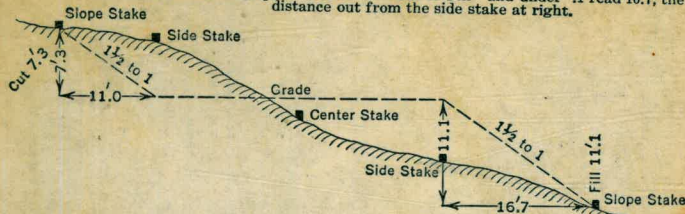


W
583

583

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING
Roadway of any Width. Side Slopes 1/2 to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Cut or Fill	Distance out from Side or Shoulder Stake										Cut or Fill
	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

KEUFFEL & ESSER CO., N. Y.
 For Curve Tables see end of book.

GROUT BOOK No. 4

MICROFILMED

JAN 13 1965

The paper in this book No. F363A
 is made of 50% high grade rag stock
 with a WATER RESISTING surface sizing.

10,360. k, a, ai. oM.

In the
from t

Out 1.3

Out of
Fill

0
1
2
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MICROFILMED

JAN 13 1982

INDEX

Hole #	18-25	1
"	6-125	3
"	11-11	4
	11-34.8	5
	12-11.6	6
	12-34.9	7
	12-24.9	8
	17-125	9
	17-375	10
	A-17-23-30.5	11
	18-272	12
	18-331	13
	A-17-23	13A
	18-331	14
	A-18-29	15
	18-125	16
	18-375	17
	A-13-5 offset	18
	13-125	19
	13-375	20
	14-125	21
	14-375	22
	20-11	23
	19-125	24
	19-375	25

Index Cont'd. last Page

B#TC-

Nohc-no

Time

To

Hrs-Min

Depth

W-PH

G-PH

Port-

CEMENT

WATER-

2
CEMENT

WASTE

6-12⁵ 6-10-42

Allen

3
Hchord

Time

Nr. min Depth

G-10

PT

Cement- Water.

8:30 A

9:15 A

0-45

25.0

60

1-3

3

9

FINAL Grouting.

pl

Hike No 11-11

Time

Depth-

DATE.

7-8-42

G-P

8⁴⁰ A

9⁰⁰ A

0.0 25.0

55

ALLEN

PR

CEMENT

WATER

1.3

3

9

4

WASTE

Hole
no 11-37 ^{34.8}

7-8-42

Depth- G-F

900 A 9' 15" A

0.0 25.0 65

Allen

Pr

Cement.

Water.

1.3

3

9

1

5
W/Total

HOLE No. 12-11-6 -- DATE 8-26-42

Inspector

D. B. Curry

Foreman

Leach

Page

6

TIME		DEPTH Fr-To	Water Test lbs/sq.in.	Grout Pressure lbs/sq.in.
From	To			

Grout Proportion	Material Used (cu. ft.)			Quantity Grout (Cu. ft)	Grout Per. Min Cu. Ft.
	Cement	Sand	Water		

9:00 AM	9:10 AM	0:10	0.0-28.0	—	110.0	1-3	1.0	0.0	3.0	1.0	0.1
---------	---------	------	----------	---	-------	-----	-----	-----	-----	-----	-----

Hole No 12-34.9 -- Date 8:26:42

Inspector

Foreman

Page

D.R. Curry

Leach

7

Time		Depth	Water	GROUT
From	To	Fr.-To	Test. Pressure lbs/sq.in.	Pressure lbs/sq.in.

GROUT Proportion	Materials Used (cu. ft.)			Quantity GROUT (cu. ft.)	GROUT Per. Min. (cu. ft.)
	Cement	Sand	Water		

9:15 am	9:47 am	0:32	0.0-28.0	—	80.0
---------	---------	------	----------	---	------

1-3	2.0	0.0	6.0	2.0	0.06
-----	-----	-----	-----	-----	------

Hole No. A-12-24.9 Date 8:26:42

Inspector

Foreman

Page

D.R. Curry

Leach

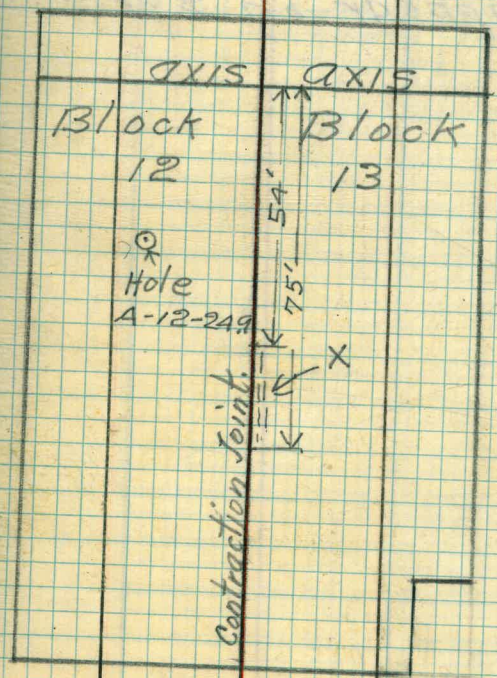
8

Time		Depth Fr.-To.	Water Test lbs/sq.in	Grout Pressure lbs/sq.in	Grout Proportion	Materials Used (cu. ft)			Quantity Grout (Cu. ft)	Grout per. Min. (Cu. ft.)	
From	To					Cement	Sand	Water			
9:50am	12:05pm	2:15	00-29.0	—	40.0	1-3	64.0	0.0	192.0	64.0	0.47
12:05pm	12:55pm	0:50	0.0-29.0	—	120.0	1-1	20.0	0.0	20.0	20.0	0.4

Note 4 sks cement was left over after grouting was finished and was wasted.

Datum

x Grout reappeared in Block 13. From cracks in Rock Foundation



Hole No - 17-12.5 - - - Date - 9-21-42

Inspector

Foreman

Page

Curry

Leach

9

Time		Depth Fr. - To	Water test lbs/sq. in.	Grout Pressure lbs/sq. in.
From	To			

Grout Proportion	Materials Used (cu. ft.)			Quantity Grout (cu. ft.)	Grout (Per min.) cu. ft.
	Cement	Sand	Water		

8:30	9:00	0:30	Washing with air	
9:00	9:45	0:45	0-25	0 60.0

			and water Holes 17-12.5 and 17-37.5	
1-3	2	0	6	2 0.045

Note Grout did not
reappear on surface.

Hole No 17-37⁵ Date 9-21-42

Inspector

Curry

Foreman

Leach

Page

10

Time		Depth		water test	Grout Pressure
From	To	Hr.-Min	Fr.-To	lbs/sq in	lbs/sq in

9:50	10:10	0:20	0:0-25	0	70.0
------	-------	------	--------	---	------

Note Grout did not reappear on sur face.

Grout Proportion

Materials Used (cu-ft.)

Cement Sand Water

Quantity

Grout Cu. ft.

Grout Per.-Min. Cu.-ft.

1-3

1.0

0

3.0

1.0

0.05

Hole No A17-23-S-30' Date 9-21-42.

Time		Depth Fr-To	Water Test lbs/sq.in.	Grout Pressure lbs/sq.in.
From	To			

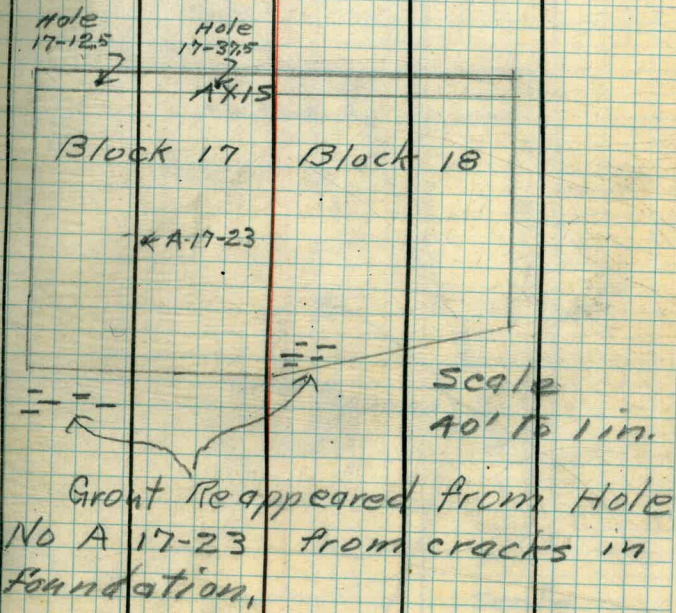
9:50	10:10	0:20	0-25	Washed
10:15	2:00	3:45	0-25	0 20.0
2:00	3:00	1:00	0-25	0 40.0

Note There were 3 sks of cement wasted at end of Days Grouting.

Inspector Curry Foreman Leach Page 11

Grout Proportion	Materials Used (cu.ft.)			Quantity Grout Cu. ft.	Grout Per Min Cu. ft.
	Cement	Sand	Water		

	out with air & water				
1-3	78.0	0	234	78.	0.35
1-1	7.0	0	7.0	7.	0.116



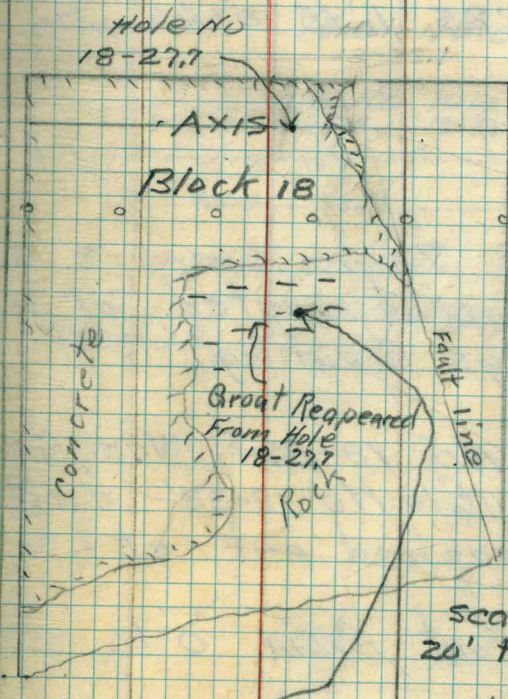
Hole No 18-27Z Date 9-22-42

Time		Depth		Water Test lbs/sqin	Grout Pressure lbs/sqin
From	To	Hr-Min	Fr-To		
8:15	8:30	0:15	0-95		
8:30	8:35	0:05	0-95		10.0
8:35	9:20	0:45	0-95		80.0

Inspector Curry Foreman Leach Page 12

Grout Proportions	Material Used (Cu Ft)			Quantity Grout Cu Ft.	Grout Per Min Cu Ft.
	Cement	Sand	Water		
	1-3	5.0	0	15.0	5.0
	1-1	15.0	0	15.0	15.0

Pumped water in hole at 7 cu ft per min. Reappeared from cracks in middle of Block.



A Nipple was set here for Grouting after Rock is covered. This is very open with many open seams.

Hole No 18-33' Date 9-22-42

Inspector
Curry

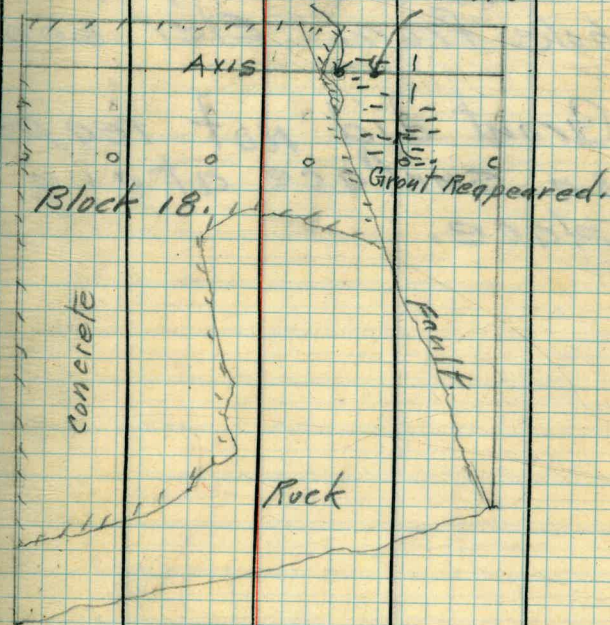
Foreman
Leach

Page
13

Time		Depth Fr.-To	Water Test lbs/sq in	Grout Pressure lbs/sq in
From	To			
9:30	10:30	1:00	0-60	
10:30	11:00	0:30	0-60	
11:00	1:10	2:10	0-60	10.0 to 60.0
1:10	2:25	1:15	0-60	60.0 80.0

Grout Proportion	Materials Used (cu. ft.)			Quantity Grout Cu. ft.	Grout Per Min Cu. ft.
	Cement	Sand	Water		
	Washing mud out of hole. Lost water and could not gain any depth.				
	Washing with Pressure Pump Reappeared from open seams East of fault.				
1-3	25.0	0	75.0	25.0	0.19
1-1	15.0	0	15.0	15.0	0.2

Hole No 18-33' Hole No 18-37.5



Note There were 3 sks of cement wasted at end of days Grouting.

Hole No 18-37.5 Was Grouted from Hole No 18-33' and was washed out at 3-30 PM

Wash out from 0 to 25'

Hole No A-17-23 Date 9-25-42

Inspector Curry Foreman Leach Page 13A

Time		Depth		Water test	Grout Pressure
From	To	Hr-Min	Fr-To	lbs/spin	lbs/sqin

2:00	2:15	0:15	0-78*		
2:45	2:40	0:25	0-78*		90.0

Grout Proportion	Materials Used (cu-ft.)			Quantity Grout Cu-ft.	Grout Per Min. Cu-ft.
	Cement	Sand	Water		

1-3	3.0	0	9.0	3.0	0.12
-----	-----	---	-----	-----	------

* 78' was depth of hole from Elev 600.
Grout did not reappear on surface at any place.

Hole #

18-33.1

Date

10-2-42

Inspector

Adolph Bock

Foreman

Leach.

14

Time

Depth

Grout
pressure

Grout

Materials Used

Cutt. Quantity

From To

Hr. Min. Fr. To

lbs. Sq. in

Proportion

Cement Sand Water

Grout
Cutt.

8:50 AM 9:05 AM 0-15 0-93

150

1-3

40

0

12

40

The drill rods were left in the hole over night and the water left running so that the hole was thoroughly washed out.

All the grout was pumped in in the first 5 min. From then on the pressure was held at 150 lbs. and no further grout was pumped in.

A total of 7.0 sacks were mixed. This left a waste of 3.0 sacks.

No grout appeared on the surface.

Hole

A-13-29

Date

10-21-42

Inspector

McGowan

Foreman

15

TIME

FROM	TO	Hr Min	Depth	Grout Ft.
9-03	9-27	0-24	25	100
9-27	9-49	0-22		100

Material used.				
Grout Mix	Cem.	Sand	water	grout Cuft.
3-1	3	0	9	3
1-1	2	0	2	2

grout did not appear on surface

water tested to 100 lb pressure

Hole No

18-12.5

Date

10-21-42

Inspector

McCain

Foreman

16

Time

From

To

Hrs Min

Depth

Grout
Pressure

Mil

Cem

Sand

water

grout
left

Cement
wasted

1.10

1.28

- 18

25

100-150

3-1

2

0

6

2

1 sack

Water tested at 125*

grout did not appear on surface

Note, 1 - Sack Cement wasted
left in mixer.

Hole No

18+37.5

Time

From

To

Hrs Min

Depth

Grout
Pressure

12-20

12-35

15

25

75

Inspector

McCown

Foreman

Leach

17

Materials Used

Mix Cement Sand water Grout Cuft.

3-1

1

0

3

1

grout did not appear on
surface

Water tested to 100 lb pressure
Note this hole grouted during
lunch hour while inspector
was away with understanding
that no grouting would be done.

Hole No

Date

Inspector

Foreman

18

A-13-5 offset,

10-22-42

McGowan

Leach

Time

From

To

hrs/Min

Depth

Grout
Pressure

Mix

Cem

Sand

water

Grout
Coft

8-53

10-30

1-37

60-100

3-1

39

117

39

10-30

11-25

55

80-125

3-1

6

18

6

Sealed at 100 #

grout did not appear on
surface.

Hole No

13-12p

Date

10-22-42

Time

From

To

Hrs Min

Depth

GROUT
Pressure

11-45

12-02

- 17

100
125

Inspector

McCown

Foreman

Leach

19

Mix

Cement

Sand

water

GROUT
cuft.

3-1

1

0

3

1

grout did not appear on
surface.

Sealed at 105*

3 sacks cement wasted

Left in Mixer and Line

Hole No

13-375

Date

10-22-42

Time

From

To

Hrs. Min.

Depth

Grout
Pressure

11-30

11-40

10

100 TO
120

Inspector

McCown

Foreman

Leach

20

Mix

Cement

Sand

Water

Grout
Cuft.

3-1

1

0

3

1

Grout did not appear on
surface.

Hole No

14-12.5

DATE

11-11-42

INSPECTOR

MCGOWAN

FOREMAN

LEACH

21

Time

From

To

Hrs Min

Depth

grout
Pressure

9-20

9-51

0-31

25

100

Mix cement Sand water grout.

3-0

5

0

15

5

Hole sealed at 100 lbs.

33 Sacks on hand Start

28 " on hand End.

Hole N
14 375

DATE
11-11-42

Time

From	To	Hrs	Min	Depth	grout Pressure
9 57	10 07	10	25	140	

No Waste.

28 sacks on hand Start.
27 " " " End

INSPECTOR
MCCOWN

FOREMAN
LEACH

22.

Mix	Cement	Sand	Water	grout
3-0	1	0	3	1

hole sealed at 140 lbs.

No Waste.

Hole #

Date

20-11

11-24-42

Time

From to

Hrs. Min

Depth

Grout
pressure

9:05 9:18

A.M.

P.M.

9:21

3:10

25

100

3:10

5:35

100

Cement on Hand 27 sacks

Received 192 "

219 "

Used 177 "

On Hand 42 "

2'-water showed here.

3'

0-20-31-5

Block #20

0-20-11

Block #19

0-19-37-5

30'

Grouted showed
here at 3:00 P.M.After this grout started coming
out the mix was changed to 1-0

Inspector

Foreman

23

H. Back

Leach

MIX Cement Sand Water grout

Hole washed out and water
tested. Would not hold water
pressure

3-0 116 0 348 116

1-0 61 0 61 61

177

At 10:25 water started coming
out of hole # 20-31-5. Grout
started showing at 10:40. At
10:55 valve was closed on this
hole and opened at times to
let out air and water, it was
grout up under pressure.At 11:30 A.M. a little water showed
2 ft south of Axis and 3' above
top of dom. No grout showed.At 1:40 P.M. water showed in
hole # 19-37-5. Grout showed at
1:52 P.M. this valve was then
left open enough to let out air
and water until it sealed up.So all three holes were sealed
off at 100 lbs.

Hole #

Date

Inspector

Foreman

24

19-12.5

11-25-42

H. Beck

Leach

Time

From to

Depth

Grout
pressure

8:35 8:40

8:45 10:00

25 50

10:00 12:20

100

Mix Cement Sand water grout
washed out and water tested
Would not hold water pressure

3-0	20	0	60	20
-----	----	---	----	----

1-0	22	0	22	22
-----	----	---	----	----

42

Cement on hand 42 s.

Received 75

117

Used 42

75

No waste

This hole was hard to seal
as grout came out at a
crack in the rock near
the up stream face of the
dam at 19-15. It also
showed in the drain pipe
at 19-10. It slowly sealed
off finally at a pressure
of 100 lbs.

Hole #
19-37.5

Date

11-25-42

Time
From to

Depth Grout
pressure

12:48 1:00

25 100

Cement on hand 75 sacks
" used 1 "
on hand. 74

No waste.

Inspector Foreman

25

Adolph Beck Leach

Mix Cement Sand Water grout

1-0 1 0 1 1

This is the hole reported
grouted from hole #20-11,
but on checking this morning
the grout was down in the
hole about 20' so decided
to test it. It held a
good water test so pump
about 1 sack of grout
so as to fill some more
of the hole.

Hole
#15-12.5

Date
11-27-42

Time
From to
A.M. A.M.
9:35 9:45

A.M. P.M.
9:47 12:50

Depth Grout
pressure

25 100

Inspector Foreman
Adolph Bock Leach

26

Mix Cement sand water grout
washed out and water tested. Did
not hold water pressure.

3-0 20 0 60 20

Grout did not show at the
surface

Cement on hand 74 S.
Cement used 20

on Hand. 54 S

Hole#
15-37.5

Date

11-27-42

Time

From to
P.M. P.M.
1:00 1:10

P.M. P.M.
1:10 2:00

Depth Grout
pressure

25 100

Cement on hand 54.5
" Used 3
On hand 51.5

Inspector

Adolph Bock

Foreman

Leach

27

Mix Cement sand water grout

Washed out and water tested

Held very good water test.

3-0 3 0 9 3

This hole took a little grout
but very slowly.

Hole # A-10
#2, lift
#22, Block #15

Date

11-27-42

Time p.m.
P.m.
2:33 2:53

Depth Grout
pressure
3.0 100 lbs

cement on hand 51 s
Cement used 1
" on hand 50 s

Inspector

Adolph Bock

Foreman

Leach

28

Mix Cement Sand water grout
3-0 1 0 3 1

This is the hole that was drilled in block #15, lift #22 and started to run water when they started to wash the rock in block #16.

This hole would not take any grout at 100 lbs pressure so raised the pressure to 150 lbs and it still did not take any grout.

Hole #
16-46.5

Date

11-27-42

Time

Depth Grout

pressure

P.M. P.M.
3:17 3:20

25 100

3:22 3:37

25 100

Cement on hand 505

" Used 2

" on hand 485

Inspector

Foreman

29

Adolph Bock

Leach

Mix cement sand water grout
Water test held very good.

3-0 2 0 6 2

Hole #
16-12.5

Date

11-27-42

Time

Depth Grout

P.M. P.M.
3:43 3:46

25 100

pressure

3:47 3:57

25 100

Cement on hand	485
" Used	2
" On hand	465

Inspector
Adolph Beck

Foreman
Leach

30

Mix Cement Sand Water grout
Very good water test.
3-0 2 0 6 2

Hole #
15-0
A15-40

Date

12-5-42

Time

From AM To AM
9:10 9:15

Depth Grout
pressure

25

AM PM
9:17 2:45

25 50

2:45 4:57

25 100

Cement on hand 46 sacks

Received 355 "

401 "

Amount used 359 "

On hand 42

Inspector
Ralph Beck

Foreman
Leach

31

Mix Cement sand water grout
Wash out and water test. Did
not hold pressure.

3-0 233 0 699 233

1-0 126 0 126 126

359

This hole only took 35 sacks
the first 2 hours and then
it started to take it a good
deal faster and at 2:45 PM
grout started to come out
of drain hole # 15-0. At
this time I thickened the
grout and the pressure
gradually rose to 100 lbs and
at 3:30 PM grout started
to come out of the first
offset grout hole in block #16.
This hole was also filled
with grout.

Hole #

16-?

A-16-20

Note: This hole was grouted
from the offset hole in
block #15. Back

32

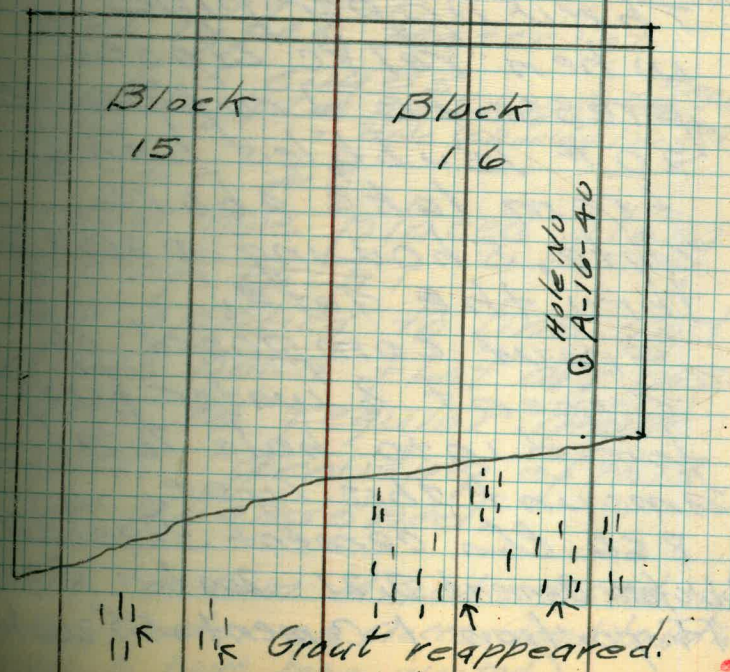
Hole No A-16-40 Date 12-8-40

Inspector
Curry

Foreman
Leach

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33

Time		Depth		Water Test	GROUT Pressure	GROUT Proportion	Materials Used (Cu. Ft.)			Quantity GROUT	GROUT Per Min.
From	To	Hr-Min	Ft-To	lbs/sq.in	lbs/sq.in		Cement	Sand	Water	Cu. ft.	Cu. ft.
1-00	3-25	2-25	0.0-25.		60.	1-3	139.0	0	417.0	139.0	0.96
3-25	4-05	6-40	0.0-25.		100.	1-1	39.0	0	39.0	39.0	0.97
4-10	2 sks mixed and not use					Waste	2.0				



Roadwar Tunnel
2" pipe placed along
bottom at East Side
by Contractor to carry
seepage while Concrcting.

Date 4-1-43

Hackley Gun set and
connected to pipe

Air applied to hole
first pressure raised
to 80 # faint passage
Thru upper pipe
when valve closed
pressure dropped to
20 # Bubbles came
from lake above
Gate, showing passage
thru the gate.

grout composed of
Cement & water first
forced into hole total
amount this type.

866 lbs cement 389 gal. water
Cubic feet. Cement 9.21 water 5.08
Proportion 1 Cement .55 water

(McLown)

Cement, Sand & Water
Next used

Total amount of this
Type forced into hole

Cement, 16.4 bbls Sand 3.2 Tons
water 213 gallons
Soft Cement 65.7 Sand 61.4 water 28.45
Proportion 1.0 : .93 : .43

pressure applied to grout
30 to 80 lbs sealed at
40 lbs.

Total Cuyds placed in hole
Both Types Material

6.5 Cuyds.
1 batch wasted at plant (spilt) Cem. Sand & water
1 batch " " hole (cleaning lines)

4-2-43

Upper hole placed along
Top of Arch.

Air applied to line and
it was noted that air passed
direct to regular grout
piper, grouting of this
line abandoned.

1736 lbs Cem. Mixed used
by Contractor on access road to Tailrace
(Was to have been wasted)

Washed-out.

WATER - Tested -
Tight

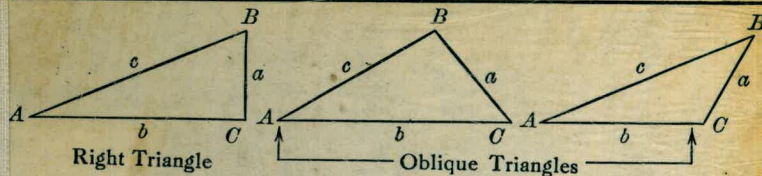
DATE	Hole.no	Depth.	DATE -	Hole.no	Depth.
			5-15-42	19-0	68.0
			5-21-42	13-0	99.0
			5-25-42	12-0	38.0
			5-25-42	12-25	58.0
			5-27-42	12-0	

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16-40	33

$48 = 96$
 $3 \frac{48}{48} = 3.48$
 156
 96
 280
 2784
 160
 80

TRIGONOMETRIC FORMULÆ



Solution of Right Triangles

For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\text{cosec} = \frac{c}{a}$

Given	Required	Formulas
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a \sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot A, c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan A, c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin A, b = c \cos A$

Solution of Oblique Triangles

A, B, a	b, c, C	$b = \frac{a \sin B}{\sin A}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180^\circ - C, \tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b}$ $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a + b + c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$ $\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}, C = 180^\circ - (A + B)$
a, b, c	Area	$s = \frac{a + b + c}{2}, \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$
A, b, c	Area	$\text{area} = \frac{b c \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = $5^\circ 10'$. From Table, Page IX. $\cos 5^\circ 10' = .9959$. Horizontal distance = $319.4 \times .9959 = 318.09$ ft.
 Horizontal distance also = Slope distance minus slope distance times (1 - cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. $\text{Cosine } 5^\circ 10' = .9959, 1 - .9959 = .0041, 319.4 \times .0041 = 1.31, 319.4 - 1.31 = 318.09$ ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance = $302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.