



## TABLES AND DIAGRAMS

## Estimates for Sewerage Work

By S. M. SWAAB, C.E.

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## TABLES AND DIAGRAMS

for facilitating the making of

## Estimates for Sewerage Work

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GENERAL

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# TABLES AND DIAGRAMS FOR FACILITATING THE COMPUTATION OF ESTIMATES FOR SEWERAGE WORK. 

By S. M. SWAAB, Civil Engineer, Philadelphia, Pa.

The object of the accompanying tables and diagrams, as the title suggests, is to facilitate the computation of estimates for sewerage work. The figures represent in the case of masonry the gross amount of brick and mortar and stone and mortar which comprise the brick masonry and stone masonry indicated by the tables.

The quantity of mortar in brick masonry amounts to about 25 to $30 \%$ of the total bulk, and the quantity of mortar in stone masonry amounts to about 32 to $35 \%$. Flve hundred bricks, more or less, of standard size are required to lay a cubic yard of brick masonry where the joints are from $1 / 4$ to $3 / 8-i n$. thick. About $2 \%$ should be allowed for breakage and cutting.

The quantities of excavation indicated by the diagrams are the minimum quantities which will allow the trench to be as wide from top to bottom as the greatest external width of the "cradle." The quantities of excavation for sewers not in "masonry cradle" refer to a trench equal in width at the top to the greatest external width of the sewer, and at the bottom to conform to the shape of the section.

Allowance has been made in all the diagrams so that the quantities indicated thereon represent the total amount of excavation to the "outside bottom" of the sewer; but as the figures representing the depth of the sewer below grade are invariably given on the "inside bottom" of the
sewer, the depth, in these diagrams, for convenience, is also given to the "inside bottom."

## Method of Using the Diagrams.

The internal dimensions in feet and inches of the egg shape and circular sewers will be found on the left of the diagrams in every case. Run over this line foward the right until the curve is found representing the depth to the inside bottom of the sewer below the surface; then follow down the vertical line which intersects the curve at this point to the bottom of the diagram, on which may be read off at once the quantity of excavation.

All the quantities given in the tabies and diagrams are in cubic yards and decimais of a cubic yard per linear foot of sewer. The quantities given in the tables have merely to be multiplied by the length of the sewer to find the
total amount of brick or stone masonry, excavation, etc., in any given piece of work.
The following examples will iilustrate the method of using the tables and diagrams:
Example 1.-Given a 3 -ft. diameter circular sewer in "fuil cradle,' $1,000 \mathrm{ft}$. long, 12 ft . deep to inside bottom: From Plate I.:

Quantity of brickwork $=-0.292_{1,000}$ cu.yds. per lin.ft.
Total " " 292 cu . yds. per $1,000 \mathrm{ft}$.

From Piate I.:
Quantity of masonry $=-0.481_{1,000}^{\text {cu.yds. per lin.ft. }}$
Total "،

From Plate VII.:
Quantity of excavation $=-3.54 \quad$ cu.yds. per lin.ft. 1,000
Total " "، $3,540 \mathrm{cu}$. yds. per $1,000 \mathrm{ft}$.
Example 2.-Given an 8 - ft . diameter circular sewer in "partial cradie" $1,000 \mathrm{ft}$. long, 18 ft . deep to inside bottom:

```
From Plate II.:
    Quantity of brickwork \(=-1.14\) cu.yds. per lin.ft.
                        1,000
    Total " " 1,140 cu. yds. per \(1,000 \mathrm{ft}\).
```

From Plate II.:
Quantity of masonry $=-1.414{ }_{1,000}$ cu.yds. per lin.ft.

Total " " $1,414 \mathrm{cu} . \mathrm{yds}$. per $1,000 \mathrm{ft}$.
From Plate XII.:
Quantity of excavation $=-9.4 \quad$ cu.yds. per lin.ft. 1,000
Total " " 9,400 cu. yds. per $1,000 \mathrm{ft}$.
Example 3.-Given a 2 -ft. 2 -in. x 3 -ft. 3 -in. egg-shape sewer in "full cradle," $1,000 \mathrm{ft}$. long, 10 ft . deep to inside bottom:
From Plate IV.:
Quantity of brickwork $=-0.25$ 1,000 cu.yds. per lin.ft. Total " ". $250 \quad$ cu. yds. per $1,000 \mathrm{ft}$.

From Plate IV.:
Quantity of masonry $=-0.50{ }_{1,000}$ cu.yds. per lin.ft. 1,000

Total " " $500 \mathrm{cu} . \mathrm{yds}$ per 1,000 ft.

## From Plate XVI.:

| Quantity of excavation $=$ | -2.58 1,000 | cu.yds. per lin.ft. |
| :--- | :--- | :--- |
| Total " | " | $2,580 \mathrm{cu}$. yds. per $1,000 \mathrm{ft}$. |

Example 4.-Given a 4 -ft. 6 -in. diameter circular sewer, $9-\mathrm{in}$. brickwork (double ring of brick all around), 1,000 ft. long, 9 ft .6 ins . deep to inside bottom.

## From Plate I.:

Quantity of brickwork $=-0.458$ cu.yds. per lin.ft. Total "
"
$458 \mathrm{cu} . \mathrm{yds}$. per $1,000 \mathrm{ft}$.
From Plate VI.:
Quantity of excavation $=-2.15_{1,000}$ cu.yds. per lin.ft.
Total " " 2,150 cu. yds. per 1,000 ft.

For quantity of excavation in rock, where the arch, haunch and counterarch are used without masonry cradle, read the quantity of excavation for the given size and depth from the diagram showing the quantity of excavation for circular sewer in partial cradle in cubic yards; next find the quantity of masonry required for the sewer in partial cradle in cubic yards; subtract the latter from the former, and the result is the total amount of rock excavation.

Example 5.-Given a $10-\mathrm{ft}$. diameter sewer in "rock excavation'’ 17 ft . to inside bottom.

From Plate XIII. ........... 10.7 cu. yds. excav. per lin. ft. From Plate II............... 1.9 " " masonry.
8.8 " " rock excavation.

An infinite number of combinations of the various tables and diagrams will suggest themselves as occasion demands. The tables and diagrams are applicable to all combinations where the general "dimensions and design" of the sewer sections compare favorably with the dimensions of the sections on which these tables were based, as shown by the headings of the different tables.

| Circular Sewers |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Size |  |  |  | BrichMasonry |  |
|  |  |  |  | 4sime Brian |  |
| Ft. In. | Quar | tryincu | yards | pr. linear | foot |
| 20 | 0. 227 | 0.3 |  | 0.103 | 0.24 |
| 3 | . 235 | . 33 |  | . $1 / 14$ | 261 |
| 6 | . 244 | 35 |  | . 125 | . 284 |
| 9 | . 270 | 43 |  | . 136 | 3 |
| 3.0 | . 292 | 48 |  | 147 | . 327 |
| 3 | . 320 | 54 |  | . 158 | . 35 |
| 6 | . 348 | . 59 |  | . 169 | . 37 |
| 9 | . 360 | . 65 |  | 18 | . 39 |
| 4.0 | 38 | . 7 |  | 19 | (4) |
| 3 | 40 | 74 |  | . 20 | .486 |
| 6 | 42 | 78 |  | . 21 | 458 |
|  | 45 | 85 |  | . 223 | . 40 |
| 5.0 | 49 | 90 | 0.74 | 0. 234 | 0.50 |
|  | . 54 | 0.96 | 0.80 |  |  |
| 6 | . 57 | 1.03 | 0.87 |  |  |
| 9 | 0.60 | 1.07 | 0.93 |  |  |



|  |  |  | $0$ | $\begin{aligned} & 0 \\ & 0 \\ & 9 \end{aligned}$ | $\pm$ | $\frac{0}{2}$ | $\stackrel{\sim}{\sim}$ | $\stackrel{a}{v}$ | $\sqrt[3]{2}$ | $\begin{aligned} & 6 \\ & \sqrt[3]{2} \end{aligned}$ | $\stackrel{y}{k}$ | $\stackrel{N}{v}$ | $\begin{aligned} & y \\ & y \end{aligned}$ | $\begin{aligned} & 0 \\ & 5 \\ & 9 \end{aligned}$ | $\left\lvert\, \begin{aligned} & 3 \\ & 0 \\ & 8 \end{aligned}\right.$ | $\stackrel{N}{N}$ | $N$ | $\stackrel{*}{\infty}$ | $\begin{aligned} & 0 \\ & 9 \end{aligned}$ | へ | ง | $\left\|\begin{array}{l} 0 \\ \tilde{\sim} \\ \underset{\sim}{2} \end{array}\right\|$ | $\begin{aligned} & 3 \\ & m \\ & \mathrm{u} \end{aligned}$ | $\begin{aligned} & 8 \\ & 2 \\ & 2 \end{aligned}$ | $\begin{aligned} & 0 \\ & b \\ & \text { in } \end{aligned}$ | 0 0 $\sim$ | 0 0 0 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & y \\ & 0 \\ & 3 \\ & 0 \end{aligned}$ |  | $\begin{gathered} 1 \\ 2 \\ 5 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{gathered}$ | $\begin{aligned} & m \\ & m \\ & n^{2} \end{aligned}$ | $\begin{aligned} & 0 \\ & 8 \\ & \hline \end{aligned}$ | $\begin{aligned} & 8 \\ & 8 \\ & \hline \end{aligned}$ | $\stackrel{y}{5}$ | $\begin{aligned} & \hat{y} \\ & \cline { 1 - 1 } \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & \infty \\ & 8 \\ & 8 \end{aligned}$ | $\stackrel{\infty}{8}$ | ${ }_{2}^{x}$ | $\left.\begin{gathered} 2 \\ 2 \\ \end{gathered} \right\rvert\,$ | $\begin{gathered} 0 \\ n_{2} \end{gathered}$ | $\grave{~ ২}$ | $\left\lvert\, \begin{aligned} & v \\ & \sim \end{aligned}\right.$ | $\begin{gathered} \hat{M} \\ \underset{\sim}{u} \end{gathered}$ | $\left\|\begin{array}{l} w \\ m \\ \dot{q} \end{array}\right\|$ | $\begin{aligned} & n \\ & \text { y } \\ & \text { in } \end{aligned}$ | $\begin{aligned} & \dot{y} \\ & \dot{v} \end{aligned}$ | $\left.\begin{aligned} & n \\ & 0 \\ & \end{aligned} \right\rvert\,$ | $\stackrel{\mathrm{N}}{\underset{\sim}{\mathrm{~N}}}$ | $\begin{aligned} & 0 \\ & \infty \\ & \mathrm{n}^{2} \end{aligned}$ | $\left\|\begin{array}{l} 0 \\ \dot{n} \end{array}\right\|$ | ¢ | N | 5 5 5 | 年 |
|  |  |  | $\begin{aligned} & 6 \\ & \infty \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & a \\ & 0 \end{aligned}$ | $\begin{aligned} & \hat{1} \\ & \hat{a}_{2} \\ & 0 \end{aligned}$ | $\begin{gathered} 2 \\ 2 \\ 0 \\ 0 \end{gathered}$ | $0$ | $\begin{aligned} & y \\ & 0 \\ & 0 \end{aligned}$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | $>$ | $5$ | $\stackrel{k}{2}$ | پે | $\begin{aligned} & y \\ & v \\ & v \end{aligned}$ | $\left\|\begin{array}{l} \infty \\ n \\ 2 \\ 1 \end{array}\right\|$ | $\begin{gathered} v \\ v \\ v \end{gathered}$ | $\left\|\begin{array}{l} 9 \\ 7 \\ \hline \end{array}\right\|$ | $\begin{aligned} & a \\ & 2 \\ & - \end{aligned}$ | $\stackrel{m}{2}$ | $5$ | $\begin{aligned} & 0 \\ & 5 \\ & \hline \end{aligned}$ | $\stackrel{3}{5}$ | $\left\lvert\, \begin{aligned} & \hat{y} \\ & 2 \end{aligned}\right.$ | $\begin{aligned} & 0 \\ & 0 \\ & 0 \end{aligned}$ | n | 6 | $\stackrel{0}{2}$ |
| 1 | $\begin{aligned} & 0 \\ & N \\ & v \end{aligned}$ | ミ | O | 3 | $\checkmark$ | $9$ | $\begin{aligned} & \mathrm{O} \\ & \mathrm{~N} \\ & \mathrm{~N} \end{aligned}$ | $9$ | $\bigcirc$ | $a$ | $\begin{gathered} 0 \\ \infty \\ 0 \end{gathered}$ | $3$ | $\omega$ | $a$ |  | $\cdots$ | $\checkmark$ | $a$ | $\left.\begin{gathered} 0 \\ \vdots \\ 0 \\ 0 \end{gathered} \right\rvert\,$ | $\cdots$ | $\omega$ | $a$ | $\left\|\begin{array}{c} 0 \\ i \\ \\ i \end{array}\right\|$ | 3 | $\checkmark$ | 9 | \％ |


|  | Circular Sewers $\qquad$ |  |  |
| :---: | :---: | :---: | :---: |
| Size | BrickMosonry 1sinArch, Hounct and 9 inch counterarch | Rubble 12 inchesthic atce InfullCradt | $r y$ counterana <br> artial Crad |
| Ft. 1 ln . | Quantity in cubic yards pr. linear foot. |  |  |
| 12......... 0 | 1.75 | 3.45 | 2.66 |
| 3 | 1.82 | 3.50 | 2.72 |
| 6 | 1.9 | 3.58 | 2. 76 |
| 9 | 2.0 | 3.70 | 2.84 |
| 13........... 0 | 2.1 | 3.75 | 2.91 |
| 3 | 2.12 | 3.85 | 2.97 |
| 6 | 2.25 | 3.90 | 3.06 |
| 9 | 2.31 | … 3.95 | 3.14 |
| 14....... 0 | 2.40 | 422 | 3.23 |
| 3 | 2.50 | 4.4 | 3.36 |
| 6 | 2.60 | 4.6 | 3.5 |
| 9 | 2.65 | 475 | 3.70 |
| 15....... 0 | 2.75 | 5.03 | 3.90 |

# Plate IV. 





Table showing Quantity of Excaration in cubicyo's. prelinear foot of Circular Sewer"ln Full Cradle".

| Diometer | Deoth to |  | inside bottom. |  | of sewer, infeet |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Ft-in. | $10^{\circ}$ | 111 | 12 | 13 | 14 | 15 | 16 |
| 2, | 2.3 | 2.53 | 2.71 | 2.92 | 3.13 | 3.34 | 35.5 |
| $2 .-3$ | 2.43, | 2.65 | 2.76 | 3,13 | 3.27 | 13.5 | 372 |
| 2.-36 | $2.56{ }^{\circ}$ | 2.78 | $3.01$ | 3 | 3.5 | 3.71 | 3.94 |
| 2.-.... 9 | 2.8 | 3.06 | 3:25. |  | 305 | 10 | 428 |
| 3..... 0 | 30 | $3{ }^{3} 3$ | 3.5 | 38 | 4.4 | 4.46 | 462 |
| 3.....3 | 2.17: | 0.51 | 375 | 4/2, | insk | 462 | 49 |
| 3.1 .6 | 3.42 | 3.73 |  | 37 | 4.9 | 1497 | 5.3 |
| 3...... 9 | $3.6{ }^{2}$ | $3.9{ }^{\circ}$ | $4.23{ }^{\circ}$ | 44. | 4.9 | 5.2 | 5.52 |
| 4.-..0 | 3.78 | 4.12 | 4.46 | 4.8 | G. 心 | 5.47 | 5.82 |
| 4-1.3 | 3.85 | 4.18 | 4.50 | 4.85 | 5.2 | 5.53 | 5.9 |
| 4-6 | 3.89 | 4.24 | 4.59 | 4.9 | 5.3 | 5.67 | 6.0 |
| 4-.... 9 | 3.96 | 4.32 | 4.68 | 5.0 | 5.4 | 5.76 | 6.11 |



Plate IX.



Plate $X$.


Plate XI.


Plate XII.




e

Plate XVI.

$\qquad$
Coy
Coy
Coy
Coy
$+75_{5}^{5}$


[^0]$x+2$

$x+\frac{2}{4}+5$
$\square+2$
$+$
$\qquad$

 $\qquad$ $\begin{array}{ll}3 \\ 5 & 3 \\ 5\end{array}$
$\qquad$ $\frac{4}{2}+$

[^1]5

$\qquad$ ？
$\square$
$\square$
$\square$ 8
$38$
-


> .





[^0]:    $$
    5858
    $$

    $\rightarrow 2$

[^1]:    经

