, V C. M. | 0.04 | 0.04 | 0.04 | 0.05 | 11.3 |
| 600 mm | III, IV, V C. M. | 0.02 | 0.02 | 0.03 | 0.03 | 7.2 |
| 750 mm | III, IV, V C. M. | 0.05 | 0.06 | 0.06 | 0.08 | 15.1 |
| 900 mm | III, IV, V C. M. | 0.03 | 0.03 | 0.04 | 0.05 | 9.8 |
| 1050 mm | III, IV, V C. M. | 0.09 | 0.09 | 0.10 | 0.13 | 24.3 |
| 1200 mm | III, IV, V C. M. | 0.06 | 0.06 | 0.07 | 0.08 | 16.3 |
| 1350 mm | III, IV, V C. M. | 0.14 | 0.14 | 0.16 | 0.20 | 35.7 |
| 1500 mm | III, IV, V C. M. | 0.09 | 0.09 | 0.10 | 0.13 | 24.3 |
| 1650 mm | III, IV, V C. M. | 0.19 | 0.20 | 0.22 | 0.28 | 49.3 |
| 1800 mm | III, IV, V C. M. | 0.13 | 0.13 | 0.15 | 0.19 | 33.9 |
| | III, IV, V C. M. | 0.26 | 0.27 | 0.30 | 0.37 | 65.0 |
| | III, IV, V C. M. | 0.18 | 0.18 | 0.20 | 0.25 | 45.2 |
| | III, IV, V C. M. | 0.34 | 0.35 | 0.39 | 0.48 | 83.0 |
| | III, IV, V C. M. | 0.23 | 0.24 | 0.27 | 0.33 | 58.0 |
| | III & IV C. M. | 0.42 | 0.44 | 0.49 | 0.60 | 103.1 |
| | III & IV C. M. | 0.44 | 0.46 | 0.51 | 0.63 | 107.7 |
| | III & IV C. M. | 0.29 | 0.30 | 0.34 | 0.42 | 72.4 |
| | III & IV C. M. | 0.52 | 0.54 | 0.60 | 0.74 | 135.4 |
| | III & IV C. M. | 0.54 | 0.56 | 0.63 | 0.77 | 130.5 |
| | III & IV C. M. | 0.36 | 0.37 | 0.42 | 0.51 | 88.5 |
| | III & IV C. M. | 0.63 | 0.65 | 0.72 | 0.89 | 149.9 |
| | III & IV C. M. | 0.65 | 0.67 | 0.75 | 0.93 | 155.5 |
| | III & IV C. M. | 0.44 | 0.45 | 0.51 | 0.62 | 106.2 |
| | III & IV C. M. | 0.74 | 0.77 | 0.86 | 1.06 | 176.6 |
| | III & IV C. M. | 0.77 | 0.80 | 0.88 | 1.09 | 182.6 |
| | III & IV C. M. | 0.52 | 0.54 | 0.60 | 0.74 | 125.4 |

FIGURE D-1M
COMPUTATIONS FOR STANDARD JB-1 JUNCTION BOX
TABLE D-15M
ADJUSTMENT QUANTITIES FOR JUNCTION BOX



PLAN VIEW



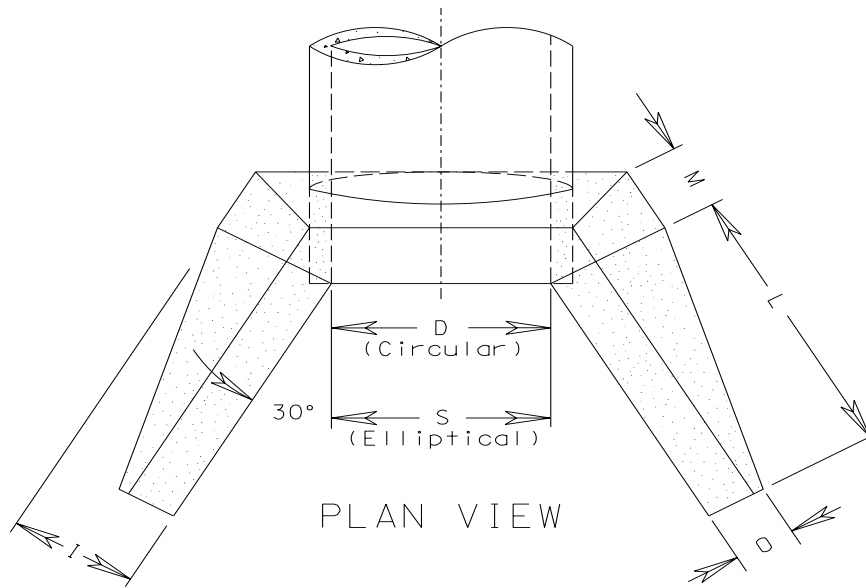
Area for computing ratio

| STANDARD | (S) Span of Culvert (mm) | Area (A) |
|----------|--------------------------------|--------------------------------|
| | | Conc or C. M. Square Meters |
| EW-1A | 1250 | 2.26 |
| | 1345 | 2.48 |

Area is given for one endwall.
Double area shown if two endwalls are used.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{S \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-16M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-1A



Area for computing ratio

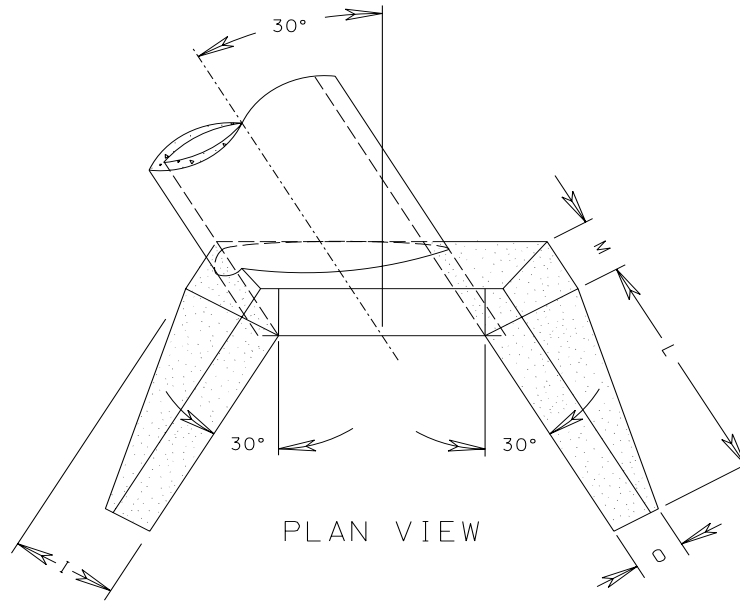
| (D) Diameter* of Culvert (mm) | Area (A) | |
|----------------------------------------|------------------|----------------|
| | 1 ½ : 1 Slope | 2 : 1 Slope |
| | Sq. Meters | Sq. Meters |
| 1200 | 2.48 | 3.12 |
| 1350 | 3.06 | 3.83 |
| 1500 | 3.65 | 4.56 |
| 1650 | 4.35 | 5.42 |
| 1800 | 5.09 | 6.35 |
| 1950 | 5.86 | 7.39 |
| 2100 | 6.65 | 8.42 |

| (S) Span* of Culvert (mm) | Area (A) | |
|------------------------------------|------------------|----------------|
| | 1 ½ : 1 Slope | 2 : 1 Slope |
| | Sq. Meters | Sq. Meters |
| 1535 | 2.15 | 2.64 |
| 1730 | 2.15 | 2.64 |
| 1920 | 2.48 | 3.12 |
| 2110 | 3.06 | 3.83 |
| 2305 | 3.65 | 4.56 |
| 2495 | 4.35 | 5.42 |
| 2690 | 5.09 | 6.35 |

Area is given for one endwall.
Double area shown if two endwalls are used.
*Nominal sizes are shown. See standard for
actual "D" and "S" dimensions .

| | |
|-----------------------|------------------------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ or } S \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|------------------------------------------------------------------------------|

TABLE D-17M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARDS EW-2, EW-2A



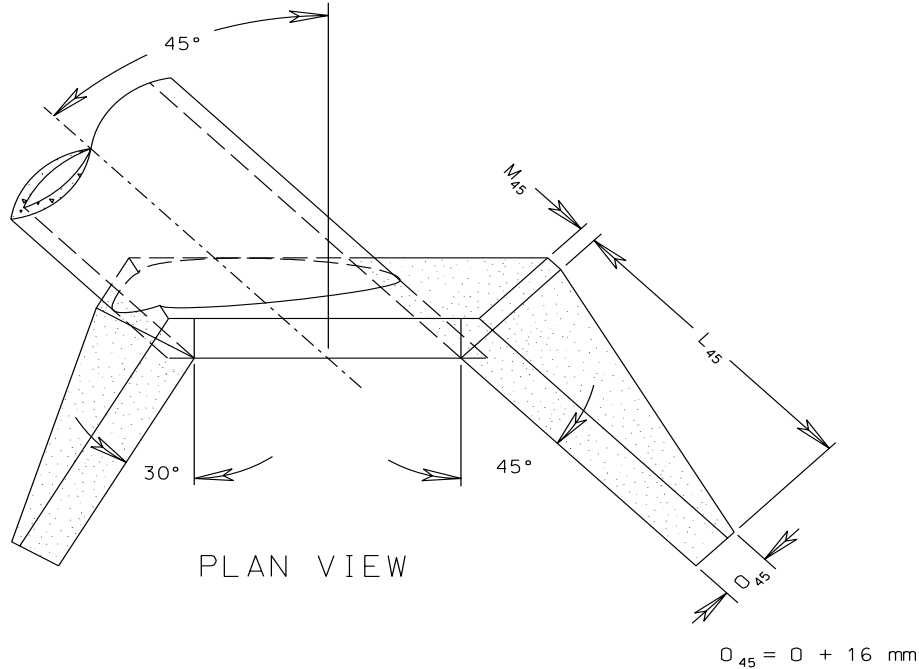
Area for computing ratio

| (D) Diameter * Of Culvert (mm) | Area (A) | |
|-----------------------------------------|------------------|----------------|
| | 1 ½ : 1 Slope | 2 : 1 Slope |
| | Sq. Meters | Sq.Meters |
| 1200 | 2.49 | 3.12 |
| 1350 | 3.06 | 3.83 |
| 1500 | 3.66 | 4.57 |
| 1650 | 4.35 | 5.43 |
| 1800 | 5.10 | 6.36 |
| 1950 | 5.86 | 7.39 |
| 2100 | 6.66 | 8.43 |

Area is given for one endwall.
Double area shown if two endwalls are used.
*Nominal sizes are shown See St'd. EW-2.
For actual "D" dimension .

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-18M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-2S (30 DEGREES)



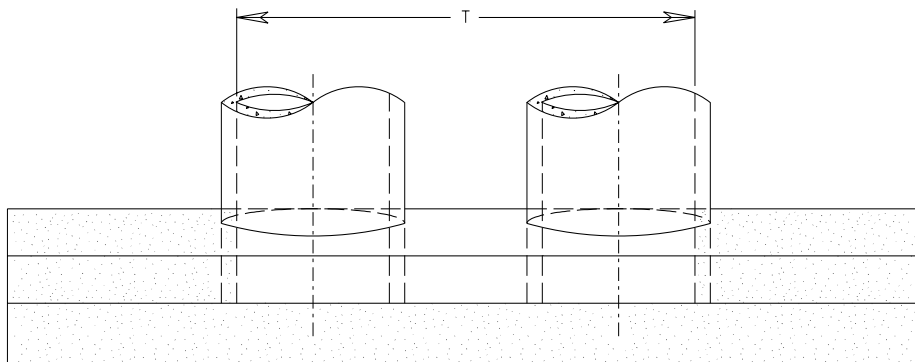
Area for computing ratio

| (D) Diameter * of Culvert (mm) | Area (A) | |
|-----------------------------------------|------------------|----------------|
| | 1 ½ : 1 Slope | 2 : 1 Slope |
| | Sq. Meters | Sq.Meters |
| 1200 | 2.96 | 3.71 |
| 1350 | 3.61 | 4.54 |
| 1500 | 4.31 | 5.46 |
| 1650 | 5.14 | 6.46 |
| 1800 | 5.97 | 7.54 |
| 1950 | 6.96 | 8.81 |
| 2100 | 7.88 | 10.00 |

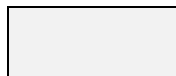
Area is given for one endwall.
Double area shown if two endwalls are used.
*Nominal sizes are shown See St'd. EW-2.
For actual "D" dimension .

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-19M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-2S (45 DEGREES)



PLAN VIEW



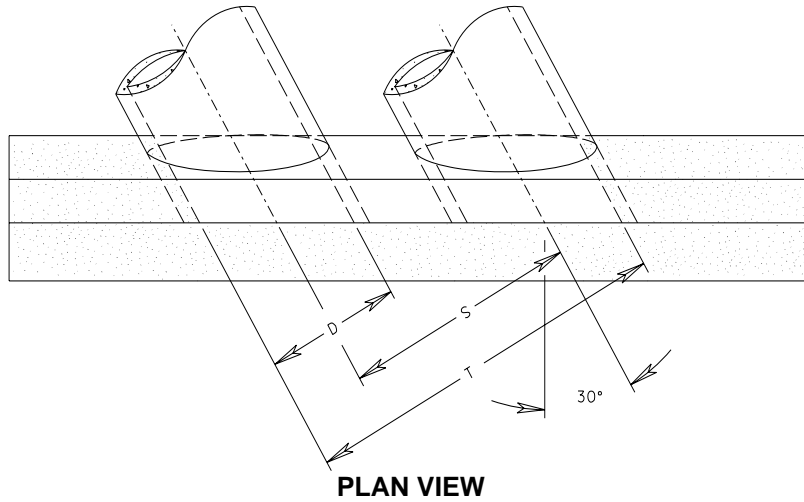
Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) | | | | | |
|---------------------------------------|-------------------|---------------|---------------|---------------|----------------|---------------|
| | Double Line | | Triple Line | | Quadruple Line | |
| | Conc. | C.M. | Conc. | C.M. | Conc. | C.M. |
| | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters |
| 375 | | | 0.81 | 0.78 | 0.91 | 0.87 |
| 450 | 0.92 | 0.90 | 1.04 | 1.01 | 1.16 | 1.11 |
| 600 | 1.56 | 1.54 | 1.79 | 1.74 | 2.01 | 1.93 |
| 750 | 2.22 | 2.18 | 2.52 | 2.45 | 2.82 | 2.71 |
| 900 | 2.82 | 2.78 | 3.16 | 3.08 | 3.51 | 3.39 |
| | Culvert Width (T) | | | | | |
| | Meters | Meters | Meters | Meters | Meters | Meters |
| 375 | | | 1.735 | 1.555 | 2.415 | 2.145 |
| 450 | 1.26 | 1.16 | 2.070 | 1.870 | 2.880 | 2.580 |
| 600 | 1.66 | 1.54 | 2.720 | 2.480 | 3.780 | 3.420 |
| 750 | 2.07 | 1.91 | 3.390 | 3.070 | 4.710 | 4.230 |
| 900 | 2.47 | 2.29 | 4.040 | 3.680 | 5.610 | 5.070 |

Area is given for one endwall.
Double area shown if two endwalls are used.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-20M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-6



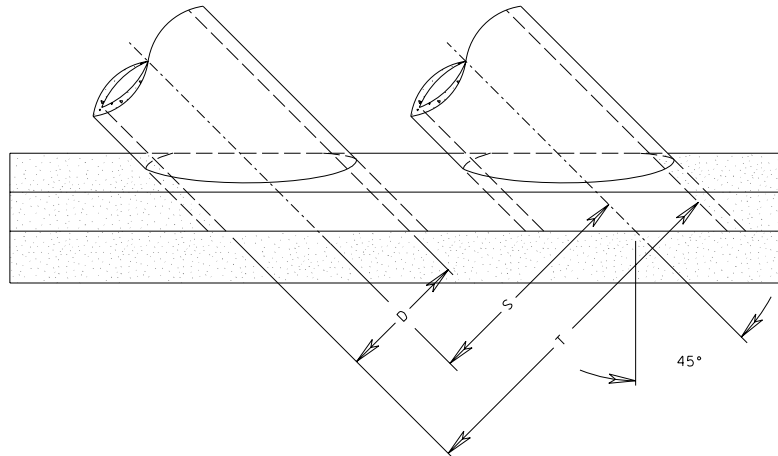
Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) | | | | | |
|---------------------------------------|-------------------|---------------|---------------|---------------|----------------|---------------|
| | Double Line | | Triple Line | | Quadruple Line | |
| | Conc. | C.M. | Conc. | C.M. | Conc. | C.M. |
| | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters |
| 375 | | | 0.82 | 0.79 | 0.94 | 0.89 |
| 450 | 0.91 | 0.89 | 1.05 | 1.01 | 1.19 | 1.14 |
| 600 | 1.56 | 1.53 | 1.81 | 1.75 | 2.07 | 1.98 |
| 750 | 2.20 | 2.16 | 2.55 | 2.47 | 2.90 | 2.78 |
| 900 | 2.79 | 2.74 | 3.19 | 3.09 | 3.59 | 3.45 |
| | Culvert Width (T) | | | | | |
| | Meters | Meters | Meters | Meters | Meters | Meters |
| 375 | | | 1.735 | 1.555 | 2.415 | 2.145 |
| 450 | 1.26 | 1.16 | 2.07 | 1.870 | 2.880 | 2.580 |
| 600 | 1.66 | 1.54 | 2.72 | 2.480 | 3.780 | 3.420 |
| 750 | 2.07 | 1.91 | 3.39 | 3.070 | 4.710 | 4.230 |
| 900 | 2.47 | 2.29 | 4.04 | 3.680 | 5.610 | 5.070 |

Area is given for one endwall.
Double area shown if two endwalls are used.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-21M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-6 (30 DEGREE)



PLAN VIEW



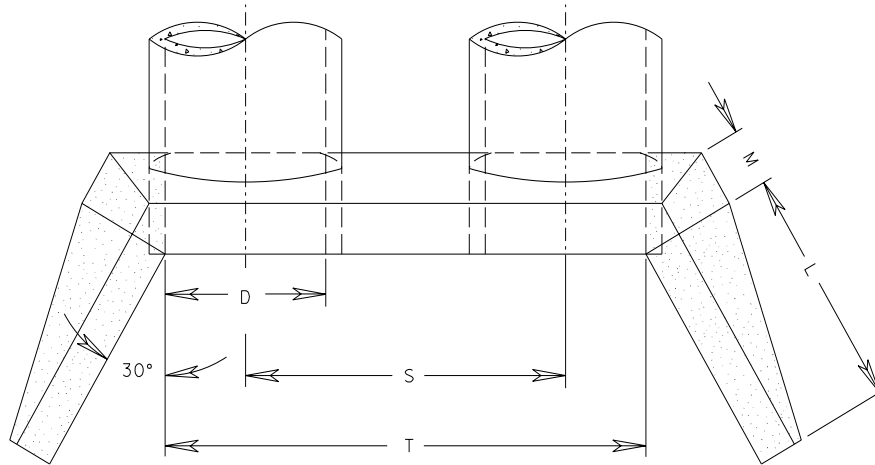
Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) | | | | | |
|---------------------------------------|-------------------|---------------|---------------|---------------|----------------|---------------|
| | Double Line | | Triple Line | | Quadruple Line | |
| | Conc. | C.M. | Conc. | C.M. | Conc. | C.M. |
| | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters | Sq. Meters |
| 375 | | | 0.84 | 0.81 | 0.98 | 0.93 |
| 450 | 0.89 | 0.87 | 1.07 | 1.02 | 1.98 | 1.18 |
| 600 | 1.54 | 1.51 | 1.86 | 1.79 | 2.17 | 2.07 |
| 750 | 2.18 | 2.13 | 2.60 | 2.50 | 3.03 | 2.88 |
| 900 | 2.73 | 2.68 | 3.22 | 3.11 | 3.71 | 3.54 |
| | Culvert Width (T) | | | | | |
| | Meters | Meters | Meters | Meters | Meters | Meters |
| 375 | | | 1.735 | 1.555 | 2.415 | 2.145 |
| 450 | 1.26 | 1.16 | 2.07 | 1.87 | 2.88 | 2.58 |
| 600 | 1.66 | 1.54 | 2.72 | 2.48 | 3.78 | 3.420 |
| 750 | 2.07 | 1.91 | 3.39 | 3.07 | 4.71 | 4.230 |
| 900 | 2.47 | 2.29 | 4.04 | 3.68 | 5.61 | 5.070 |

Area is given for one endwall.
Double area shown if two endwalls are used.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-22M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-6S (45 DEGREE)



PLAN VIEW



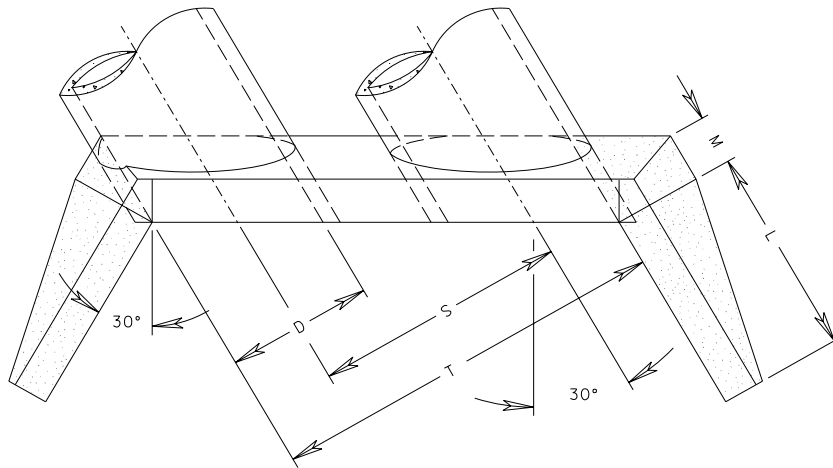
Area for computing ratio

| (D) Diameter* of Culvert (mm) | Area (A) | | Culvert width (T) | | | | | |
|----------------------------------------|-----------------------------------|---------------------------------|-------------------|----------------|-----------------|----------------|-----------------|----------------|
| | 1 ½ : 1 Slope Sq. Meters | 2 : 1 Slope Sq. Meters | Double Line | | Triple Line | | Quadruple Line | |
| | | | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters |
| 1050 | 2.14 | 2.64 | 2.890 | 2.68 | 4.710 | 4.290 | 6.530 | 5.90 |
| 1200 | 2.48 | 3.12 | 3.300 | 3.06 | 5.380 | 4.900 | 7.460 | 6.74 |
| 1350 | 3.06 | 3.83 | 3.700 | 3.44 | 6.030 | 5.510 | 8.360 | 7.58 |
| 1500 | 3.65 | 4.56 | 4.110 | 3.82 | 6.700 | 6.110 | 9.290 | 8.40 |
| 1650 | 4.35 | 5.42 | 4.520 | 4.20 | 7.360 | 6.720 | 10.200 | 9.24 |
| 1800 | 5.09 | 6.35 | 4.920 | 4.58 | 8.010 | 7.330 | 11.100 | 10.08 |
| 1950 | 5.86 | 7.39 | 5.330 | 4.96 | 8.680 | 7.940 | 12.030 | 10.92 |
| 2100 | 6.64 | 8.42 | 5.740 | 5.34 | 9.340 | 8.550 | 12.940 | 11.76 |

Area is given for one endwall.
 Double area shown if two endwalls are used.
 *Nominal sizes are shown See St'd. EW-2.
 For actual "D" dimension .

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-23M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-7S



PLAN VIEW



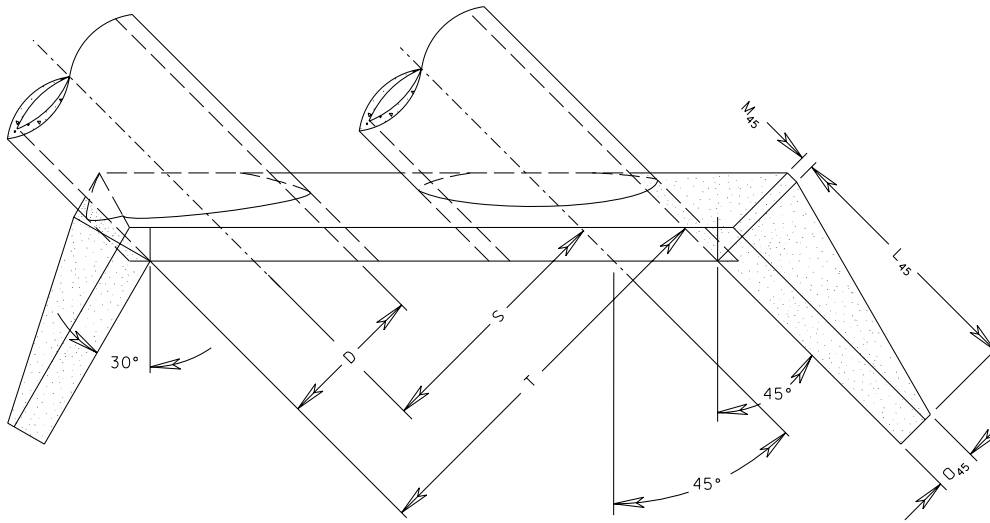
Area for computing ratio

| (D) Diameter* of Culvert (mm) | Area (A) | | Culvert width (T) | | | | | |
|----------------------------------------|-----------------------------------|---------------------------------|-------------------|----------------|-----------------|----------------|-----------------|----------------|
| | 1 ½ : 1 Slope Sq. Meters | 2 : 1 Slope Sq. Meters | Double Line | | Triple Line | | Quadruple Line | |
| | | | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters |
| 1050 | 2.14 | 2.64 | 2.89 | 2.68 | 4.71 | 4.29 | 6.53 | 5.90 |
| 1200 | 2.48 | 3.12 | 3.30 | 3.06 | 5.38 | 4.90 | 7.46 | 6.74 |
| 1350 | 3.06 | 3.83 | 3.70 | 3.44 | 6.03 | 5.15 | 8.36 | 7.58 |
| 1500 | 3.65 | 4.56 | 4.11 | 3.82 | 6.70 | 6.11 | 9.29 | 8.40 |
| 1650 | 4.35 | 5.42 | 4.52 | 4.20 | 7.36 | 6.72 | 10.20 | 9.24 |
| 1800 | 5.09 | 6.35 | 4.92 | 4.58 | 8.01 | 7.33 | 11.10 | 10.08 |
| 1950 | 5.86 | 7.39 | 5.33 | 4.96 | 8.68 | 7.94 | 12.03 | 10.92 |
| 2100 | 6.65 | 8.42 | 5.74 | 5.34 | 9.34 | 8.55 | 12.94 | 11.76 |

Area is given for one endwall.
 Double area shown if two endwalls are used.
 *Nominal sizes are shown See St'd. EW-2.
 For actual "D" dimension .

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-24M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-7S (30 DEGREE)



$O_{45} = O + 16 \text{ mm}$

PLAN VIEW



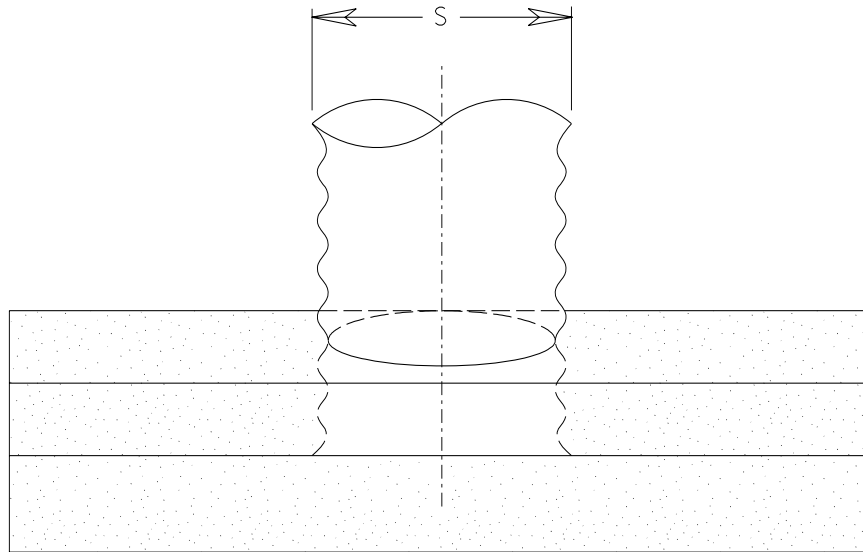
Area for computing ratio

| (D) Diameter* of Culvert (mm) | Area (A) | | Culvert width (T) | | | | | |
|----------------------------------------|-------------------------------------|---------------------------------|-------------------|----------------|-----------------|----------------|-----------------|----------------|
| | 1 1/2 : 1 Slope Sq. Meters | 2 : 1 Slope Sq. Meters | Double Line | | Triple Line | | Quadruple Line | |
| | | | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters | Conc. Meters | C.M. Meters |
| 1050 | 2.51 | 3.11 | 2.89 | 2.68 | 4.71 | 4.29 | 6.53 | 5.90 |
| 1200 | 2.96 | 3.71 | 3.30 | 3.06 | 5.38 | 4.90 | 7.46 | 6.74 |
| 1350 | 3.61 | 4.54 | 3.70 | 3.44 | 6.03 | 5.15 | 8.36 | 7.58 |
| 1500 | 4.31 | 5.46 | 4.11 | 3.82 | 6.70 | 6.11 | 9.29 | 8.40 |
| 1650 | 5.14 | 6.46 | 4.52 | 4.20 | 7.36 | 6.72 | 10.20 | 9.24 |
| 1800 | 5.97 | 7.54 | 4.92 | 4.58 | 8.01 | 7.33 | 11.10 | 10.08 |
| 1950 | 6.96 | 8.81 | 5.33 | 4.96 | 8.68 | 7.94 | 12.03 | 10.92 |
| 2100 | 7.88 | 10.00 | 5.74 | 5.34 | 9.34 | 8.55 | 12.94 | 11.76 |

Area is given for one endwall.
 Double area shown if two endwalls are used.
 *Nominal sizes are shown See St'd. EW-2.
 For actual "D" dimension .

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-25M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-7S (45 DEGREE)



PLAN VIEW



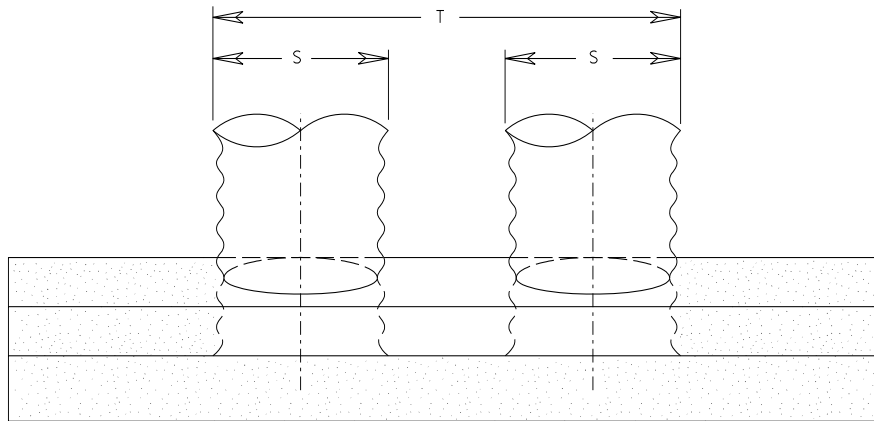
Area for computing ratio

| (S) Span of Culvert (mm) | Area (A) |
|--------------------------------|------------|
| | Sq. Meters |
| 1225 | 2.11 |
| *1150 | 2.15 |
| 1425 | 2.63 |
| *1325 | 2.69 |

Area is given for one endwall.
Double area shown if two endwalls are used
* 75 mm x 25 mm corrugation dimension.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{S \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-26M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-9



PLAN VIEW



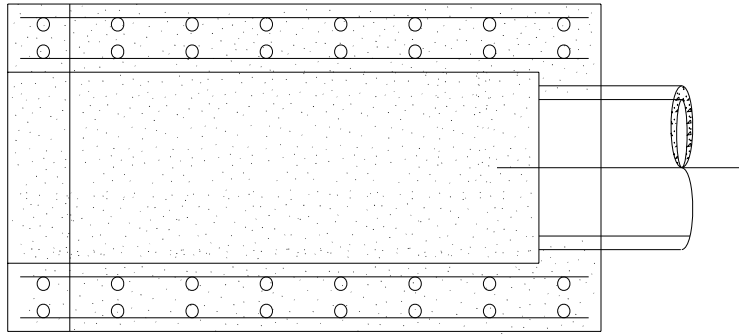
Area for computing ratio

| (S) Span of Culvert (mm) | Area (A) | | | Culvert Width (T) | | |
|-----------------------------------|----------------|----------------|-------------------|-------------------|----------------|-------------------|
| | Double Line | Triple Line | Quadruple Line | Double Line | Triple Line | Quadruple Line |
| | Sq. Meters | Sq. Meters | Sq. Meters | Meters | Meters | Meters |
| 525 | 0.58 | 0.68 | 0.79 | 1.385 | 2.245 | 3.105 |
| 600 | 0.83 | 0.96 | 1.09 | 1.540 | 2.480 | 3.420 |
| 700 | 1.01 | 1.17 | 1.33 | 1.740 | 2.780 | 3.820 |
| 875 | 1.57 | 1.82 | 2.08 | 2.095 | 3.315 | 4.535 |
| 1050 | 2.17 | 2.51 | 2.84 | 2.520 | 3.990 | 5.460 |
| *1000 | 2.19 | 2.53 | 2.87 | 2.470 | 3.940 | 5.410 |
| 1225 | 2.51 | 2.90 | 3.29 | 2.925 | 4.625 | 6.325 |
| *1150 | 2.55 | 2.94 | 3.33 | 2.850 | 4.550 | 6.250 |
| 1425 | 3.05 | 3.49 | 3.92 | 3.405 | 5.385 | 7.365 |
| *1325 | 3.11 | 3.55 | 3.98 | 3.305 | 5.285 | 7.265 |

Area is given for one endwall.
Double area shown if two endwalls are used
* 75 mm x 25 mm corrugation dimension.

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{T \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-27M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-10



PLAN VIEW

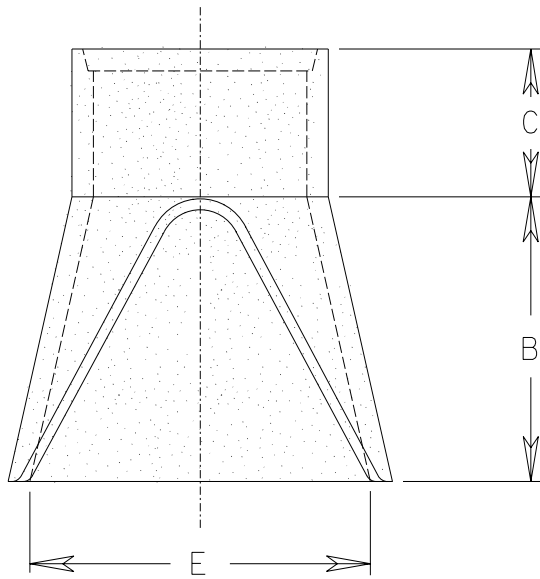


Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) | | |
|---------------------------------------|--------------|--------------|--------------|
| | 3:1 Slope | 4:1 Slope | 6:1 Slope |
| | Sq. Meters | Sq. Meters | Sq. Meters |
| 1220 | 10.50 | 13.77 | 20.31 |
| 1370 | 13.25 | 17.40 | 25.70 |
| 1520 | 14.40 | 18.30 | 28.05 |

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-28M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD EW-11



PLAN VIEW



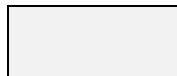
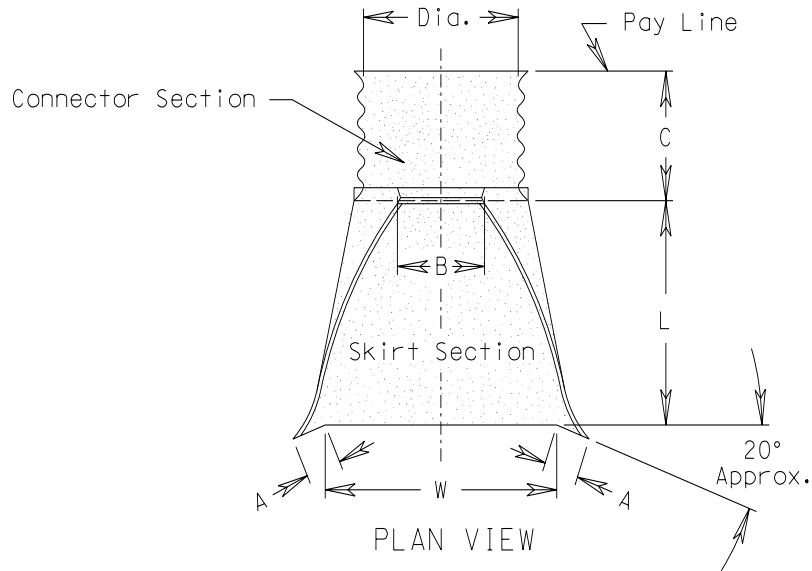
Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) |
|---------------------------------------|------------|
| | Sq. Meters |
| 1200 | 4.44 |
| 1350 | 4.81 |
| 1500 | 5.22 |

Area is given for one end section.
Double area shown if two end sections are used

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-29M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD ES-1



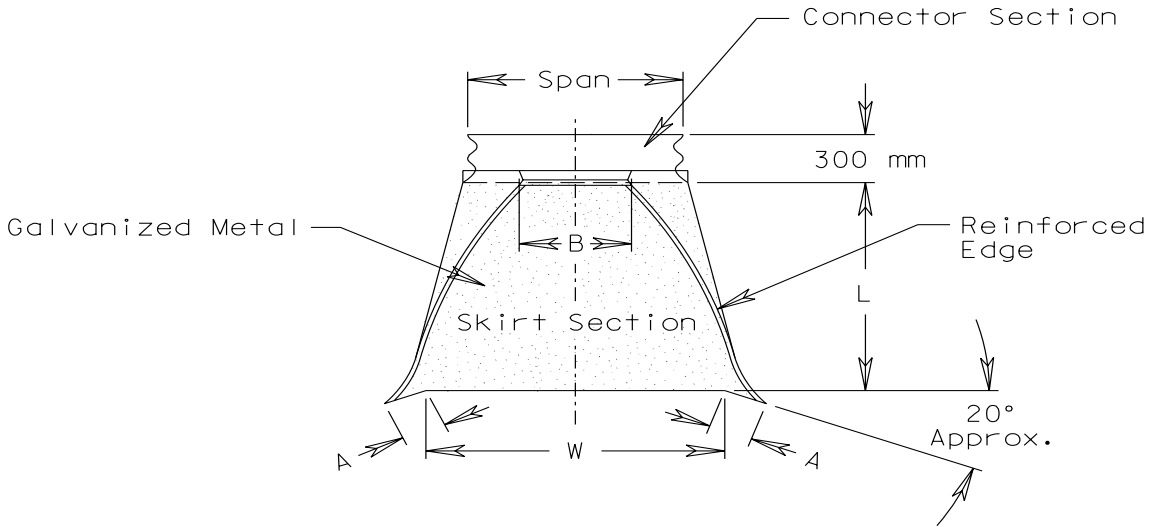
Area for computing ratio

| (D) Diameter of Culvert (mm) | Area (A) |
|---------------------------------------|------------|
| | Sq. Meters |
| 1200 | 4.90 |
| 1350 | 5.91 |
| 1500 | 6.56 |

Area is given for one end section .
Double area shown if two end sections are used

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{D \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-30M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD ES-2



PLAN VIEW



Area for computing ratio

| (S) Span of Culvert (mm) | Area (A) |
|-----------------------------------|------------|
| | Sq. Meters |
| 1150 | 2.56 |
| 1325 | 3.44 |
| 1500 | 4.39 |
| 1650 | 5.44 |

| (S) Span of Culvert (mm) | Area (A) |
|-----------------------------------|------------|
| | Sq. Meters |
| 1150 | 3.29 |
| 1390 | 4.29 |
| 1650 | 5.42 |

Area is given for one end section.
Double area shown if two end sections are used

| | |
|-----------------------|----------------------------------------------------------------|
| TO DETERMINE RATIO | $\frac{A}{S \text{ (meters)} \times \text{Length of Culvert}}$ |
|-----------------------|----------------------------------------------------------------|

TABLE D-31M
COMPUTATION OF RATIOS FOR MINOR STRUCTURE EXCAVATION
STANDARD ES-3

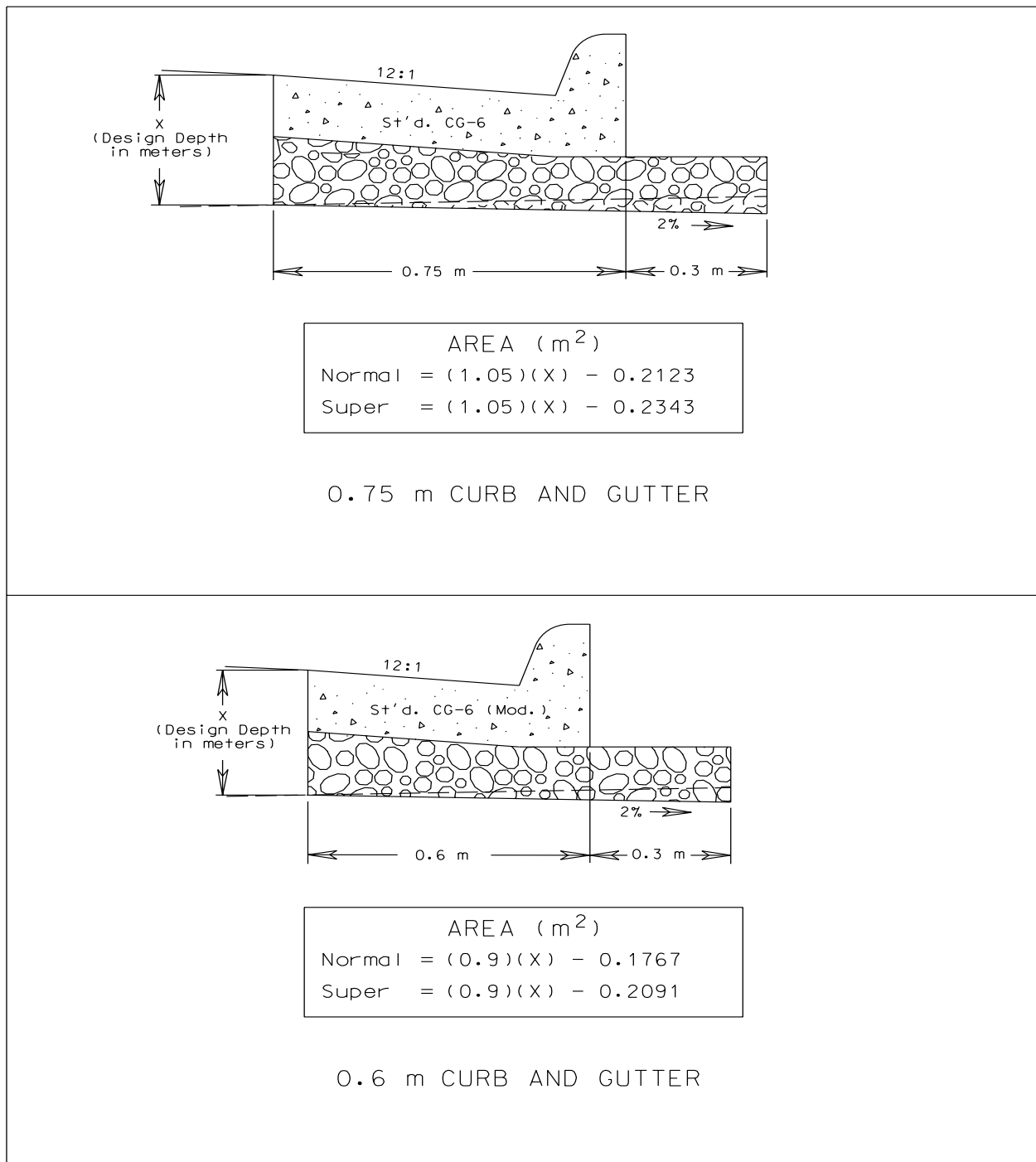
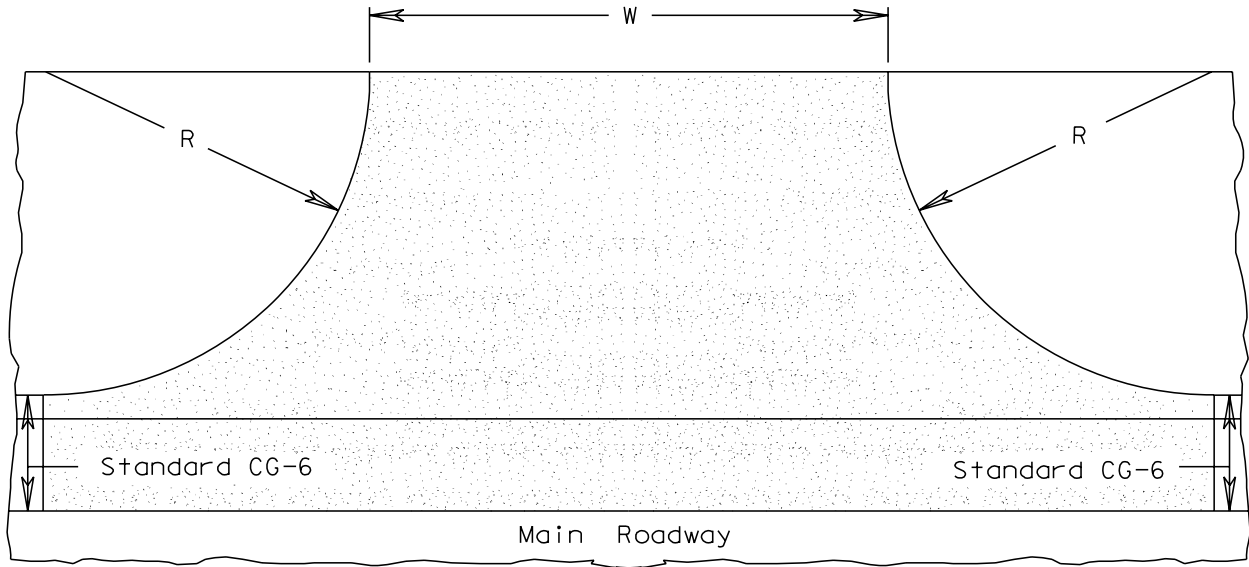


FIGURE D-2M
SUBBASE END AREAS AT CURB AND GUTTER LOCATION



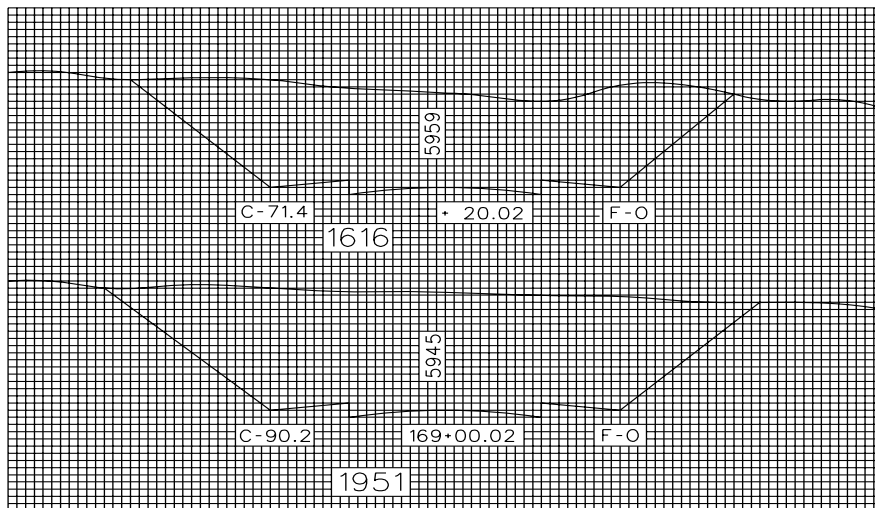
W= Width of Entrance



Area for computing ratio

| Width Of Entrance (Meters) | No Accessible Route (R = 1.35 m) | Accessible Route (R = 2.25m) |
|----------------------------|----------------------------------|------------------------------|
| | Sq. Meters. | Sq. Meters. |
| 4 | 11.21 | 17.55 |
| 5 | 13.31 | 20.55 |
| 6 | 15.41 | 23.55 |
| 7 | 17.51 | 26.55 |
| 8 | 19.61 | 29.55 |
| 9 | 21.71 | 32.55 |
| 10 | 23.81 | 35.55 |
| 11 | 25.91 | 38.55 |
| 12 | 28.01 | 41.55 |
| 13 | 30.11 | 44.55 |
| 14 | 32.21 | 47.55 |
| 15 | 34.31 | 50.55 |
| Each Additional 0.1 m | 0.21 | 0.30 |

TABLE D-32M
AREAS FOR ENTRANCE GUTTER
STANDARD CG-9D



The cut area of station 163+00.02 is 90.2 square meters, and the area of station 169+20.02 is 71.4 square meters. To find the average area of the two, we would add the two and divide by two.

$$\text{Thus, } \frac{90.2 + 71.4}{2} = \frac{161.6}{2} = 80.8 \text{ Square Meters (average)}$$

Now we must find the volume of the area between the two stations. The cross section has an average of 80.8 square meters and there is 20 meters between stations. Therefore, 80.8 multiplied by 20 equals 1616 cubic meters to be removed from between these stations.

Therefore, the volume in m^3 between two stations 20 m apart equals 10 (ten) times the sum (in m^2) of the end areas.

The formula used to determine the volume of earthwork is called the AVERAGE END AREA METHOD and is noted below. Examine it closely.

$$\text{Volume} = \frac{L (A' + A'')}{2}$$

L = distance between stations (m)
 A' = area of one station (m^2)
 A'' = area of second station (m^2)
 2 gets the average of A' & A''

EXAMPLE

$$\text{Volume (in } m^3) = \frac{20 (90.2 + 71.4)}{2} = 1616$$

FIGURE D-4M
EARTHWORK QUANTITY COMPUTATIONS