

W

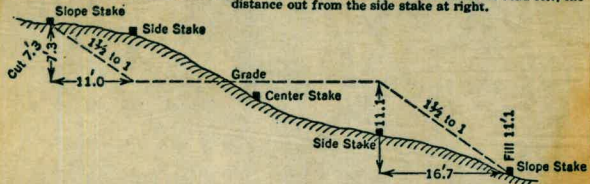
590

590

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1 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.

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JAN 13 1965

The paper in this book No. F370A
is made of 50% high grade rag stock
with a WATER RESISTING surface sizing.

10,455. cm, h, ai. cm.

Index

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Levels - E Keyway 4

Original Cross-Section
East Keyway 5-15

Original Cross-Section
West Keyway 16-22

Original Cross-Section
East Keyway 23-24

Original Cross-Section
West Keyway 25-30

Addition to Original 31-35
Cross-Section E Keyway

Addition to Original 36-42
Cross-Section - W. Side
STA. 5+41 to 6+41 (SOUTH)

092

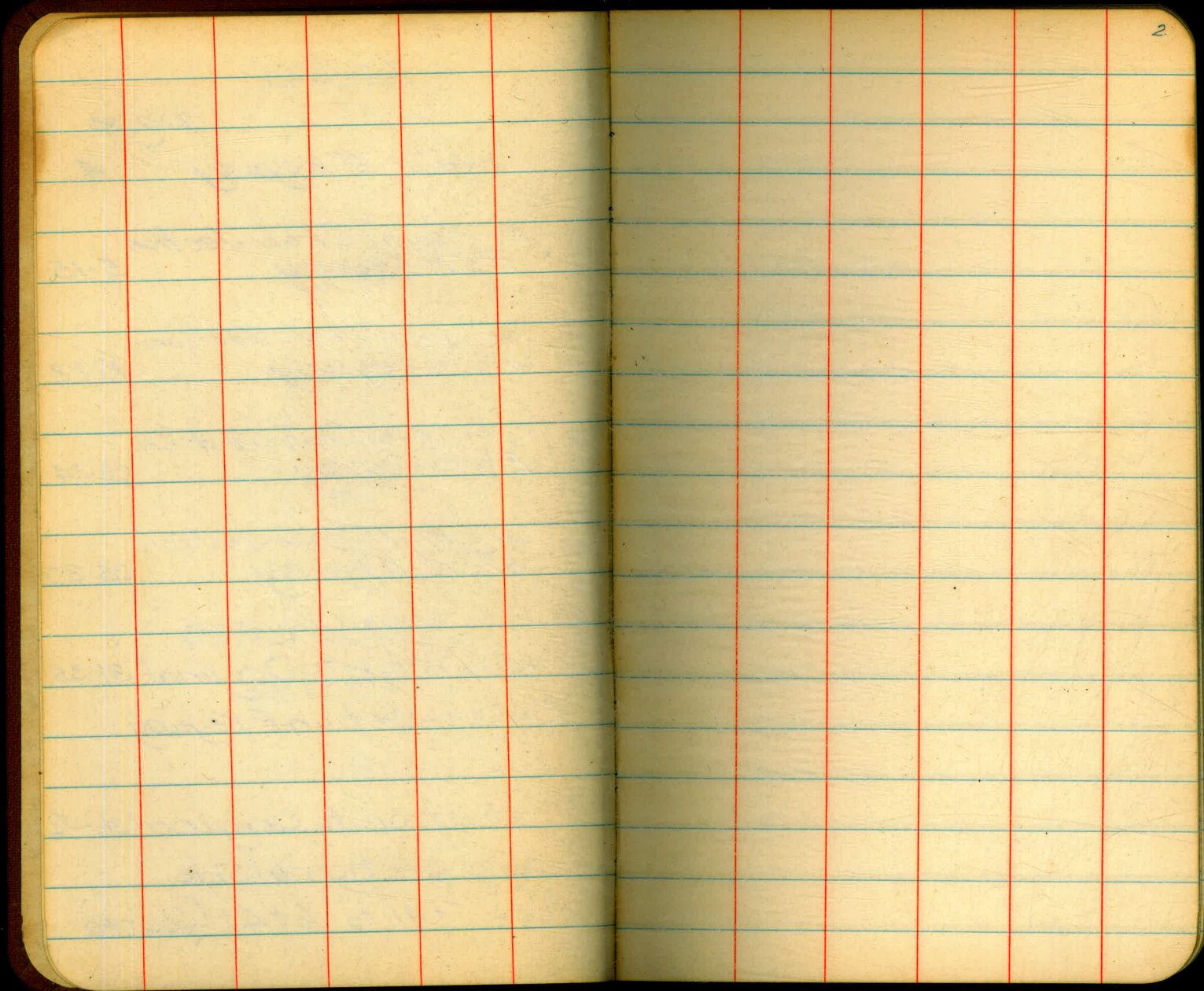
MICROFILMED

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2

LEVELS - EAST KEYWAY

B.M. 33 594.72

178 596.50

46 591.9

B.M. 33 178 594.72

11/25/41

4

π Dickinson

π Ecker

φ Bruce

φ King

OFFSET 50. ELE. 592 = 45.83 (tables)

Original
Cross-section E. side dam

Date - 11/27/41

Weather: Fair

Warm

Dickinson

Ecker

Jackson

Loing

Polak

King

Cote

5.

Sta + H.I. - Elev

A-25

B.M.

588.25

Top of rock outcrop - 110' ± S of Axis

1.59 589.84 ✓

Sta. 10 + 50 approx

10+40

110'S

6.7 583.1 ✓

120'S

12.5 577.3 ✓

130'S

16.1 573.7 ✓

10+50

130'S

8.2 581.6 ✓

120'S

5.8 584.0 ✓

110'S

2.4 587.4 ✓

T.P.

0.75 589.09 ✓

1265 601.74 ✓

plotted
12-18-41

(ORIGINAL GROUND)
Cross-section E. side of dam

Date - 11/27/41

6

Sta + H.I - Elev

601.74

10+60

110'S 4.6 597.1 ✓

120'S 7.4 594.3 ✓

130'S 11.0 590.7 ✓

T.P. 1.43 600.31 ✓

11.75 612.06 ✓

10+70

110'S 10.9 601.2 ✓

120'S 10.9 601.2 ✓

130'S 11.9 600.2 ✓

Plotted
12-18-41

ORIGINAL GROUND
Cross-section E side of dam

Date - 11/27/41

7.

Sta + H.I. - Elev.

6+206

10+80

130'S 6.9 605.2 ✓

120'S 6.4 605.7 ✓

110'S 6.1 606.0 ✓

100'S 5.8 606.3 ✓

10+90

100'S 2.8 609.3 ✓

110'S 2.4 609.7 ✓

120'S 2.2 609.9 ✓

130'S 2.3 609.8 ✓

T.P. 0.07 611.99 ✓

Plotted
12-18-41

Cross-section E. side of dam

Date - 11/27/41

8

Sta + H.I. - Elev

T.P. 611.99

13+10 625.09 ✓

11+00

90'S 14.1 611.0 ✓

100'S 10.7 614.4 ✓

110'S 11.8 613.3 ✓

120'S 10.0 615.1 ✓

130'S 9.1 616.0 ✓

11+10

130'S 3.8 621.3 ✓

120'S 4.0 621.1 ✓

110'S 5.5 619.6 ✓

100'S 7.1 618.0 ✓

90'S 10.8 614.3 ✓

Photo
12-18-41

Cross-section of E. side dam Date-11/27/41

9

Sta + H.I - Elev

62509 ✓

11+20

90'S	6.9	618.2 ✓
100'S	3.1	622.0 ✓
110'S	2.9	622.2 ✓
120'S	2.8	622.3 ✓
130'S	2.3	622.8 ✓

11+30

90'S	3.6	621.5 ✓
100'S	2.1	623.0 ✓
110'S	1.7	623.4 ✓
1 T.P.	1.2.1	623.88 ✓

12.87 636.75⁵

11/27/44

10

Sta + H.I. - Elev

636.7⁵

11+30

120's 9.4 627.4 ✓

130's 8.2 628.6 ✓

11+40

90's 13.8 623.0 ✓

100's 11.0 625.8 ✓

110's 8.8 628.0 ✓

120's 5.0 631.8 ✓

130's 2.4 634.4 ✓

11+50

90's 10.6 626.2 ✓

100's 8.0 628.8 ✓

Plotted
12-18-41

11/27/44

11

Sta - H.I. - Elev.

636.7⁵₆

11+50

110'S 5.4 631.4 ✓

120'S 2.5 634.3 ✓

T.P. 1.58 635.1⁷₈

12.12 647.²⁹₅

11+50

130'S 10.0 637.3 ✓

11+60

90'S 14.0 633.3 ✓

Plot 4
12-18-41

11/27/41

12.

Sta + H.I - Elev

647.²⁹~~30~~

11+60

100's 9.8 637.5 ✓

110's 8.7 ~~638.6~~ 638.6

120's 7.6 639.7 ✓

130's 4.6 642.7 ✓

11+70

90's 7.7 639.6 ✓

100's 5.7 641.6 ✓

110's 1.7 645.6 ✓

11+80

90's 4.1 643.2 ✓

Plotted
12-18-41

11/27/44

15

Sta.	+	H.I	-	Elev.
		647. ²⁹ ₃₀		
		11780		
100's		1.7		645.6 ✓
T.P.		1.32		645. ⁹⁷ 98
	12.25	658. ² 75		
		11780		
110's		6.8		651.4 ✓
		11790		
90's		11.4		646.8 ✓
100's		7.8		650.4 ✓

Plotted
12-18-41

11/27/44

14.

Sta.	+	H.I.	-	Elev
		658.23 ²		
		11+90		
110's		4.5		653.7 ✓
		12+00		
90's		7.5		651.7 650.7 ✓
100's		4.1		654.1 ✓
110's		1.3		656.0 ✓
		12+10		
90's		3.4		654.8 ✓
100's		0.6		657.6 ✓
T.P.		0.73		657. ⁴⁹ 50

 Plopped
 12-18-41

ORIGINAL GROUND -
Cross-section E. side of dam

11/27/44
Fair - Warm

Jackson
King
Loring

15

Sta. + H.I. - Elev.

12.51 670.00

12+20

90's 8.6 661.4 ✓

100's 4.9 665.1

12+30

90's 2.7 667.3 ✓

100's 0.4 669.6 ✓

dirt road

A-31
B.M. 6.94 663.0⁶ 663.09

Plotted
12-18-41

ORIGINAL GROUND -
Cross-section - W. side of Dam

11/28/41
Fair - Warm

Jackson
King
Latng

16

Sta. + H.L. - Elev.

A-15
B.M.

680.35

1.36 681.71 ✓

3+11

50's 6.3 675.4 ✓ 0

40's 8.1 673.6 ✓ 0

30's 8.4 673.3 ✓ 0

3+01

50's 3.8 677.9 ✓ 0

40's 4.7 677.0 ✓ 0

30's 7.0 674.7 ✓ 0

20's 11.7 670.0 ✓ 0

2+91

10'N 11.0 670.7 ✓ 0

11/28/41

17

Sta + H.I. - Elev

681.71 ✓

2+91

Axs 10.4 671.3 ✓ 0

10's 10.7 671.0 ✓ 0

20's 5.9 675.8 ✓ 0

30's 6.0 675.7 ✓ 0

40's 0.0 681.7 ✓ 0

2+81

30's 0.4 681.3 ✓ 0

20's 2.5 679.2 ✓ 0

10's 3.9 677.8 ✓ 0

Axs 6.8 674.9 ✓ 0

10'N 8.8 672.9 ✓ 0

11/28/41

18

Sta.	+	H.I.	-	Elev.
		681.71 ✓		
		2+71		
10' N			11.0	670.7 ✓ 0
Axis			6.3	675.4 ✓ 0
10'S			1.5	680.2 ✓ 0
T.P.			0.03	681.68 ✓
	10.83	692.51 ✓		
		2+71		
20'S			10.0	682.5 ✓ 0
30'S			7.0	685.5 ✓ 0
40'S			6.0	686.5 ✓ 0
50'S			4.3	688.2 ✓ 0

11/28/41

19

Sta + H.I - Elev

692.51 ✓

2+81

50's 5.5 6870 ✓ 0

40's 8.5 6840 ✓ 0

2+91

50's 10.0 6825 ✓ 0

T.P. 12.77 679.74 ✓

1.69 681.43 ✓

T.P. 11.96 669.47 ✓

0.46 669.93 ✓

2+71

20's 4.2 665.7 ✓ 0

11/28/41

20.

Sta	+	H.I.	-	Elev
		669.93 ✓		
		2+71		
30' N			7.5	662.4 ✓ 8
40' N			8.7	661.2 ✓ 8
		2+81		
40' N			12.4	657.4 ⁵ ✓ 8
30' N			10.8	659.1 ✓ 8
20' N			6.0	663.9 ✓ 8
		2+91		
20' N			7.3	662.6 ✓ 8
T.P.			12.37	657.56 ✓
	10-10	667.66 ✓		

11/28/41

27

Sta	+	H.I.	-	Elev	
		669.66 ✓			
		2+91			
40'N			12.7	655.0 ✓	Ø
30'N			11.7	656.0 ✓	Ø
		3+01			
10'S			1.7	666.0 ✓	Ø
4x15			3.5	664.2 ✓	Ø
10'N			2.0	665.7 ✓	Ø
20'N			5.1	662.6 ✓	Ø
30'N			12.9	654.8 ✓	Ø
		3+11			
20'N			8.8	658.9 ✓	Ø
10'N			6.6	661.1 ✓	Ø
7x15			6.1	661.6 ✓	Ø

ORIGINAL GROUND
Cross-section for W. side
of Dam

11/28/41
Fair - Worm

Jackson
King
Loing

22.

Sta	+	H.I.	-	Elev	
		667.66 ✓			
		3+11			
20'S			0.1	667.6 ✓	Ø
10'S			2.0	665.7 ✓	Ø
T.P.			13.09	654.57 ✓	
	1.42	655.99 ✓			
		3+11			
30'N			4.0	652.0 ✓	Ø
40'N			8.1	647.9 ✓	Ø
		3+01			
40'N			5.2	650.8 ✓	Ø
B.M.			6.49	649.55 ✓	
A-16					

CROSS SECTION - ORIGINAL GROUND

11-29-41

23

Dickinson
Ecker
KING

OF KEYWAY - ON EAST SLOPE

A-26
B.M. 602.34

12.38 614.72 ✓

T.P. 1.16 613.56

12.26 625.82 ✓

T.P. 1.15 624.67

12.60 637.27 ✓

T.P. 0.53 636.74 ✓

12.67 649.41 ✓

11+70

130 S 0.3 649.1 ✓

120 S 5.2 644.2 ✓

T.P. 2.01 647.40 ✓

12.23 659.63 ✓

11+80

120 S 7.5 652.1 ✓

130 S 6.9 652.7 ✓

Plotted
12-18-41

11/29/41

2.d.

659.63

11+90

1205 2.1 657.5 ✓

1305 0.0 659.6 ✓

T.P. 0.94 658.69 ✓

12 11 670.80 ✓

12+10

1105 9.7 661.1 ✓

1205 6.0 664.8 ✓

1305 7.0 663.8 ✓

12+00

1305 9.5 661.3 ✓

1205 10.2 660.6 ✓

12+20

1105 3.6 667.2 ✓

BM# 7.69 663.11 ✓

Record Eley = 663.09 See F.B.554 Pg. 77 #

17/10 + had
12-18-41

Cross-Sections - Original
Ground - West Keyway

12/9/41
Cool - cloudy

Dickinson
Jackson 25.
Laird
Polak
King
Cole

Sta.	+ HI	- Elev
A-13		629.33
B.M.	12.99	642.32
	3+81	
90'S.	1.2	641.1
	3+71	
90'S.	4.56	36.7
	3+91	
90'S	7.0	35.3
100'S	8.5	33.8
	4+01	
90'S	12.0	30.3
T.P.	11.57	630.75
B	0.34	631.09

12/9/41
Cool-cloudy

Sta.	+ H.I.	- Elev
	631.09 ✓	
	4+01	
100'S.	2.4	628.7 ✓
	4+11	
90'S	48	26.3 ✓
100'S	56	25.5 ✓
	4+21	
90'S	9.5	21.6 ✓
100'S	12.1	19.0 ✓
T.P.	12.80	618.29 ✓
1.11	619.40 ✓	

12/9/41

27

Sta.	+	H.I.	-	Elev
		619.40		
		4+21		
110's			3.3	616.1
		4+31		
100's			4.7	14.7
90's			3.7	15.7
		4+41		
90's			9.1	10.3
100's			12.0	7.4
		4+31		
110's			8.5	10.9
T.P.			12.09	607.31
	0.06	607.37		

12/9/41

28

Sta	+	H.I.	-	Elev.
		607.3 ⁷		
		4+41		
110's			2.0	605.4
120's			6.5	600.9
		4+51		
90's			4.6	602.8
100's			5.8	601.6
110's			8.0	599.4
120's			12.8	594.6
T.P.			12.48	594.89
	1.25	596.14		

12/9/41

29.

Sta.	+	H.I.	-	Elev
		596.14		
		4+61		
90's			2.4	593.7 /
100's			3.7	92.4 /
110's			3.8	92.3 /
120's			7.8	88.3 /
		4+71		
90's			8.0	88.1 /
100's			9.3	86.8 /
110's			10.5	85.6 /
120's			13.1	83.0 /
T.P.			11.60	584.54
	0.59	585.13		

Cross Sections - Original
Ground - West Keyway

12/9/41
Cool-cloudy

Dickinson
Jackson
Iging
Polak
King
Cole

30.

Sta.	+	H.I.	-	Elev.
		585.13 ✓		
		4+81		
110's			5.5	579.6 ✓
120's			6.6	78.5 ✓
		4+91		
110's			10.5	74.6 ✓
120's			11.0	74.1 ✓
T.P.			0.63	589.50 ✓
	8.65	593.15 ✓		
B.M. A-12			0.76	592.45 ✓
				592.45

Addition to Original Cross

1/23/42
Fair - Warm

Dickinson 31.
Jackson
Pelak
Laing
King
Cole

Section of East Abutement

Sta + H.I. - I.S. Elev.

A-28
B.M.

707.80

0.90 708.70

13+50

6.4 702.3

30' North of Axis

13+50

5.2 703.5

40' " " "

13+40

7.7 701.0

40' " " "

13+40

8.6 700.1

30' " " "

13+40

10.0 698.7

20' " " "

13+40

11.2 697.5

10' " " "

13+30

12.3 696.4

10' " " "

13+30

10.5 698.2

20' " " "

13+30

13.2 695.5

30' " " "

13+30

12.5 696.2

40' " " "

T.P.

12.3

696.41

0.62 697.03

13+30

1.8 695.2

Axis

Addition to Original Cross

Section of East Abutement

1/23/42
Fair - Warm

Dickinson 52
Jackson
Palak
Laing
King
Cole

Sta + H.I. - I.S. Elev

697.03

13+30		3.0	694.0	10' South of Axis
13+30		2.2	694.8	20' " " "
13+20		5.7	691.3	30' " " "
13+20		5.2	691.8	20' " " "
13+20		4.4	692.6	10' " " "
13+20		2.8	694.2	Axis
13+20		4.8	692.2	10 North " "
13+20		5.2	691.8	20' " " "
13+20		10.9	686.1	30' " " "
13+20		8.4	688.6	40' " " "
13+10		3.5	693.5	50' South " "
13+10		7.9	689.1 ✓	40' " " "
13+10		7.2	689.8 ✓	30' " " "
13+10		5.9	691.1 ✓	20' " " "

Addition to Original Cross
Section of East Abutement

1/23/42
Fair - Warm

Dickinson 53.
Jackson
Palak
Laing
King
Cole

Sta + H.I. - I.S. Elev

697.03

13+10 9.0 6880 10' South of Axis

13+10 13.1 6839 Axis

13+10 13.3 6837 10' North " "

13+00 9.2 6878 50' South " "

12+90 12.0 6850 " " " "

12+90 11.5 6855 60' " " "

T.P. 1303 68400

0.96 68496

13+10 4.2 6808 20' North " "

13+10 6.3 6787 30' " " "

13+10 8.6 6764 40' " " "

13+10 13.2 671.8 50' " " "

12+80 1.6 6834 50' South " "

12+80 2.1 6829 60' " " "

12+80 0.8 684.2 70' " " "

Addition to Original Cross
Section of East Abutement

11/23/42
Fair - Warm

Dickinson 34.
Jackson
Palak
Laing
King
Cole

Sta + H.I. - I.S. Elev

684.96

12+70 3.5 681.5 60 South of Axis

12+60 4.4 680.6 70 " " "

12+60 6.5 678.5 70 " " "

12+60 7.6 677.4 80 " " "

12+50 9.7 675.3 80 " " "

12+50 10.6 674.4 90 " " "

12+50 9.8 675.2 100 " " "

12+40 12.2 672.8 90 " " "

T.P. 12.96 672.00

0.35 672.35

12+50 1.1 671.2 70 " " "

12+40 1.3 671.0 100 " " "

12+40 1.0 671.3 110 " " "

12+30 4.0 668.3 120 " " "

12+30 3.7 668.6 110 " " "

Addition to Original Cross

Section of East Abutement

Sta + H.I. - I.S. Elev.

672.35

12+20 5.6 666.7 120 South of Axis

12+20 6.8 665.5 130 " " "

A-
B.M. 9.28 663.07 El. of B.M. = 663.09

1/23/42
Fair-Warm

Dickinson 35.
Jackson
Polak
Laing
King
Cole

2/6/42
Cool-Cloudy

Dickinson
Jackson
Polak
King
Cote

36

Addition to Original
Cross-Section - W. Abutement

Sta. + H.I. - I.S. Elev.

T.B.M. 475.23

11.16 486.39

6+41

220'S 10.6 475.8

230'S 12.9 473.5

240'S 14.0 472.4

250'S 16.3 470.1

6+31

220'S 3.3 483.1

230'S 4.3 482.1

240'S 4.6 481.7

250'S 5.9 480.5

T.P. 0.04 486.35

11.88 498.23

2/6/42
Cool-Cloudy

37

Sta + H.I. - I.S. Elev.

498.23

6+21

190'S 7.1 491.1

200'S 7.9 490.3

210'S 8.4 489.8

220'S 8.8 489.4

230'S 9.6 488.6

240'S 10.3 487.9

250'S 10.5 487.7

6+11

250'S 8.0 490.2

240'S 6.4 491.8

230'S 4.8 493.4

220'S 4.1 494.1

210'S 1.5 496.7

200'S 1.9 496.3

190'S 0.2 498.2

2/6/42
Cool-Cloudy

38.

Sta. + H.I. - I.S. Elev.

498.23

6+01

230'S 0.0 498.2

240'S 0.2 498.0

T.P. 0.20 498.03

12.67 510.70

6+01

220'S 10.1 500.6

210'S 9.2 501.5

200'S 8.2 502.5

190'S 7.1 503.6

180'S 6.2 504.5

5+91

180'S 1.9 508.8

190'S 2.9 507.8

200'S 3.5 507.2

2/6/42
Cool - Cloudy

39

Sta. + H.I. - I.S. Elev.

510.70

5+91

210'S 3.3 507.4

220'S 3.6 507.1

230'S 7.0 503.7

T.P. 0.58 510.12

11.70 521.82

5+91

170'S 6.7

5+81

230'S 11.8 510.0

220'S 9.8 512.0

210'S 7.9 513.9

200'S 8.2 513.6

190'S 9.0 512.8

180'S 9.2 512.6

170'S 4.8

2/6/42
Cool-Cloudy

40.

Sta. + H.I. - IS Elev.

521.82

5+71

190'S 1.0 520.8

200'S 2.0 519.8

210'S 3.7 518.1

220'S 4.0 517.8

230'S 6.5 515.3

T.P. 0.46 521.36

11.72 533.08

5+71

180'S 11.6 521.5

170'S 11.6 521.5

5+61

170'S 5.2 527.9

180'S 4.6 528.5

190'S 6.0 527.1

2/6/42
Cool - Cloudy

41.

Sta + H.I. - I.S. Elev.

53308

5+61

200'S 6.2 526.9

210'S 2.9 530.2

220'S 8.4 524.7

T.P. 0.70 532.38

1269 545.07

5+61

160'S 10.2 534.9

5+51

150'S 2.8 542.3

160'S 2.7

170'S 4.7

180'S 8.0

190'S 9.1

200'S 11.3

Addition to Original
Cross-Section - W. Side

2/6/42
Cool - Cloudy

42

Sta	+	H.I.	-	I.S.	Elev.
		545.07			
		5+41			
200'S				2.9	542.2
190'S				3.0	542.1
180'S				1.5	543.6
170'S				4.5	540.6
160'S				+1.1	546.2
150'S				+3.7	548.8
T.P.			0.63		544.44
	1300	557.44			
T.P.			5.76		551.68
	1294	564.62			
A-11					
B.M.			6.09		558.53
					558.56

SLOPE STAKES
HIGHWAY X-SECTIONS DS.

Rogers
Jul. 20 - 1907

Sta Grade GR.

H.I. = 479.82

1+51.9 479.40

1.4 1.4 1.0
-1.0 -1.0 -1.0
11.0 11.0

479.23
4.59
479.82

1+75.8 478.91 0.9

2.6
-1.7

1+99.8 477.95 1.9

17

12

3.7
-1.8

2+24.6 476.96 2.9

15.6
-12.3
33.0

4.7
-1.8

18.7
-15.8
33.7

H.I. = 476.09

2+55 475.74 0.3

1.7
-1.4
17.1

1.4
-1.1

12.3
-12.0
33.0

475.23
86
476.09

27.1
1.4
30.5
1.5
32.0

HIGHWAY X-SECTIONS D.S.

Sta Grade G.R.

±

HI = 476.09

2+85 474.65 1.4

20
-06
15.9

18
-04

10.9
-9.3
28.9

3+15 474.13 2.0

20
00
15.0

18
02

11.9
-9.9
29.8

3+45 "

20
00
15.0

17
03

6.2
-4.2
21.3

P.T.
3+86.57 "

20
00
15.0

20
00

2.0
0.0
15.0

HIGHWAY X-SECTIONS U.S.

July 25-07

Sta Grade G.R.

±

H.I. = 483.99

483.61

0+144.6 480.90 3.6

3.6
0.0

.38
483.99

P.C.

0+394.6 480.23 3.8

4.4
-0.6

9.2
-5.4
23.1

0+59.6

15.3
-11.5
37.2

4.9
-1.1

9.1
-5.3
22.9

P.T.

0+79.23

5.1
-1.3

5.8
-2.0
18.0

1+00 480.18 3.8

5.0
-1.2
16.8

5.2
-1.2

5.8
-2.0
18.0

15.3
-11.5
37.2

HIGHWAY X-SECTIONS U.S.

STA GRADE G.R.

H.I. - 483.99

1+30 480.11 3.9

4.1
-0.2
15.3

4.3
-0.2

4.4
-0.5
15.7

Pipe Line

1+60 480.02 4.0

3.6
0.2
12.0

3.8
0.2

4.3
-0.3
15.4

FINAL GRADE STAKES - HIGHWAY DETOUR

July 27th
DICKINSON

BM Station	2.01	482.03	GRADE ROD	480.02	
147.9		479.57	2.46		
147.58		479.08	2.95		
1499.78		478.12	3.91		
2124.6		477.13	4.90	PC	0'-00"
2155 ⁰⁰		475.90	6.13		2°-43'-18"
2185 ⁰⁰		474.82	7.21		5°-24'-27"
3115.00		474.30	7.73		8°-05'-36"
3145 ⁰⁰		474.30	7.73		10°-46'-45"
3186 ⁵⁷		474.30	7.73		14°-30'-00"

BM	1.21	484.82		483.61
0139 ⁴⁶		480.40	4.42	
0159 ⁶		480.40	4.42	
0179 ⁷³		480.40	4.42	
1100		480.35	4.47	
1130		480.28	4.54	
1160		480.19	4.63	

B.M. #25 588.245

B.M. #26 602.315

B.M. #28 707.80

B.M. #31 663.09

B.M. #32 626.055

B.M. #33 594.72

B.M. #34 553.575

670.0
2.7

67.3

658.2
0.6

57.6

13+10 82.03 478.71
 12.75 78.82 77

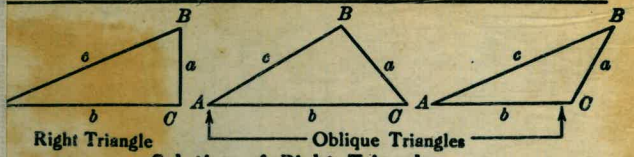
246 N. to bank
 13+20 2 9.5 2424.60
 13+30 - 2.0 1,109.78 ✓

13+40 82.03
 77.15 24.82

24.05 ✓ 3407.32
 82.76 ✓ 1775.95
 2482 845

131.63
 479.60
 47 131.41

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 |

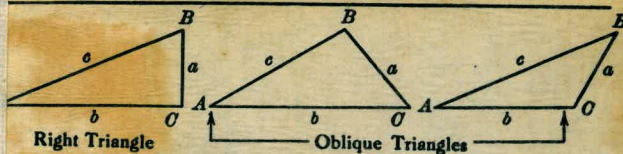
MADE IN U.S.A.

Angle	Sine	Cosine	Tangent	Cotangent	Secant	Cosecant
0	0.0000	1.0000	0.0000	∞	1.0000	∞
1	0.0174	0.9998	0.0174	57.29	1.0002	57.29
2	0.0349	0.9994	0.0349	28.65	1.0006	28.65
3	0.0523	0.9986	0.0523	19.08	1.0010	19.08
4	0.0698	0.9976	0.0698	14.30	1.0014	14.30
5	0.0872	0.9963	0.0872	11.43	1.0018	11.43
6	0.1042	0.9948	0.1042	9.51	1.0022	9.51
7	0.1213	0.9930	0.1213	8.24	1.0026	8.24
8	0.1382	0.9909	0.1382	7.26	1.0030	7.26
9	0.1549	0.9886	0.1549	6.46	1.0034	6.46
10	0.1714	0.9860	0.1714	5.77	1.0038	5.77
11	0.1877	0.9831	0.1877	5.21	1.0042	5.21
12	0.2039	0.9799	0.2039	4.75	1.0046	4.75
13	0.2200	0.9764	0.2200	4.38	1.0050	4.38
14	0.2358	0.9726	0.2358	4.08	1.0054	4.08
15	0.2514	0.9686	0.2514	3.86	1.0058	3.86
16	0.2668	0.9643	0.2668	3.71	1.0062	3.71
17	0.2820	0.9598	0.2820	3.60	1.0066	3.60
18	0.2970	0.9550	0.2970	3.52	1.0070	3.52
19	0.3118	0.9500	0.3118	3.46	1.0074	3.46
20	0.3264	0.9448	0.3264	3.42	1.0078	3.42
21	0.3408	0.9393	0.3408	3.39	1.0082	3.39
22	0.3550	0.9336	0.3550	3.37	1.0086	3.37
23	0.3690	0.9277	0.3690	3.36	1.0090	3.36
24	0.3829	0.9216	0.3829	3.35	1.0094	3.35
25	0.3966	0.9153	0.3966	3.35	1.0098	3.35
26	0.4101	0.9088	0.4101	3.35	1.0102	3.35
27	0.4234	0.9021	0.4234	3.35	1.0106	3.35
28	0.4365	0.8952	0.4365	3.35	1.0110	3.35
29	0.4494	0.8881	0.4494	3.35	1.0114	3.35
30	0.4621	0.8808	0.4621	3.35	1.0118	3.35
31	0.4747	0.8733	0.4747	3.35	1.0122	3.35
32	0.4871	0.8656	0.4871	3.35	1.0126	3.35
33	0.4993	0.8577	0.4993	3.35	1.0130	3.35
34	0.5114	0.8496	0.5114	3.35	1.0134	3.35
35	0.5233	0.8413	0.5233	3.35	1.0138	3.35
36	0.5351	0.8328	0.5351	3.35	1.0142	3.35
37	0.5467	0.8241	0.5467	3.35	1.0146	3.35
38	0.5581	0.8152	0.5581	3.35	1.0150	3.35
39	0.5694	0.8061	0.5694	3.35	1.0154	3.35
40	0.5806	0.7968	0.5806	3.35	1.0158	3.35
41	0.5917	0.7873	0.5917	3.35	1.0162	3.35
42	0.6027	0.7776	0.6027	3.35	1.0166	3.35
43	0.6136	0.7677	0.6136	3.35	1.0170	3.35
44	0.6244	0.7576	0.6244	3.35	1.0174	3.35
45	0.6351	0.7473	0.6351	3.35	1.0178	3.35
46	0.6457	0.7368	0.6457	3.35	1.0182	3.35
47	0.6562	0.7261	0.6562	3.35	1.0186	3.35
48	0.6666	0.7152	0.6666	3.35	1.0190	3.35
49	0.6769	0.7041	0.6769	3.35	1.0194	3.35
50	0.6871	0.6928	0.6871	3.35	1.0198	3.35
51	0.6972	0.6813	0.6972	3.35	1.0202	3.35
52	0.7072	0.6696	0.7072	3.35	1.0206	3.35
53	0.7171	0.6577	0.7171	3.35	1.0210	3.35
54	0.7269	0.6456	0.7269	3.35	1.0214	3.35
55	0.7366	0.6333	0.7366	3.35	1.0218	3.35
56	0.7462	0.6208	0.7462	3.35	1.0222	3.35
57	0.7557	0.6081	0.7557	3.35	1.0226	3.35
58	0.7651	0.5952	0.7651	3.35	1.0230	3.35
59	0.7744	0.5821	0.7744	3.35	1.0234	3.35
60	0.7836	0.5688	0.7836	3.35	1.0238	3.35
61	0.7927	0.5553	0.7927	3.35	1.0242	3.35
62	0.8017	0.5416	0.8017	3.35	1.0246	3.35
63	0.8106	0.5277	0.8106	3.35	1.0250	3.35
64	0.8194	0.5136	0.8194	3.35	1.0254	3.35
65	0.8281	0.5003	0.8281	3.35	1.0258	3.35
66	0.8367	0.4868	0.8367	3.35	1.0262	3.35
67	0.8452	0.4731	0.8452	3.35	1.0266	3.35
68	0.8536	0.4592	0.8536	3.35	1.0270	3.35
69	0.8619	0.4451	0.8619	3.35	1.0274	3.35
70	0.8701	0.4308	0.8701	3.35	1.0278	3.35
71	0.8782	0.4163	0.8782	3.35	1.0282	3.35
72	0.8862	0.4016	0.8862	3.35	1.0286	3.35
73	0.8941	0.3867	0.8941	3.35	1.0290	3.35
74	0.9019	0.3716	0.9019	3.35	1.0294	3.35
75	0.9096	0.3563	0.9096	3.35	1.0298	3.35
76	0.9172	0.3408	0.9172	3.35	1.0302	3.35
77	0.9247	0.3251	0.9247	3.35	1.0306	3.35
78	0.9321	0.3092	0.9321	3.35	1.0310	3.35
79	0.9394	0.2931	0.9394	3.35	1.0314	3.35
80	0.9466	0.2768	0.9466	3.35	1.0318	3.35
81	0.9537	0.2603	0.9537	3.35	1.0322	3.35
82	0.9607	0.2436	0.9607	3.35	1.0326	3.35
83	0.9676	0.2267	0.9676	3.35	1.0330	3.35
84	0.9744	0.2096	0.9744	3.35	1.0334	3.35
85	0.9811	0.1923	0.9811	3.35	1.0338	3.35
86	0.9877	0.1748	0.9877	3.35	1.0342	3.35
87	0.9942	0.1571	0.9942	3.35	1.0346	3.35
88	1.0006	0.1392	1.0006	3.35	1.0350	3.35
89	1.0069	0.1211	1.0069	3.35	1.0354	3.35
90	1.0131	0.1028	1.0131	3.35	1.0358	3.35

When
 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.

13+10 82.03 478.71
 13+20 78.02 17
 13+30 246 24.8
 13+10 - 246 N. to bank
 13+20 - 9.5 24.24.60
 13+30 - 9.0 14.99.78
 13+40 82.03 24.82
 77.15
 24.05 ✓ 3407.32
 82.76 ✓ 1475.95
 24.82 845
 131.63
 3407.36
 1475.95
 479.60
 479

TRIGONOMETRIC FORMULÆ



Solution of Right Triangles
 For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given | Required |

a.

a, c

A, a

A, b

A, c

Given

B, a

a, b

a, c

B, c

a, b, c

B, C, c

Horizontal

Slope

When

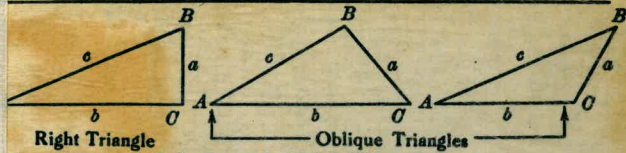
rise less the square of the rise divided by twice the slope distance. Thus: rise=14 ft., slope distance=302.6 ft. Horizontal distance=302.6 - $\frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.

OFFSET UPSTREAM

Elev	0	1	2	3	4	5	6	7	8	9
650	2.20									
640	2.70	2.65	2.60	2.55	2.50	2.20	2.20	2.20	2.20	2.20
630	3.20	3.15	3.10	3.05	3.00	2.95	2.90	2.85	2.80	2.75
620	4.43	3.65	3.60	3.55	3.50	3.45	3.40	3.35	3.30	3.25
610	4.93	4.88	4.83	4.78	4.73	4.68	4.63	4.58	4.53	4.48
600	5.43	5.38	5.33	5.28	5.23	5.18	5.13	5.08	5.03	4.98
590	6.44	6.34	6.24	6.14	5.73	5.68	5.63	5.58	5.53	5.48
580	7.44	7.34	7.24	7.14	7.04	6.94	6.84	6.74	6.64	6.54
570	9.18	8.34	8.24	8.14	8.04	7.94	7.84	7.74	7.64	7.54
560	10.18	10.08	9.98	9.88	9.78	9.68	9.58	9.48	9.38	9.28
550	11.18	11.08	10.98	10.88	10.78	10.68	10.58	10.48	10.38	10.28
540	12.18	12.08	11.98	11.88	11.78	11.68	11.58	11.48	11.38	11.28
530	13.18	13.08	12.98	12.88	12.78	12.68	12.58	12.48	12.38	12.28
520	15.06	14.08	13.98	13.88	13.78	13.68	13.58	13.48	13.38	13.28
510	16.06	15.96	15.86	15.76	15.66	15.56	15.46	15.36	15.26	15.16
500	17.06	16.96	16.86	16.76	16.66	16.56	16.46	16.36	16.26	16.16
490	18.06	17.96	17.86	17.76	17.66	17.56	17.46	17.36	17.26	17.16
480	19.06	18.96	18.86	18.76	18.66	18.56	18.46	18.36	18.26	18.16
470	20.65	19.96	19.86	19.76	19.66	19.56	19.46	19.36	19.26	19.16
460	21.65	21.55	21.45	21.35	21.25	21.15	21.05	20.95	20.85	20.75

82.03 478.71
 78.12 17
 .8
 - 246 N. to bank
 95
 - 9.1 2424.60
 - 2.0 1,199.78

TRIGONOMETRIC FORMULÆ



Right Triangle Oblique Triangles
 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 |

OFFSET DOWNSTREAM

Elev.	0	1	2	3	4	5	6	7	8	9
650	14.00									
640	14.64	14.41	14.23	14.10	14.03	14.00	14.00	14.00	14.00	14.00
630	18.92	18.42	17.93	17.45	16.99	16.54	16.10	15.68	15.27	14.93
620	24.79	24.13	23.49	22.88	22.25	21.66	21.08	20.52	19.97	19.44
610	32.15	31.39	30.63	29.87	29.11	28.35	27.60	26.87	26.16	25.46
600	39.75	38.99	38.23	37.47	36.71	35.95	35.19	34.43	33.67	32.91
590	47.35	46.59	45.83	45.07	44.31	43.55	42.79	42.03	41.27	40.51
580	54.95	54.19	53.43	52.67	51.91	51.15	50.39	49.63	48.87	48.11
570	62.55	61.79	61.03	60.27	59.51	58.75	57.99	57.23	56.47	55.71
560	70.15	69.39	68.63	67.87	67.11	66.35	65.59	64.83	64.07	63.31
550	77.75	76.99	76.23	75.47	74.71	73.95	73.19	72.43	71.67	70.91
540	85.35	84.59	83.83	83.07	82.31	81.55	80.79	80.03	79.27	78.51
530	92.95	92.19	91.43	90.67	89.91	89.15	88.39	87.63	86.87	86.11
520	100.55	99.79	99.03	98.27	97.51	96.75	95.99	95.23	94.47	93.71
510	108.15	107.39	106.63	105.87	105.11	104.35	103.59	102.83	102.07	101.31
500	115.75	114.99	114.23	113.47	112.71	111.95	111.19	110.43	109.67	108.91
490	123.35	122.59	121.83	121.07	120.31	119.55	118.79	118.03	117.27	116.51
480	130.95	130.19	129.43	128.67	127.91	127.15	126.39	125.63	124.87	124.11
470	138.55	137.79	137.03	136.27	135.51	134.75	133.99	133.23	132.47	131.71
460	146.15	145.39	144.63	143.87	143.11	142.35	141.59	140.83	140.07	139.31

319.4 x .0041 = 1.31. 319.4 - 1.31 = 318.09 ft.
 If 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.

13+10

82.03

478.71

12/25

78.42

17
0.8

13+10 - 246 N. to bank

13+20 - 9.5 2424.60

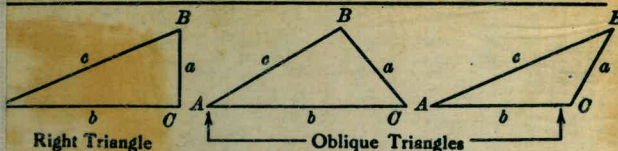
13+30 - 9.0 100.00

13+

F	S	T	O
1.41	13.41	14.41	15.41
1.51	13.51	14.51	15.51
1.61	13.61	14.61	15.61
1.71	13.71	14.71	15.71
1.81	13.81	14.81	15.81
1.91	13.91	14.91	15.91
2.01	14.01	15.01	16.01
2.11	14.11	15.11	16.11
2.21	14.21	15.21	16.21
2.31	14.31	15.31	16.31
2.41	14.41	15.41	16.41
2.51	14.51	15.51	16.51
2.61	14.61	15.61	16.61
2.71	14.71	15.71	16.71
2.81	14.81	15.81	16.81
2.91	14.91	15.91	16.91
3.01	15.01	16.01	17.01
3.11	15.11	16.11	17.11
3.21	15.21	16.21	17.21
3.31	15.31	16.31	17.31
3.41	15.41	16.41	17.41
3.51	15.51	16.51	17.51
3.61	15.61	16.61	17.61
3.71	15.71	16.71	17.71
3.81	15.81	16.81	17.81
3.91	15.91	16.91	17.91
4.01	16.01	17.01	18.01
4.11	16.11	17.11	18.11
4.21	16.21	17.21	18.21
4.31	16.31	17.31	18.31
4.41	16.41	17.41	18.41
4.51	16.51	17.51	18.51
4.61	16.61	17.61	18.61
4.71	16.71	17.71	18.71
4.81	16.81	17.81	18.81
4.91	16.91	17.91	18.91
5.01	17.01	18.01	19.01
5.11	17.11	18.11	19.11
5.21	17.21	18.21	19.21
5.31	17.31	18.31	19.31
5.41	17.41	18.41	19.41
5.51	17.51	18.51	19.51
5.61	17.61	18.61	19.61
5.71	17.71	18.71	19.71
5.81	17.81	18.81	19.81
5.91	17.91	18.91	19.91
6.01	18.01	19.01	20.01
6.11	18.11	19.11	20.11
6.21	18.21	19.21	20.21
6.31	18.31	19.31	20.31
6.41	18.41	19.41	20.41
6.51	18.51	19.51	20.51
6.61	18.61	19.61	20.61
6.71	18.71	19.71	20.71
6.81	18.81	19.81	20.81
6.91	18.91	19.91	20.91
7.01	19.01	20.01	21.01
7.11	19.11	20.11	21.11
7.21	19.21	20.21	21.21
7.31	19.31	20.31	21.31
7.41	19.41	20.41	21.41
7.51	19.51	20.51	21.51
7.61	19.61	20.61	21.61
7.71	19.71	20.71	21.71
7.81	19.81	20.81	21.81
7.91	19.91	20.91	21.91
8.01	20.01	21.01	22.01
8.11	20.11	21.11	22.11
8.21	20.21	21.21	22.21
8.31	20.31	21.31	22.31
8.41	20.41	21.41	22.41
8.51	20.51	21.51	22.51
8.61	20.61	21.61	22.61
8.71	20.71	21.71	22.71
8.81	20.81	21.81	22.81
8.91	20.91	21.91	22.91
9.01	21.01	22.01	23.01
9.11	21.11	22.11	23.11
9.21	21.21	22.21	23.21
9.31	21.31	22.31	23.31
9.41	21.41	22.41	23.41
9.51	21.51	22.51	23.51
9.61	21.61	22.61	23.61
9.71	21.71	22.71	23.71
9.81	21.81	22.81	23.81
9.91	21.91	22.91	23.91
10.01	22.01	23.01	24.01

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TRIGONOMETRIC FORMULÆ



Right Triangle
 Oblique Triangles
 Solution of Right Triangles
 For Angle A. $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\csc = \frac{c}{a}$

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

Solution of Oblique Triangles

Given	Required	Formulas
B, a, c	b, c, C	$b = \frac{a \sin B}{\sin A}$, $C = 180^\circ - (A + B)$, $c = \frac{a \sin C}{\sin A}$
a, b, c	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	$A + B = 180^\circ - C$, $\tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b}$ $c = \frac{a \sin C}{\sin A}$
b, c, C	A, B, C	$s = \frac{a + b + c}{2}$, $\sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$ $\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}$, $C = 180^\circ - (A + B)$
b, c, Area	Area	$s = \frac{a + b + c}{2}$, $\text{area} = \sqrt{s(s - a)(s - b)(s - c)}$
b, c, Area	Area	$\text{area} = \frac{bc \sin A}{2}$
C, a, Area	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° 10'. From Table, Page IX. $\cos 5^\circ 10' = .9959$. Horizontal distance = 319.4 × .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. $\cos 5^\circ 10' = .9959$. $1 - .9959 = .0041$. $319.4 \times .0041 = 1.31$. $319.4 - 1.31 = 318.09$ 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.