Chapter 9

Question (1)

The type of information about the excavation that the estimator learn from the specifications are as follows.

- Type of concrete.
- Strength of concrete.
- Colour of concrete.
- Any special curing or testing.

Question (5)

The difference among a bank cubic yard, a loose cubic yard and a compacted cubic yard are as follows.

- The bank cubic yard shows the measurement of the natural occurrence which are in the form of bank material. The loose cubic yard is the measurement for un-compacted excavated materials. The compacted cubic yard shows the measurement of a compressed volume of materials.
- The bank cubic material shows a large amount of expansion by the swell. The loose cubic yard shows materials which are able to show shrinkage factors. The compacted cubic yard shows materials which can under go compaction of materials.

Question (6)

The term cut and fill is defined as the procedure in which the section is cut and later on filled with building materials. The material is made to fill the embankment. This minimizes the amount of labour.

Question (7)

The estimator in case of substantial amount of cut on the job would have to consider the depth of the soil at the top. The other factors that must be taken care are type of equipment, clearance and slope required. In the presence of substantial amount of fill the slope required for excavation is taken into consideration.

Question (8)

The estimator can get an estimate of the depth of the topsoil by using some equipment or by finding out manually.

Question (9)

Special excavation is commonly considered as a general excavation. Power shovels, bulldozers, graders, and loaders are commonly used for excavation work. Various excavations are normally estimated separately.

Question (14)

Determine the loose cubic yards of soil need to be hauled.

$$\text{Cubic yards of haul} = \text{In place quantity} \times (1 + \text{swell percentage})$$

Substitute 1,450 bcy for in place quantity and 25 percent for the swell percentage.

$$\begin{aligned}\text{Cubic yards of haul} &= 1,450 \text{ bcy} \times (1 + 0.25) \\ &= 1,812.5 \text{ lcy}\end{aligned}$$

Therefore, the loose cubic yards of soil need to be hauled is $\boxed{1,812.5 \text{ lcy}}$.

Calculate the number of truck loads required to haul the soil offsite.

$$\text{Loads} = \frac{\text{lcy of haul}}{\text{lcy per load}}$$

Substitute 1,812.5 lcy of haul for 9 lcy per load.

$$\begin{aligned}\text{Loads} &= \frac{1,812.5 \text{ lcy of haul}}{9 \text{ lcy per load}} \\ &= 202 \text{ loads}\end{aligned}$$

Therefore, the number of truck loads required to haul the soil offsite is $\boxed{202 \text{ loads}}$.

Question (16)

Determine the required bank cubic yards.

$$\text{Required bank cubic yards} = \frac{\text{Required in place cubic yards}}{\text{shrinkage}}$$

Substitute 750 ccy for in place quantity and 90 percent for the swell percentage.

$$\text{Required bank cubic yards} = \frac{750 \text{ in place ccy}}{0.9}$$

$$= 833.33 \text{ bcy}$$

Calculate the volume of the material to be transported.

$$\text{Loose cubic yards} = \text{Bank cubic yards} \times (1 + \text{swell percentage})$$

Substitute 833.33 bcy for in place quantity and 30 percent for the swell percentage.

$$\text{loose cubic yards} = 833.33 \text{ bcy} \times (1 + 0.30)$$

$$= 1,083.33 \text{ lcy}$$

Calculate the number of truck loads required to haul the soil offsite.

$$\text{Loads} = \frac{\text{lcy of haul}}{\text{lcy per load}}$$

Substitute 1,083.33 lcy of haul for 10 lcy per load.

$$\text{Loads} = \frac{1,083.33 \text{ lcy of haul}}{10 \text{ lcy per load}}$$

$$= 109 \text{ loads}$$

Therefore, the number of truck loads required to haul the soil offsite is $\boxed{109 \text{ loads}}$.

Question (27)

Determine the quantity of topsoil to be removed.

$$\text{Quantity of topsoil to be removed} = \text{Length} \times \text{Breadth} \times \text{Thickness of topsoil}$$

Substitute 53 ft. for length, 42 ft. for breadth, and 0.50 ft. for thickness of topsoil.

Add 8 ft. to the length and breadth of the building for working around the building and the sloping the sides of the excavation.

$$\begin{aligned}\text{Quantity of topsoil to be removed} &= (53' + 8') \times (42' + 8') \times (0.50') \\ &= 1,525\,\text{bcf} \times \frac{1\,\text{bcy}}{27\,\text{bcf}} \\ &= 56.48\,\text{bcy}\end{aligned}$$

Therefore, the quantity of topsoil needs to be removed is $\boxed{56.48\,\text{bcy}}$.

Question (35)

Step 1

Calculate the average width of cut.

Add width of the footing, the work space between the edge of the footing and the beginning of the excavation, and the horizontal foot distance of the slope.

$$\begin{aligned}\text{Average width of cut} &= 2' + 1' + 1' + 1' + 1' \\ &= 6'\end{aligned}$$

Calculate the perimeter of the building by using the equation.

$$\text{Perimeter} = \text{Sum of the sides of the Building}$$

Substitute 25 ft, 21 ft. 5 ft. 15 ft. 20 ft. and 36 ft for the sides of the building.

$$\begin{aligned}\text{Perimeter} &= 25' + 21' + 5' + 15' + 20' + 36' \\ &= 122'\end{aligned}$$

Step 2

Calculate the amount of excavation by using the equation.

$$\text{General excavation} = \text{Average width of cut} \times \text{Perimeter} \times \text{Depth of cut}$$

Substitute $6'$ for average width of cut, $122'$ for average length of cut, and $2'$ for depth of cut.

$$\begin{aligned}\text{General excavation} &= 6' \times 122' \times 2' \\ &= 1,464\,\text{bcf} \times \frac{1\,\text{bcy}}{27\,\text{bcf}} \\ &= 54.22\,\text{bcy}\end{aligned}$$

Therefore, the amount of excavation is $\boxed{54.22\,\text{bcy}}$.

Question (41)

Step 1

Calculate the general excavation by using the following relation.

$$\text{General excavation} = \left\{ \begin{array}{l} \text{Average width of cut} \\ \times \text{Average length of cut} \times \text{Depth of cut} \end{array} \right\}$$

Step 2

Calculate the average width of cut for the fig 9.59 in the text book.

Add the length of the wall, the work space between the edge of the footing and the beginning of the excavation, the horizontal foot distance of the slope, and the projection of footing from the wall section.

$$\begin{aligned} \text{Average width of cut} &= 8' + 3' + 3' + 4'9'' + 4'9'' \\ &= 8' + 3' + 3' + 4.75' + 4.75' \\ &= 23.5' \end{aligned}$$

Step 3

Calculate the average length of cut.

Add the length of the wall, the work space between the edge of the footing and the beginning of the excavation, the horizontal foot distance of the slope, and the projection of footing from the wall section.

$$\begin{aligned} \text{Average length of cut} &= 17' + 3' + 3' + 4'9'' + 4'9'' \\ &= 17' + 3' + 3' + 4.75' + 4.75' \\ &= 32.5' \end{aligned}$$

Step 4

Substitute, $23.5'$ for average width of cut, $32.5'$ for average length of cut, and $9.5'$ for depth of cut in the equation (1)

$$\begin{aligned} \text{General excavation} &= 23.5' \times 32.5' \times 9.5' \\ &= 7,255.63\,\text{bcf} \times \frac{1\,\text{bcy}}{27\,\text{bcf}} \\ &= 268.73\,\text{bcy} \end{aligned}$$

Therefore, the amount of excavation needed for spread footing is $\boxed{268.73\,\text{bcy}}$.

Question (44)

Step 1

Find the area of the rectangle $227' \times 146'$ and $23' \times 12'$.

$$\text{Area} = \text{Length} \times \text{Breadth}$$

Calculate the area of the rectangle $227' \times 146'$.

$$\begin{aligned}\text{Area} &= 227' \times 146' \\ &= 33,142\,\text{sf}\end{aligned}$$

Calculate the area of the rectangle $23' \times 12'$.

$$\begin{aligned}\text{Area} &= 23' \times 12' \\ &= 276\,\text{sf}\end{aligned}$$

Find the total area.

$$\begin{aligned}\text{Area} &= 33,142\,\text{sf} + 276\,\text{sf} \\ &= 33,418\,\text{sf}\end{aligned}$$

Step 2

Determine the quantity of asphalt.

The asphalt paving for the compacted thickness 3 inch. is 19.5 tons per 1,000 sf. of surface area.

Find the quantity of asphalt required for 33,418 sf.

$$\begin{aligned}\text{Asphalt} &= 33,418\ \text{sf} \times \frac{19.5\,\text{tons}}{1,000\ \text{sf}} \\ &= 651.65\,\text{tons}\end{aligned}$$

Therefore, the required quantity of asphalt is $\boxed{651.65\,\text{tons}}$.

Step 3

Determine the quantity of granular material.

The granular material for the compacted thickness 6 inch. is 31.5 tons per 1,000 sf. of surface area.

Find the quantity of asphalt required for 33,418 sf.

$$\begin{aligned}\text{Asphalt} &= 33,418\ \text{sf} \times \frac{31.5\,\text{tons}}{1,000\ \text{sf}} \\ &= 1,052.67\,\text{tons}\end{aligned}$$

Therefore, the required quantity of asphalt is $\boxed{1,052.67\,\text{tons}}$.

Chapter 10

Question (3)

The unit of measure for concrete is cubic yards. It can also be converted into cubic foot. It can be stated as $27\text{cf} = 1\text{cy}$.

Question (5)

The different strengths of concrete be kept separate in order to keep a frame out of the cracks and creeps. It is given a proper size and shape of the mold.

Question (8)

A lap is when two pieces of rebar are overlapped to create a continuous line of rebar. The length of the lap depends on various factors.

Lapping or splicing in the rebar may increase the cost of reinforcement from 5 to 15 percent depending on the size of the bar and yield strength of steel used.

Question (13)

The finish must be listed separately on the estimate because this makes the linear feet of footing more precise. The cross section area can be determined properly by this. The conversions can be done correctly.

Question (21)

Step 1

Calculate the area of the cross-section of the footing using the formula,

$$A = bh$$

Here, b is the width of the footing and h is the height of the footing.

Substitute $2'6''$ for b and $1'$ for h.

$$\begin{aligned} A &= 2'6'' \times 1' \\ &= 2.5 \text{ ft}^2 \end{aligned}$$

Since, the footing lies throughout the building length, calculate the perimeter of the building using the formula,

$$L = 2(l_1 + l_2)$$

Here, l_1 and l_2 are the length and width of the foundation plan.

Substitute $36'$ for l_1 and $25'$ for l_2.

$$\begin{aligned} L &= 2 \times (36 + 25) \\ &= 122' \end{aligned}$$

Step 2

Calculate the volume of the concrete required to lay the continuous footing using the formula,

$$V = AL$$

Substitute $2.5\ \text{ft}^2$ for A and $122'$ for L.

$$V = 2.5 \times 122$$
$$= 305\ \text{ft}^3$$

Convert Volume in cubic feet to Volume in cubic yard using the conversion formula.

$$V\left(\text{yd}^3\right) = \frac{V\left(\text{ft}^3\right)}{27}$$

Substitute $305\ \text{ft}^3$ for V.

$$V = \frac{305}{27}$$
$$= 11.296\ \text{yd}^3$$

Calculate the required volume of concrete for the continuous footing using the formula,

$$V' = V \times \text{waste factor}$$

Substitute $11.296\ \text{yd}^3$ for V and 1.07 for waste factor.

$$V' = 11.296 \times 1.07$$
$$= 12.09\ \text{yd}^3$$

Therefore, the required volume of concrete for the continuous footing is $\boxed{12.09\ \text{yd}^3}$.

Question (22)

Step 1

List the rebar and dowels used in the continuous footing.

- 4 EACH #4 CONT. REBAR
- #5 DOWELS @12" O.C ALTERNATING DIRECTIONS

Step 2

Calculate the value of rebar required for the foundation section of building using the formula,

$$\text{Rebar} = n_1 L + \left(n_2 \frac{L}{s} \times L_d \right) \quad \ldots\ldots (1)$$

Here, n_1 is the number of rebar, n_2 is the number of dowels, s is the spacing of dowels, and L_d is the length of the dowel.

Calculate the perimeter of the building using the formula,

$$L = 2(l_1 + l_2)$$

Here, l_1 and l_2 are the length and width of the foundation plan.

Substitute $36'$ for l_1 and $25'$ for l_2.

$$\begin{aligned} L &= 2 \times (36 + 25) \\ &= 122' \end{aligned}$$

Step 3

Calculate the length of the dowel using the formula,

$$L_d = L_w + B_f - C$$

Here, L_w is the length of dowels into the wall, B_f in the width of the footing, and C is the cover.

Substitute $15"$ for L_w, $1'$ for B_f, and $2"$ for C.

$$\begin{aligned} L_d &= 15 + (1 \times 12) - 2 \\ &= 25" \\ &= 2'1" \end{aligned}$$

Substitute 4 for n_1, $122'$ for L, 5 for n_2, $12"$ for s, and $2'1"$ for L_d in equation (1).

$$\begin{aligned} \text{Rebar} &= n_1 L + \left(n_2 \frac{L}{s} \times L_d \right) \\ &= (4 \times 122) + \left(5 \times \frac{122}{(12\ 12)} \times 2'1" \right) \\ &= 1,758.83 \text{ ft} \end{aligned}$$

Step 4

Calculate the total required rebar for the completion of the foundation of building using the formula,

$$\text{Total rebar} = \text{Rebar} + (\text{Lap and Waste})$$

Substitute 10% of Rebar for Lap and Waste and $1,758.83$ ft for Rebar.

$$\begin{aligned} \text{Total rebar} &= \text{Rebar} + (10\% \text{ of Rebar}) \\ &= 1,758.83 + \left(\frac{10}{100} \times 1,758.83 \right) \\ &= 1,934.72 \text{ ft} \end{aligned}$$

Therefore, the required value of REBAR for the continuous footings is $\boxed{1,934.72 \text{ ft}}$.

Question (23)

Write the expression to calculate the required number of linear feet of forms:

$N = l \times h \times n$ ..... (1)

Here, N is the total number of the linear feet of forms, l is the length of the footing, h is the height of the footing, and n is the number of sides formed.

Now, calculate the total length of the footing:

$$l = 25 + 36 + 21 + 15 + 20 + 5$$
$$= 122 \text{ ft}$$

Substitute 122 ft for l, 1 ft for h, and 2 for n in the equation(1).

$$N = l \times h \times n$$
$$= 122 \times 1 \times 2$$
$$= 244$$

Therefore, required number of liner forms or square-feet for the continuous footing for the building is $\boxed{244}$.

Question (25)

Step 1

List the rebar and dowels are used in the foundation section.

- #4 REBAR@12"O.C
- 5 Each#4 cont.REBAR
- #5 Dowels@ 12" O.C alternative directions

Step 2

Calculate the value of rebar required for the foundation section of building using the formula,

$$\text{Rebar} = n_1 L + \left(n_2 \frac{L}{s} \times L_d \right) \text{ ..... (1)}$$

Here, n_1 is the number of rebar, n_2 is the number of dowels, s is the spacing of dowels, and L_d is the length of the dowel.

Calculate the perimeter of the building using the formula,

$$L = 2(l_1 + l_2) + l_3 + l_4$$

Here, l_1 and l_2 are the length and width of the foundation plan, l_3 and l_4 are the length and width of the inner wall in the foundation plan.

Substitute $40'$ for l_1, $30'$ for l_2, $18'$ for l_3, and $12'$ for l_4.

$$L = 2 \times (40 + 30) + 18 + 12$$
$$= 170'$$

Step 3

Calculate the length of the dowel using the formula,

$$L_d = L_w + B_f - C$$

Here, L_w is the length of dowels into the wall, B_f in the width of the footing, and C is the cover.

Substitute $15"$ for L_w, $1'3"$ for B_f, and $2"$ for C.

$$\begin{aligned} L_d &= 15 + (1 \times 15) - 2 \\ &= 28" \\ &= 2'4" \end{aligned}$$

Substitute 1 for n_1, $170'$ for L, 5 for n_1, $170'$ for L, $12"$ for s, and $2'4"$ for L_d in equation (1).

$$\begin{aligned} \text{Rebar} &= n_1 L + \left(n_2 \frac{L}{s} \times L_d \right) \\ &= \left(5 \times \frac{170}{(12\ 12)} \times 2'4" \right) + (5 \times 170) + \left(5 \times \frac{170}{(12\ 12)} \times 4'3" \right) \\ &= 5,341.4 \text{ ft} \end{aligned}$$

Step 4

Calculate the total required rebar for the completion of the foundation of building using the formula,

$$\text{Total rebar} = \text{Rebar} + (\text{Lap and Waste})$$

Substitute 10% of Rebar for Lap and Waste and $5,341.4$ ft for Rebar.

$$\begin{aligned} \text{Total rebar} &= \text{Rebar} + (10\% \text{ of Rebar}) \\ &= 5,341.4 + \left(\frac{10}{100} \times 5,341.4 \right) \\ &= 5,875.54 \text{ ft} \end{aligned}$$

Therefore, the required value of REBAR for the continuous footings is $\boxed{5,875.54 \text{ ft}}$.

Question (26)

Step1

Write the expression to calculate the required number of linear feet of forms:

$$N = l \times h \times n \quad \ldots\ldots (1)$$

Here, N is the total number of the linear feet of forms, l is the length of the footing, h is the height of the footing, and n is the number of sides formed.

Now, calculate the total length of the footing:

$$l = 40 + 30 + 18 + 12 + 40 + 30$$

Step 2

Substitute 170 ft for l, 1.25 ft for h, and 2 for n in the equation (1).

$$N = l \times h \times n$$
$$= 170 \times 1.25 \times 2$$
$$= 425 \text{ SFCA}$$

Therefore, required number of liner forms or square-feet for the continuous footing for the building is $\boxed{425}$.

Question (28)

Step 1

Here, 4 REBARS are provided in both ways.

Calculate the total value of rebar required for the single spread footing as follows.

$$= 4 \times 2'\text{-}6'' + 4 \times 2'\text{-}6''$$
$$= 20.00 \text{ ft}$$

Calculate the total value of rebar required for the two spread footings as follows.

$$= \text{value of rebar for singe spread footing} \times 2$$
$$= 20.00 \times 2 \text{ feet}$$
$$= 40.00 \text{ feet.}$$

Step 2

Rod weight per unit length of 4# bars is 0.67 lb.

Calculate the amount rebar.

$$\text{amount of rebars} = \text{length} \times \text{rod weight per unit length}$$
$$= 40 \times 0.67$$
$$= 26.8 \text{ lb}$$

Hence, the amount of REBAR required for the two spread footings is $\boxed{26.8 \text{ lb}}$.

Chapter 10

Question (30)

Step 1

Determine the number of #8 bars along longitudinal direction.

$$N_s = (2 \times 12)$$
$$= 24$$

Determine the number of #8 bars along transverse direction.

$$N_s = \left(2 \times \frac{17''}{9''}\right)$$
$$= 3.77$$

Calculate the total length of #8 bars.

$$L_s = \left(24 \times \left(17' - 2(3'')\right)\right) + 3.77 \times \left(8' - 2(3'')\right)$$
$$= 424.28'$$

Here, $17'$ is the length of the footing along longitudinal direction and $3'$ is the cover.

Step 2

Determine the number of 28EA #10 dowel bars.

$$N_{10} = 28$$

Calculate the total length of 28EA #10 bars.

$$L_{10} = \left(2'3'' + \frac{24''}{12}\right) \times 28$$
$$= 4.25' \times 28$$
$$= 119'$$

Step 3

Calculate the total amount of #8 REBAR.

$$\text{amount of rebars} = \text{length} \times \text{rod weinght per unit length}$$

Substitute 424.28 ft for length and 2.67 lb for rod weight per unit length in equation.

$$\text{amount of rebars} = 424.28 \times 2.67$$
$$= 1132.83 \text{ lb}$$

Calculate the total amount of #28 REBAR.

$$\text{amount of rebars} = \text{length} \times \text{rod weinght per unit length}$$

Substitute 119 ft for length and 4.30 lb for rod weight per unit length in equation.

$$\text{amount of rebars} = 119 \times 4.30$$
$$= 511.7 \text{ lb}$$

Calculate the total amount of REBAR required for the foundation section of building.

$$= 1132.83 + 511.7$$
$$= 1644.53 \text{ lb}$$

Therefore, required value of REBAR for footing is $\boxed{1644.53 \text{ lb}}$.