Drilled Shaft Homework Questions CBT

Introduction

This section contains review questions for you that will help you prepare for the exam. The Review is divided in two parts. The first part of your work consist of simple questions. The second part of the review work consists of problems. Have ready with you a calculator, pencil, paper, ruler, and your notes.

Question 1.

Auger bits are generally classified as what two types?

Soil and Rock

Question 2. Multiple Choice

Which of the following is **NOT** a method of Drilled Shaft installation?

A. Permanent Casing Method
B. Vibratory Method
C. Wet Method
D. Dry Method
E. Temporary Casing method

Question 3. True or False-

The Contractor is required to use temporary/surface casing.

True

Question 4. Multiple Choice

Which of the following purposes does slurry serve?

A. Maintains a stable borehole
B. Facilitates the removal of cuttings
C. Maintains high effective stress in the soil to retard softening or loosening
D. All of the above

Question 5.

When using earth augers, which has superior removal capacity, single or double flight?

Double

Question 6.

Which type of bucket is the image below?

Digging

Question 7. True or False-

When Pilot Holes are shown in the plans, they are to be performed prior to shaft excavation.

True

Question 8.
Which type of bucket is the image below?

Cleanout or Bailing

Question 9.
Which document is the Contractor to prepare and submit to the Engineer at the preconstruction conference?

Drilled Shaft Installation Plan

Question 10.
Which type of tool is the image below?

Overreaming tool

Question 11.
In accordance with the project requirements, the contractor has obtained a 4" diameter core from below the shaft bottom. The core run was 5.0' and the total rock recovered was 4.2'. A total of 3.7' of the recovered core consisted of core fragments greater than 4". Calculate the percent core recovery (%REC) and Rock Quality Designation (RQD).

$$\%\ REC = \frac{4.2'}{5'}\ (100\%) = 84\%$$

Recovery is equal to 4.2 ft divided by 5 feet times 100 equals to 84%. Now please compute the RQD.

$$\%\ RQD = \frac{3.7'}{5'}\ (100\%) = 74\%$$

RQD Is equal to 3.7 feet divided by 5 feet times 100 equals to 74%

Question 12.
The plans for a bridge specify that the drilled shaft diameter be 48". However, the contractor supplied a temporary casing with an outside diameter equal to the specified shaft diameter (O.D. casing). The authorized shaft length below ground was 68' and the casing supplied had a wall thickness of ½" . What additional length of shaft is required?

$D_1 = 4.0' = 48"$
$D_2 = D_1 - 2\ (t) = 48" - 2\ (.5") = 47"$
$t = 0.5"$
$L = 68.0'$

The required diameter is D1 equals to 4 feet equals to 48 inches.
The actual diameter to be provided is the internal diameter D2 which is equals to D1 minus 2 times the thickness of the wall. This is equal to 48 inches minus 2 times 0.5 equals to 47 inches.
(shows the t=0.5")
L= 68 feet. This is the depth below ground because it is a temporary casing.
The Additional length is 48 inches minus 47 inches divided by 47 inches times 68 feet.

$$\text{Additional Length} = \frac{(D_1 - D_2)\,L}{D_2} = \frac{(48" - 47")\,68'}{47"} = 1.45'$$

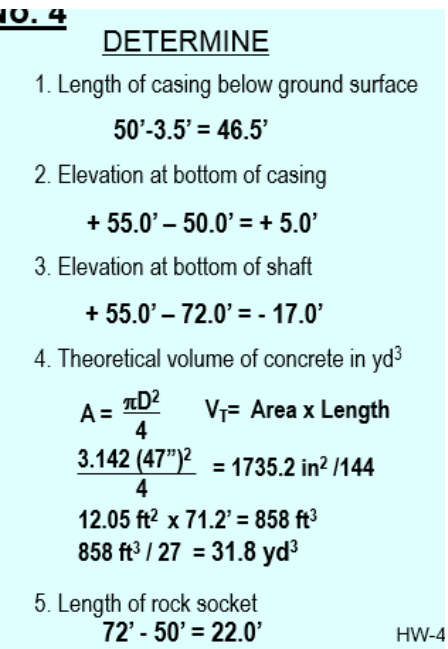
Question 13.
For the situation presented in Problem #2, determine the factor (F) to adjust pay quantities to compensate for smaller shafts.

The factor F is equal to 2 times 47 inches minus 48 inches divided by 47 inches equals to 0.9787

$$F = \frac{2(D_2) - D_1}{D_2} = \frac{2(47") - 48"}{47"} = 0.9787$$

Question 14.

Please calculate the values asked in this slide.



Length 50Item 1. Calculate length of casing below ground:
Based on the figure the top of the casing is 3.5 feet above ground. Therefore, to compute the casing length below ground we just need to deduct 3.5 feet from the total casing length. Therefore:
50 minus 3.5 equals to 46.5 feet.
Item 2. Compute the elevation at bottom of casing.
The bottom of casing elevation is equals to plus 55 minus 50 equal to plus 5 feet.
Item 3. Elevation at bottom of shaft:
The bottom of shaft elevation is plus 55 minus 72 equals to minus 17 feet.
Item 4 Theoretical volume:
The theoretical volume is computed as area times length. The theoretical volume is 858 cubic feet equals to 31.8 cubic yard
Item 5: Length of rock socket:
The rock socket length is 72 feet minus 50 feet, equals to 22 feet.

Question 15.

Spacers per Row

455-16.3-…. one spacer per 30 inches of circumference of cage with a minimum of four at each level.

Circumference (C) = πD

$\pi(36")/30" = \frac{113.11"}{30"} = 3.77 = \mathbf{4}$

Number of Rows

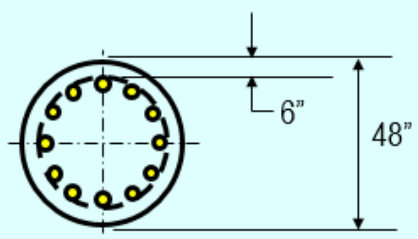
455-16.3- …within 3 feet of the bottom, within 6 feet of the top, and intervals not exceeding 10 feet along the shaft…

With 1st row placed at 1.5' from bottom,
7 rows are required.

Total number of side spacers:
7 Rows @ 4 per row
7 x 4 = 28

HW-5

The plans for a bridge show that the drilled shaft diameter is to be 48" and that all concrete cover is to be 6". The length of the drilled shaft is 63'. Determine the total number of side spacers required. At this point show this sketch (see below)



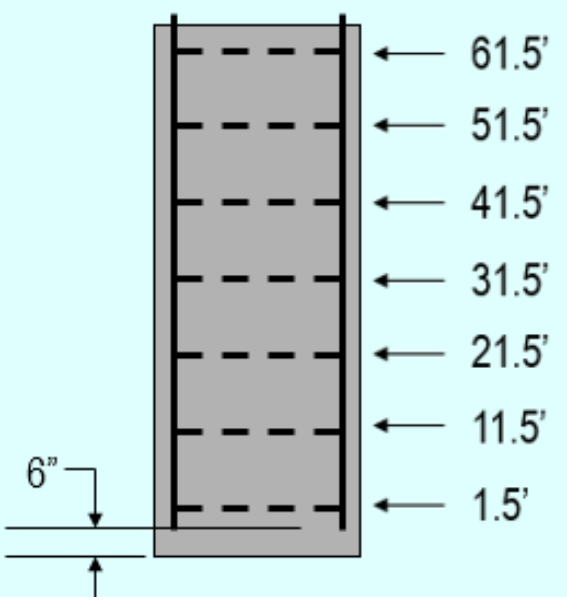
Let us remember that the contractor needs to provide one spacer at a maximum spacer of one spacer per 30 inches of circumference at each level. Now compute the number of spacers for level:

The number of spacers is pi times 36 inches divided by 30 inches equals to 3.77, which we round up to 4 spacers per level.

Now, estimate the number of rows. Assume the bottom row starts at 1.5 feet from the bottom.

At this point display the sketch below

Starting at 1.5 ft we placed a spacer every 10 feet to meet the specification. We need to make sure the upper row is within 6 feet from the top of the shaft



This gives a number of rows of 7.

The total number of pacers will be equals to the number of rows times the number of spacers per row. This is 7 times 4 equals to 28 spacers

Question 16.

Using the information from Problem 5 and below, how many CSL tubes are required for the drilled shaft and what should their minimum length be.

Number of CSL Tubes

455-16.4 ....Provide the following number and configuration of cross hole sonic logging access tubes in each drilled shaft based on the diameter of the shaft.

Shaft Diameter	Number of Tubes Required	Configuration around the inside of Circular Reinforcing Cage
36 to 48 inches	4	90 degrees apart
Greater than 48 inches	1 [illegible] foot of Shaft Diameter	360 degrees divided by the Number of Tubes

The specs require 4 tubes for a 48 inch diameter shaft.

Length of CSL Tubes

455-16.4 .... from the tip of shaft to a point high enough above top of shaft to allow crosshole sonic logging testing, but not less than 30 inches above the top of the drilled shaft, ground surface or water surface, whichever is higher.

The length will be the length of the shaft plus 2.5 feet or 30 inches. This is 63 feet plus 2.5 equals to 65.5 feet.

63' + 2.5' = 65.5 ft.

HW-6

Question 17.

A drilled shaft contractor placed concrete in a 48" (nominal diameter) shaft which had a top elevation of + 5.50 ft. and a bottom elevation of – 60 ft. The following information was recorded by the inspector during the concrete placement operation. Assume permanent casing having an inside diameter of 54" was used in the upper 10'. The Contractor used 48" nominal drilling equipment below the upper 10'. Neglect the volume of reinforcing steel, telltales, etc.

Determine:

A. The theoretical volume of the shaft.
B. Plot the theoretical volume
C. Plot the actual volume
D. Does the shaft appear OK?

A drilled shaft contractor placed concrete in a 48" (nominal diameter) shaft which had a top elevation of + 5.50 ft. and a bottom elevation of – 60 ft. The following information was recorded by the inspector during the concrete placement operation. Assume permanent casing having an inside diameter of 54" was used in the upper 10'. The Contractor used 48" nominal drilling equipment below the upper 10'. Neglect the volume of reinforcing steel, telltales, etc.

DETERMINE

A. The theoretical volume of the shaft.
B. Plot the theoretical volume
C. Plot the actual volume
D. Does the shaft appear OK?

Item 1: The theoretical volume of the shaft.

upper 10':
(from El +5.5 to El -4.5)

V_T= Area x Length

$A = \frac{\pi D^2}{4}$

$\frac{3.142\ (54")^2}{4} = 2290.5\ in^2/144$

$15.9\ ft^2 \times 10' = 159\ ft^3$

$159\ ft^3 / 27 = \mathbf{5.9\ yd^3}$

Below the upper 10':
(from El -4.5' to El -60.0')

V_T= Area x Length

$A = \frac{\pi D^2}{4}$

$\frac{3.142\ (48")^2}{4} = 1809.8\ in^2/144$

$12.6\ ft^2 \times 55.5' = 699.3\ ft^3$

$699.3\ ft^3 / 27 = \mathbf{25.9\ yd^3}$

Theoretical volume. This is a case where two diameter sizes are used. The top elevation of the shaft is plus 5.5 feet and the upper 54 inch diameter shaft is 10 feet long. This means the bottom elevation of the 54 inch shaft is 5.5 feet minus 10 feet= -4.5 feet. So we need to compute one volume between elevations plus 5.5 and – 4.5 and another volume between -4.5 and -60 and then add them together.
Compute first this upper part of the shaft.
The volume of the upper part is 5.9 cubic yards

Now compute the volume of the bottom part where the diameter is 48 inches.
The bottom volume is 25.9 cubic yards.

THEORETICAL VOLUME
DATA FOR PLOTTING THE THEORETICAL

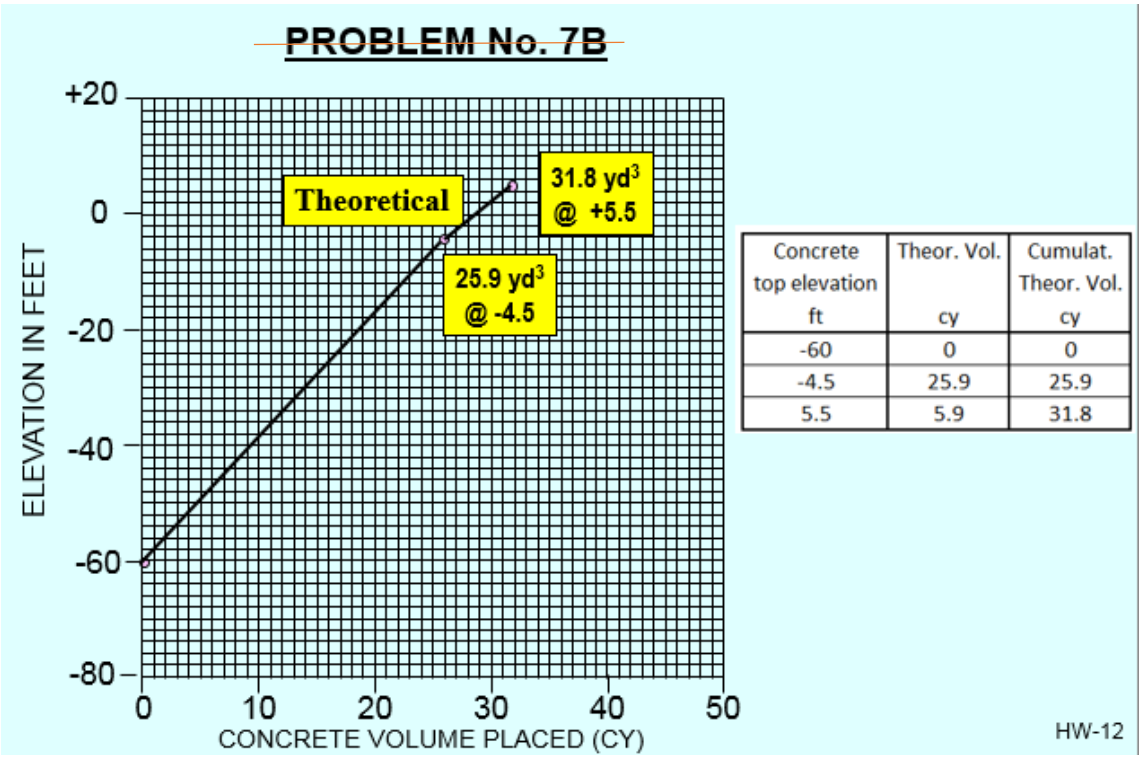
At El -65':	Cumulative volume=0
At El -4.5':	Cumulative volume= 25.9 cy
At El +5.5':	Cumulative volume= 25.9 + 5.9= 31.8 cy

Plot the theoretical volume
Add CONTINUE Button

Note: The theoretical volume will consist of two straight lines.
Here is the summary for plotting
At El -65, the bottom of the shaft, the cumulative theoretical volume is zero.
At Elevation -4.5, the theoretical volume will be the volume we computed for the bottom part of the shaft, which is 25.9 cubic yards.
At elevation plus 5.5, we will have the total volume of the two parts, which is 25.9 plus 5.9 equals 31.8 cubic yards.
(wait 15 seconds)

Now, plot the theoretical curve with the values computed previously. See table next to chart. Plot the first point, volume zero at elevation minus 60.
Now plot the second point, volume 25.9 cubic yards at elevation minus 4.5
This line represents the theoretical volume for the bottom part of the shaft, between elevation minus 60 and elevation minus 4.5.
Now plot the third point, volume 32.8 cubic yards at elevation plus 5.5

17B.



Concrete top elevation ft	Theor. Vol. cy	Cumulat. Theor. Vol. cy
-60	0	0
-4.5	25.9	25.9
5.5	5.9	31.8

17B. Plot the theoretical volume and actual volume placed of concrete. Below is the truck information.

Plot the theoretical volume and actual volume placed of concrete. In the table is the truck information.
Try to complete the given table. As indicated in the table, in all the trucks they took samples for testing that took 0.1 cubic yards each. And after the last truck was poured the inspector estimated that 0.5 cy was left on the ground. Complete the concrete elevation, volume placed, and the cumulative volume placed. You will have a minute). For the calculation of the elevations remember that the reference elevation is plus 5.5 feet, which is the top of casing at the time of concreting.

Reference Elevation= + 5.5

Truck #	Volume Delivered cy	used for Testing cy	left on ground cy	Depth to concrete ft	Concrete top elevation ft	Volume Placed cy	Cum. Vol Placed cy
1	9	0.1		50			
2	9	0.1		38.3			
3	9	0.1		30			
4	9	0.1		13.3			
5	9	0.1	0.5	0			

Here is the completed table. Please check your results. When you are ready to continue please click the CONTINUE button

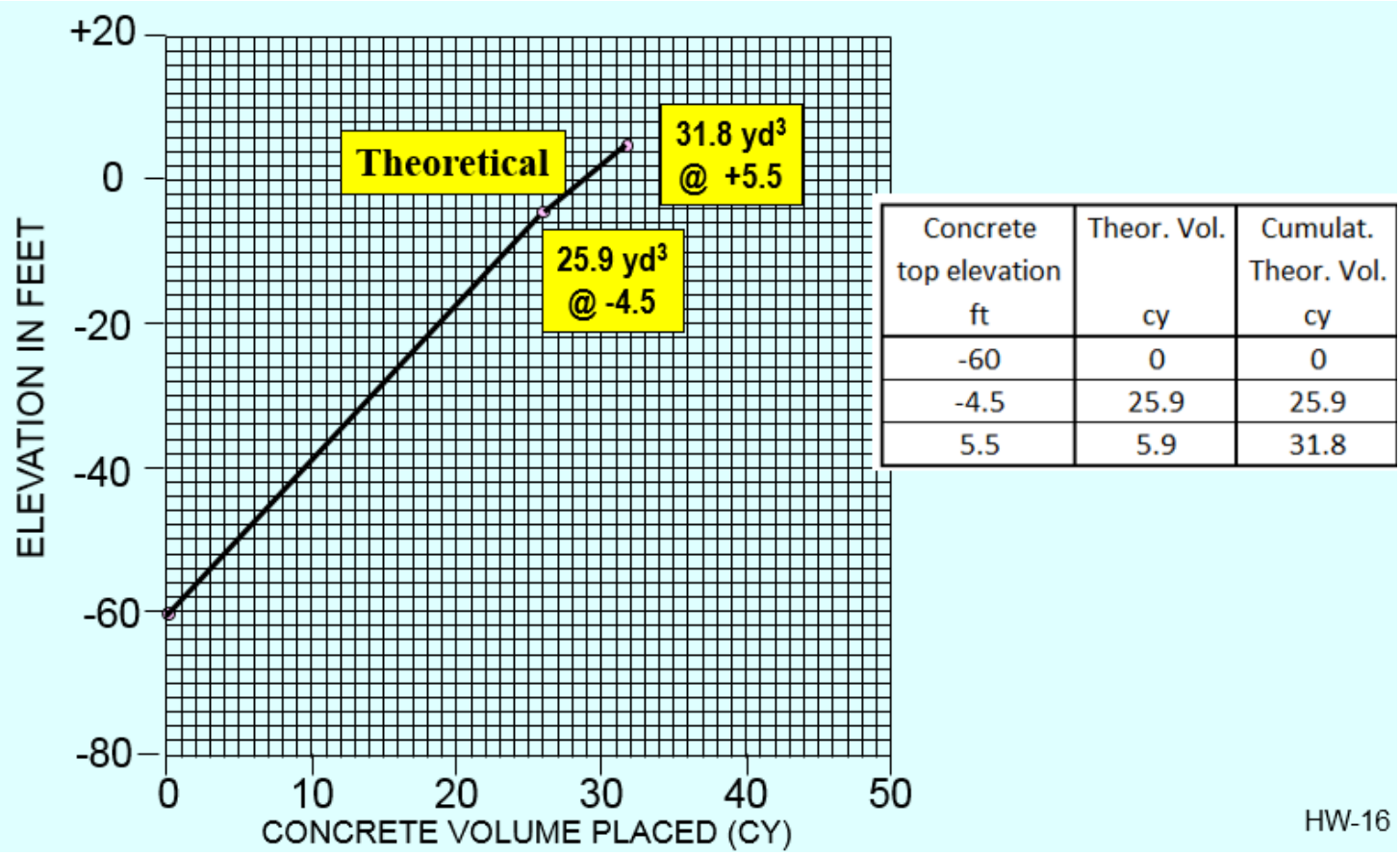
Reference Elevation= + 5.5

Truck #	Volume Delivered cy	used for Testing cy	left on ground cy	Depth to concrete ft	Concrete top elevation ft	Cum. Vol Placed cy
1	9	0.1		50	-44.5	8.9
2	9	0.1		38.3	-32.8	17.8
3	9	0.1		30	-24.5	26.7
4	9	0.1		13.3	-7.8	35.6
5	9	0.1	0.5	0	5.5	44

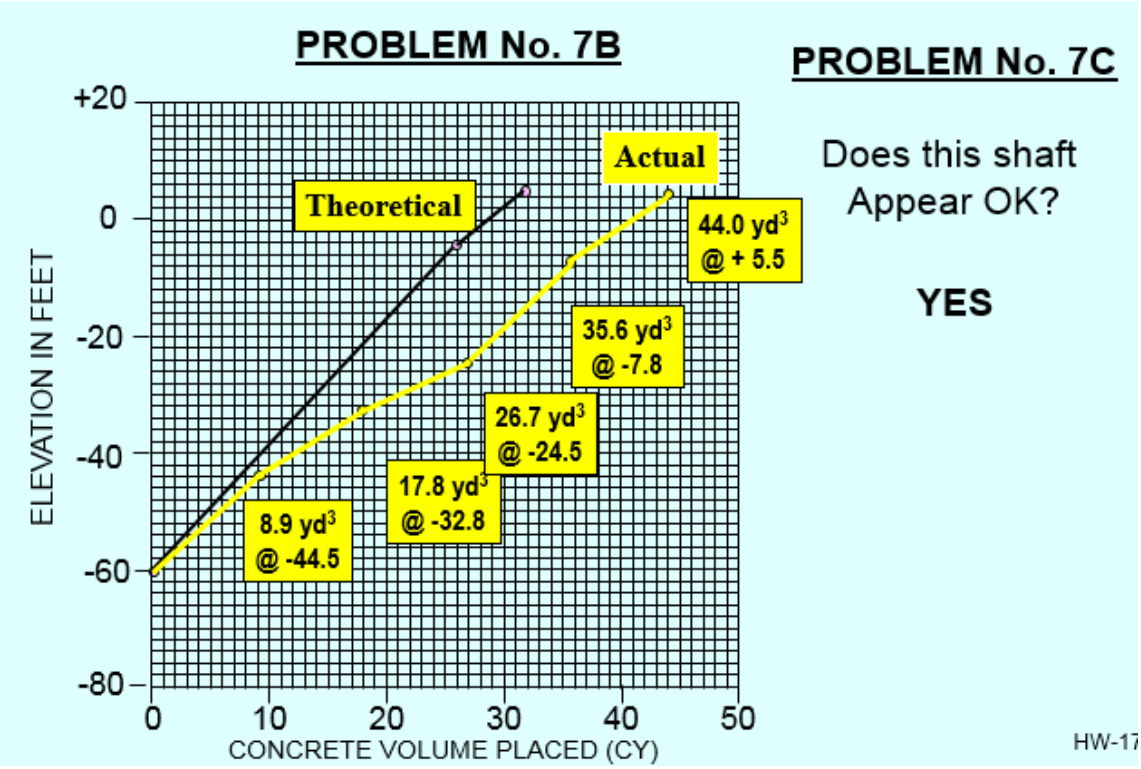
Now plot the concrete top elevations versus the cumulative volume placed

The values to be plotted have been brought to the table at the right side of the chart. You have one minute to plot.

Show graph from slide HW-16 below.



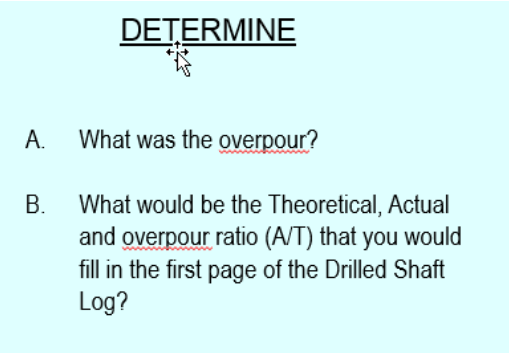
Concrete top elevation ft	Theor. Vol. cy	Cumulat. Theor. Vol. cy
-60	0	0
-4.5	25.9	25.9
5.5	5.9	31.8



17C. Does this shaft appear OK?

Yes

Show this:



- DETERMINE

A. What was the overpour?
B. What would be the Theoretical, Actual and overpour ratio (A/T) that you would fill in the first page of the Drilled Shaft Log?

A. OP= 44 – 31.8= 12.2 cy

B. Theoretical= 31.8 cy
Actual= 44.0 cy (=Vp)
Ratio (A/T)= 44.0/31.8= 1.38

Answers:

What is the overpour in cubic yards?

Overpour OP is equal to total volume placed minus the theoretical volume. Therefore overpour is equals to 44 minus 31.8 equals to 12.2 cubic yards.

What is the overpour ratio A over T?

Theoretical volume is 31.8 cubic yards

Actual volume placed is 44 cubic yards

Therefore, the overpour ratio A over T is equal to 44 divided by 31.8 equals to 1.38.