

FALL 1954

DREDGE REPAIRS

MEIZO

1

FIELD, SCOT

1047

1047

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be $30.6 + (20 - 16) \div 2$ or 2 ft. added to $30.6 = 32.6$. For slopes of 1 on $1\frac{1}{2}$ see inside of back cover.

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DREDGE REPAIR SCHEDULE

1955-1956

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Dredge 11

① Buckets, Lips, Pins, & Bushings:

70 Buckets in the line, all O.K.

Bucket Line Tape removed this Fall.

Regd for 1955 70 Lips B-7155

70 Bushings O.S. $\frac{1}{8}$ " B-5181

Regd for 1956 70 Lips B-7155

70 Bushings O.S. B-5181

70 Pins A-5141

② Ladder & Suspension:

check over, repair, weld etc.
where necessary.

3 sets (6) Roller Bushings. F-8274

③ Lower Tumbler:

Remove & send bearing cap to shop
To be built up & machined

Send Tumbler to shop where hub
built up & machined.

④ Upper Tumbler:

Build up cushion ^{plate} in the Spring.

Build up cushion plate holes.

Req'd for 1955 - 6 Heel Plates C-8136

30 Bolts $1\frac{1}{4}" \times 6"$

" " 1956 6 Ear Plates D-8136

⑤ Main Drive:

Re-line pulley shaft and check over & make any necessary adjustments.

Turn over Main Drive Belt.

⑥ Ladder Hoist:

Send the Friction shaft to the Shop to be over-hauled.

Ladder lines O.K.

Req. 2 spare Ladder lines: $1" \times 575'$

⑦ Swing Winch & Controls:

Check over all drums, depression leaves, etc at shutdown & send any parts needing repair to the shop this Fall.

Req'd - 1 - Bow line $1" \times 900'$

1 - " " $1" \times 800'$

1 - Gross line $\frac{3}{8}" \times 1500'$

stern line O.K.

⑧ Deck Sheaves & Fair-leads:

check over & repair where necessary.

⑨ Screen Machinery:

Overhaul drive machinery in the Spring

→ check Forl Treads This Fall.

Screen Drive Roller gear to be replaced.

→ Send Screen Drive Tread to the shop

F-8277

⑩ Revolving Screen:

Reqd for 1955: 8 End Batt/straps D-7051

24 Lifting Bars B-5221

1 Lower end liner Bar Ring Drug# 10-2

Reqd for 1956 8 plates B-8362

16 " C-8362

8 " F-8362

16 I.S Batt/straps C-7051

16 End " " D-7051

16 Lifting Bars A-5221

50 " " B-5221

8 Joint lifting Bars A-7051

20 B-7051

32 Lower End liner Bars G-7051

8 upper " " A-8508

8 Obstruction segments E-7051

⑪ Hopper, Spout, ^{chute}Screen, & Savelall:

Hopper: Check over & weld & repair where necessary. Require 2 Plates No 11-8

Spout: Reg'd. ¹⁹⁵⁵ 1 Port Bottom Liner Box C-8632

1 Centre " " " D-8632

1 Std " " " E-8632

8632 B

1 Port liner H-2536 B

8632 F

1 Std " H-2536 F

Reg'd. 1956 1-Port Bottom Liner Box C-8632

1-Centre " " " D-8632

1-Std " " " E-8632

^{chute}
Reg'd - 1955 48 Nugget catcher Bars B-5123

Savelall: Patch up the walls of the lower part of the hopper.

⑫ Screen Casing:

check over & patch with rubber where necessary.

(13) Distributor, Tables, & Tail/slurice.

Reg'd. 1955 - 10 Starting angles 13-6

Dist. Patch & rebuild where reg'd.
 6 - Std Side Dist. Wearing Plates Drwg ?

13-7

Tables: To be patched where reg'd.
 Send worn ripples to the Shop this Fall.

Reg'd - 50 Ripples 34"

Tail/slurice: O.K.(14) Stacker Machinery:

Send drive & snub roller bearings
 to the shop To be re-bolting
 Check suspension & pins

Reg'd 3 centre rolls. Type 2P

6 end rolls. " 15P

Side Pan plates 2 - $7\frac{1}{16}$ " x $7\frac{3}{4}$ " x 60' - 6"

11

(15) Pumps, Screens & Piping:

Inspect all pumps & screens at shut-down & send any parts needing repair to the shop.

(16) Sand Elevators:

Overhaul in the Spring.

Send the upper drums to the shop & have rims put on sides - $\frac{7}{8}$ " x 2"

Upper part of hoisting to be sent to shop & overhauled.

(17) Spud & Suspension:

check for loose bolts & broken plates
all suspension pins

Line is O.K.

(18) Hall & Housing:

Reg'd 2-Port Side Plates 3' x 3' x 1/2"

(19) Miscellaneous:

send all gas Tanks to the shop
to be checked.

Boiler inspected & O.K.

Dredge 8① Buckets, Lips, Pins, & Bushings:

67 Buckets in the line: All OK.

Reg'd 1955	67 Lips		A-5386
	30 Bushings	O.S.	B-5181
	67 Pins		A-5141

Reg'd 1956:	67 Lips		A-5386
	67 Bushings	O.S.	B-5181

② Ladder & Suspension:

check rollers.

Patch Pan.

Shim the chafing beam on the gantry as there is too much play.

Reg'd 1955 2 lines - $\frac{3}{8}$ " x 500'③ Lower Tumbler:

check bearings & washers & repack.

④ Upper Tumbler:

Buildup cushion plates & weld wedges
1 set heel plates on board A-5277

Reg'd 1955 12 - 1' $\frac{1}{4}$ " x 7" Bolts
12 - 1' x 8" "

Reg'd 1956 6 Heel Plates A-5277

⑤ Main Drive:

Refit bearings

check over & re-align

Tighten all bolts & adjust where necessary

clean all guards & repair " "

Both ball wheels to be driven further onto shaft

⑥ Ladder Hoist:

Bearings to be lined upon the brake

Align brgs on ladder hoist shaft

Digging Friction blocks to be installed (1 set aboard)

check all Transfer rods & reset & align all brgs.

⑦ Swing Winch & Controls:

Same as 54-55

Reg'd For 1955 - 2 Bowlines: 1 - 1" x 900'

1 - 1" x 800'

1 stern line: $\frac{3}{8}$ " x 800'

1 Grass " : $\frac{3}{8}$ " x 1500'

Main drive (cont)

Key To have lug welded on end

(cont) The bow line drums must be thoroughly checked at shut-down for bushing wear. In the spring line up all Transfer shafts & bearings. Inspect all reach rods & pins & lubricate where necessary

⑧ Deck Sheaves & Fairleads

check & over-haul all deck sheaves & fairleads

Send shore sheaves to shop for repair.

⑨ Screen Machinery:

Send 2 idler-rollers To shop for machining.

Send 4 idler-brgs To shop to be built up.

Reg'd 1955 ⁽¹⁰⁾ 3 sets Brg bushings A-5301

6-1/2" washers - K-8296

Send old washers to shop to be machined to smaller size

⑩ Revolving Screen:

Reg'd 1955 New upper Tread band (fr'd)

sections 53,405 8 Screen plates A-8362

8 " " B-8362

8 " " C-8362

8 " " F-8362

32 inside ball straps C-7051

16 End " " D-7051

24 Lifting bars B-5221

8 " " (long) A-5221

8 Joint lifting Bars A-7051

32 " " " B-7051

32 Lower end liner Bars F-7051

Reg'd bolts, nuts & washers for all plates, bars etc.

(cont)

check all machine drive.

Side & Thrust rollers to be shimmed.

check drive pinion for wear.

(cont)

Reg'd for 1956: sec 24A & Screen Plates

8 " "

16 Lifting bars B-5221

16 Joint lifting bars B-7051

8 upper end liner plates B-8508

8 obstruction segments F-7051

Wearing rings for lower end liner bars F-7051

(11) Screen Casing:

Requires patching.

" 2 sets bars stbd side

No 12-1

(12) Hopper, Spout, Chute, & Savelall:Hopper. Reg's all new liner pins.

Casing requires overhauling.

Spout. Requires 15 old pins (long) & 10 short pins
as per drawing #11-25Savelall.

Requires new spray pipe

" patching

" 2 new rails

8629

" all new wearing plates (bottom of savelall)

#11-23

Chute. Requires new bars centre to port side
#11-21 A, B, C, D, E & F or 5418

⑬ Distributor, Tables, & Tailshafts:

Dist. Cut out Top of partitions & weld in new pieces
Reg'd- 14 starting angles. 8992 MRE

Tables require patching
Tailshafts " "

send worn rittles to the shop this Fall

⑭ Stocker Machinery:

check all machinery, drum & snub roller this fall.

send bogie to shop for re-babbitting.

Reg'd 1955	4 centre rollers	Type 47A
	8 end "	" 46A
	3 return "	" 4132

Lower drum reg's 1 set of collars on the shaft
check shaft in the yard

(15) Pumps, Screen, & Water Piping:

Pumps to be checked & sent to the shop
check foot valves for wear

New couplings to be welded on the screen
spray pipe. (H.P.)

std pump hose reg's end brace

several water pipes to be replaced

12 Nozzles - 2" x 6" (H.P.) 10 Nozzles - 1 1/2" (L.P.)
x44

(16) Spud & Suspension:

Freeze down & check spud point

Tighten all loose bolts on the spud.

Repair lower spud keepers.

change wearing plates on the upper spud keeper.

check for cracked plates on spud.

check suspension sheaves & pins.

(17) Hull & Housing:

Reg's Corner plate for Port side of well hole

" Well hole plate port side (3rd plate from bow)

Pat on deck canvas & Paint (All now aboard)

5357

M-546

(18) Sand Elevator:

Reg's general overhaul.

(19) Miscellaneous:

Send all gas tanks in to be checked.

Boiler overhauled this fall. O.K.

New Tubes fitted.

Power cable floats to be repaired.

Dredge 6

① Buckets, Lips, Bushings, & Pins:

There are 76 buckets in the line (All OK)

Reg'd 1955	76 Lips	A-5386
	76 Bushing std	A-5181

Reg'd 1956	76 Lips	A-5386
	76 Bushings std	A-5181
	76 Pins	A-5141

② Ladder & Suspension:

upper Ladder Tows re-riveted

Pan to be patched

2 Ladder rollers to be replaced

Ladder chairs to go to shop for re-building

2 Ladder lines - 1" x 500'

③ Lower Tumbler:

Appears O.K.

check bearings & washers & repack.

AC-8169

← Drawg 8169-K

④ Upper Tumbler:

Build up cushion plates

Reg'd for 1955 6 cushion plates C-8136

12 Ear plates D-8136

30 - $1\frac{1}{2}$ " x $6\frac{1}{2}$ " Bolts.

Reg'd for 1956 6 - Heel plates C-8136

⑤ Main Drive:

check, align & tighten bearings.

Tighten up bolts

⑥ Ladder Hoist:

OK. check over

⑦ Swing Winch & Controls:

check, align & re-adjust

Send bow line drums & shaft to shop for
rebushing & fitting

(cont.)

Reg'd for 1955	1 Bow line	1" x 800'
	1 " "	1" x 900'
	1 Stern "	$\frac{3}{4}$ " x 800'
	1 Grass line	$\frac{3}{8}$ " x 1500'

⑧ Deck Sheaves & Fairleads:

check & those needing repair to be sent to shop.

⑨ Screen Machinery:

Appears O.K. check over

⑩ Revolving Screen:

Reg'd 1955	12 screen Plates ^(Sect.) (34)	M	8129
	6 " " (5)	N	8129
	18 Joint lifting bars	G-	8129
	36 Lifting "	H-	8129
	12 I.S. Batt straps	K-	8129
	Bolts, nuts & lock washers		
	Wearing Ring for lower liner plate. #10-6		

(cont)

Reg'd 1956	6-Screen Plates ^(Sect.) (1)	B-8129
	6 " " (2)	C-8129
	12 Joint Lifting Bars	G-8129
	24 " "	H-8129
	12 I.S. Batt straps	K-8129
	6 End " "	J-8129
	6 Obstruction Segments	A-5236
	6 Lower End Liner Plates	D-8139
	6 upper " " "	E-8139

- (11) Screen Casing:
Patching Required.

- (12) Hopper, Spout, Saveall, & Chute.

Hopper: Requires Patching
" 3-2 1/2" x 30" Pins for bottom of hopper

Spout: Reg'd ¹⁹⁵⁵ - 6 Wearing bars E-8136
Reg'd 1956 6- " " E-8136

Chute: Reg'd 1955 6-Wearing bars ¹¹⁻¹⁵

Saveall: Replace worn plates & patch
were necessary.

Re-design & build a new saveall.

(13) Distributor, Tables & Tail/Sluices:

All in good shape
 send worn ripples to shop.

Req'd for 1955 1 spare set of rubber for Tail/Sluice
 1 set of tailsluice cover bars - ~~8780~~ ⁸⁷⁸⁰

MK. A

(14) Stacker Machinery:

Operating well.

send brgs to shop for re-babbiting

Req for 1955 Complete set of drive shaft
 bearings.

6 - centre rollers

Type 47A

12 - end rollers

" 80

Send 2 snub rollers to shop

" lower drum brg to shop for re-babbiting

⑮ Pumps, Screen, & Water Piping:

Open up & Inspect in Fall.
Send worn parts to shop.

Install extra spray pipe on each of the first three Tables. Measure & draw up after dredge shots down.

⑯ Sand Elevator:

⑰ Hall & Housing:

Hall leaking in the stern & should be repaired this fall.

Remove lower tie timbers & bolt gentries to the boat.

Rebolt the bottom planks & caulk.

(18) Spud & Suspension:

Overhaul the spud keepers
Freeze the lower spud keeper.

(19) Miscellaneous:

Boiler inspected this Fall O.K.
Send all tanks, gauges etc to shop this
fall for testing.

Dredge 9

① Buckets, Lips, Bushings & Pins:

There are 65 buckets in the line.

Req'd 1955: 65 $\frac{1}{8}$ " O.S. Bushings A-5346

Req'd 1956: 65 Pins A-5217

65 Welded Lips A-5383

65 Bushings $\frac{1}{8}$ " O.S. A-5346

② Ladder & Suspension:

check over in spring. Re-rivet where necessary. Upper end castings to have bolts tightened. check to see if ladder roller bushings are in the shape if they have been rubbed. check suspension sheave

Req'd - 2 lines 1" x 450'

③ Lower Tumbler:

Remove & send to shop in fall to have hub built up.

④ Upper Tumbler:

Build up under the plates if necessary.

Reg'd 1955 - 6 Heel Plates A-5278

1 set Bolts (1" longer than usual) #4

Reg'd 1956: 6 Heel Plates A-5278

⑤ Main Drive:

Inspect, Tighten all bolts & make any necessary adjustments.

⑥ Ladder Hoist:

check over in the spring & adjust friction
Re-line the brake.

Ladder hoist drum is cracked in the key-way.

⑦ Swing Winch & Controls:

check all drums & brgs in the spring

Inspect & lubricate reach rods, pins & brgs.

Reg'd 1955 1 Bowline $\frac{7}{8}$ " x 800'

1 sternline $\frac{3}{4}$ " x 800

1 set bowline brake blocks A-8282

⑧ Deck Sheaves & Fairleads:

check in the fall & send worn ones to the shop for re-bushing.

⑨ Screen Machinery:

check over in the fall.

⑩ Revolving Screen:

Replace Sec. I Plates (on board now)

Reg'd 1955 6 lower end liners

D-8/39

⑩ Screen Casing.

Check over in the Spring & patch
where necessary.

⑪ Hopper, Spout, Chate, & Saveall:

Hopper Require a new back plate See Drwg. 9050K.
" a new lip plate See Drwg. A-8286
" 8 - 7 1/2" old bucket pins (cat off 4")

Spout Reqs. 4 Bars E-8136

Reqd 1956 A Bars E-8136

Saveall: Patch where necessary

Chate: Patch where necessary.

⑬ Distributor Tables & Tail/Slarices:

Dist. Patch partitions between each section of dist.

Tables: Req. 7 new rubbers for head of the Tables
Patch upper end of Tables

Tail/slurices: 2 Plates - $9' \times 35" \times \frac{1}{8}"$
4 old screen Plates - $4\frac{1}{2}'$ long (flattened)

send old ripples to the shop.

⑭ Stacker Machinery:

Send all prgs to the shop for re-babbiting
check rubber on upper drum.

Inspect & patch pan.

34" W. do

⑮ Pumps, Screens & Water Piping:

Open all pumps this fall & send worn parts to shop for repair.

Req. 24 Screen nozzles.

Send 4" Pump to shop this fall.

Try to freeze down stbd pump house to replace planks that are missing.

⑯ Spud & Suspension:

check all suspension & all pins.

check for loose rivets on the spuds tighten where necessary.

⑰ Hull & Housing:

Freeze down stbd forward corner & replace plate. (Plate is here now)

Bolt the plate on where possible

Put 4" plates on both sides of bow to protect it against ice (3' wide) check length

⑱ Miscellaneous:

send all gas tanks in this fall for inspection

Boiler was inspected this fall. O.K.

Dredge 10

① Buckets, Lips, Pins, & Bushings:

65 Buckets in the line - All O.K.

Reg'd 1955: 65 Welded Lip Segments A-5386

65 Bushings (std) A-5181

135 Lip Bolts $1\frac{1}{4}" \times 6\frac{1}{4}"$ (+extres)105 Washers $1\frac{1}{4}"$

Reg'd 1956: 65 Welded Lip Segments A-5386

65 Bushings (std) A-5181

65 Pins A-5141

135 Bolts & Washers $1\frac{1}{4}"$

② Ladder & Suspension:

check over pan & patch where necessary.

Send 3 rollers to shop for re-building

③ Lower Tumbler:

Remove, check over & re-pack in Spring

④ Upper Tumbler:

Build up cushion plates

Replace wedges.

Replace Heel plates (on board new)

8 Bolts - $1\frac{1}{2}$ " x 8" - 6 Bolts $1\frac{1}{2}$ " x 7"

Req'd for 1956: 6 Heel plates

⑤ Main Drive:

Line up in the Spring

check shaft & Brgs in Spring

⑥ Ladder Hoist:Appears O.K. check over in spring
& Tighten all bolts & adjust friction⑦ Swing Winch & Controls:Remove bow line drums & clean up this Fall
check over, inspect & lubricate
send swing winch pulley shaft & Brgs to
shop for repair, this fall

(cont)

18 washers - $1\frac{1}{2}$ "

(cont)

Req'd 1955 2 Bow lines 1 - 1" x 900'
1 - 1" x 800'

⑧ Deck Sheaves & Fair leads:

check over in fall & send those requiring new bushings to the shop.

check drive & Brgs & clean up in spring

⑨ Screen Machinery:

check idler rollers & Brgs this fall.

send any worn parts to shop for repair.

⑩ Revolving screen:

Reg'd	8	Screen Plates	A-8362
	8	" "	B-8362
	16	" "	C-8362
	8	" "	F-8362
	24	I.S. Bott Straps	C-7051
	16	End " "	D-7051
	16	Lifting Bars	A-5221
	32	" "	B-5221
	8	Joint Lifting Bars	A-7051
	32	" "	B-7051
	32	Lower End Linc Bars	F-7051
	8	upper " " Plates	B-8508
	8	Obstruction segments	E-7051

⑪ Screen Casing:

check over & patch where necessary.

1 set skirt bars (Sec Dr. 8) #12#1

⑫ Hopper, Spout, chute & Saveall:

Hopper: Reline with ^{old} Bucket Pins
Patch where necessary

Spout: 1955 1 Bottom Plate 202673 AA

" " "

" " "

1956: 1 " " 202673 AA

1 " "

1 " "

chute: All OK. Patch where necessary.

Saveall: O.K. Check over & patch
where necessary

(13) Distributor, Tables, & Tailsluices:

Replace distributor with same one as on Dr. 8. Present one is badly worn.

Tailsluices O.K.

Require 1955 1 set Joint Cover Strips Port & stbd. #13-5

Tables: Patch where necessary

send worn rittles to shop.

Enough on board for 1955

(14) Stacker Machinery:

check over & send worn Brgs to shop this Fall.

Req'd 1955	6 Centre Rolls	Type 47-A
	12 Side "	" 46-A
	2 Return Rolls	Type 4132

check suspension in the Spring.

⑮ Pumps, Screen, & Water Piping:

Open up all pumps & inspect in the fall
send worn parts to shop for repair

Screens all OK.

Send ^{side} spray pipes to shop to have nipples
replaced. Replace worn pipes.

Require Main spray pipe Nozzles (12) 2" x 6"

⑯ Hull & Housing:

Freeze down well hole this winter to
replace stbd chafing plate. Plate is aboard now.
Hull requires patching.

⑰ Miscellaneous:

send grass line hoist to shop for overhaul.

send gas tanks & torches to shop this fall.

Boiler checked this fall. & O.K.

Paint Boiler in spring.

Require new air-receiver (compressor)

check over Tie rods in the spring &

Tighten where necessary.

Repaint boat & renew deck canvass.

38" diam x 6'

Dredge 12

① Buckets, Lips, Bushings, & Pins:

There are 60 Buckets in the line. All O.K.

Reg'd 1955 60 Lips Amco 185565

60 Bushings (onboard) " 185566

60 Pins 9 # 2-4402

Reg'd 1956 60 Lips Amco 185565

60 Pins " 185566

60 Bushings (std) 2-4402

② Ladder & Suspensions: O.K.

Reg'd Ladder roller bushings

Send worn rollers to shop this fall

③ Lower Tumbler:

Remove & check over this fall

Send Brgs to shop.

Order new spare lower Tumbler

④ Upper Tumbler:

Reg'd 1955: 6 Heel Plates 5458

check over & rebuild if necessary.

Have spare Upper Tumbler & plates

⑤ Main Drive:

Main Drive Inter. shaft breaks the big bolts;
replace with $1\frac{1}{2}$ " bolts x 35"

⑥ Swing Winch & Ladder Hoist:

check over & repair as necessary.

Drive shaft to be removed & inspected

Bow line drums to be " " "

(cont.)

2 Bow lines - $7/8$ " x 400'

2 shore " $1\frac{1}{8}$ " x 600'

⑦ Deck Sheaves & Fairleads:

check over & send worn ones to shop for
rebushing.

⑧ Screen Machinery:

check over thoroughly & sand worn parts to shop.

Reg drive shaft & gear	drive shaft	Gross
	6-216	216-5
" spare motor pinion	12-216	

⑨ Revolving Screen:

Reg 1955 1 set plates
 1 " wearing plates upper & lower
 1 " lifting bars
 1 " I.S. Ballstraps 5411
 1 " set balls, nuts & washers

Reg. drug of screen treads

⑩ Screen Casing:

Will be changed in the spring.

⑪ Hopper, Spout, chute, & Saveall:

Hopper: Reg. 1 set wearing plates.

Patch & repair

Hopper should be widened out to facilitate wing chutes.

Spout: Regs. 1 set wearing bars.

Chute: Regs. new plates.

Saveall: To be re-designed.

⑫ Distributor, Tables & Tailshafts:

Req. new distributor Tables etc.

⑬ Pumps & Water Piping:

Open up & inspect. Send worn parts
to shop for repair.

⑭ Stacker Machinery:

check over.

Req. new set of stacker rolls. ^{Top} (upper)
new set of return rollers

Put cover on stacker

Req. stacker winch.

(15) Hall & Housing:

After partoon leaking. To be welded

(16) Miscellaneous:

Req. boiler.

Send gas Tanks to shop for Testing.

Req. new tin for housing.

Dredge 4

① Buckets, Pins, Lips & Bushings:

There are 70 buckets in the line. All OK

Reg'd 1955: 140 Round Bushings Std. A-5179

70 Lips A-7222

70 Pins D-8100

Reg'd 1956: 140 ^{round} Bushings std A-5179

70 Lips A-7222

② Ladder-Suspension:

Reg'd Spare Suspension Shaft. 5384

Upper & lower Ends of Ladder need rivetting.

Reg'd ^{'55} 20 Roller Pins 1" x 14"

check stock of Roller Brg Bushings. E-8132

③ Lower Tumbler:

check in spring & repack.

④ Upper Tumbler:

Build up under heel plates

Reg'd 1955: 6 Ear Plates

6 Heel Plates

24 Bolts $1/2" \times 10"$

Reg'd 1956: 6 Heel Plates

E-7056

A-7056

(or board now)

A-7056

⑤ Main Drive:

check in spring & tighten all bolts, brgs & adjust friction.

⑥ Ladder Hoist:

Take friction apart & clean up.

⑦ Swing Winch & Controls:

check over all drums at shutdown, inspect friction & brake rods, lubricate all transfer shafts, brgs & pins

Regd 1055: 2 bow lines $1\frac{1}{4}" \times 1200'$
 2 stern " $1" \times 1000'$
 1 spud line $1\frac{1}{4}" \times 600'$
 1 gross " $\frac{1}{2}" \times 1500'$

⑧ Deck Sheaves & Fairleads:

check at shutdown & send worn ones to shop for re-bushing.

Regd 1055 - 2 Shore Floats Drug 7191

Ladder Hoist lead sheave to be replaced.

⑨ Screen Machinery:

check in spring.

side roller & thrust roller to be checked & if necessary sent to shop.

check idler rollers.

⑩ Revolving Screen:

Reg'd 1955: 9 screen plates (Sec 1)	J-8165
18 End ball straps	B-7000
36 I.S. " "	E-7000
60 Lifting Bars	K-8165
36 Joint lifting Bars	H-8165

6-Lower End Inner Plates	- A-7000
Reg'd 1956: 9 Screen Plates (Sec 2)	B-8165
9 " " (Sec 3)	B-8165
9 " " (Sec 4)	D-8165
9 " " (Sec 5)	E-8165
36 Joint lifting Bars	H-8165
72 " "	K-8165
18 ~~Upper~~ End Ball Straps	B-7000
36 I.S. " "	E-7000
9 upper Hoop Weaving Plates	A-8229
9 Lower " " "	B-8229

⑪ Screen Casing:

Requires welding & patching at the lower end,

⑫ Hopper, Spout, Chute & Saveall:

Hopper: Reg'd 1955: 2 wearing plates C-8127
1956 " " " C-1827

Spout: Reg'd 1955: 1 Curved Pin 2- 7/8" x 3/4 Bolt
12 long Pins 12- 7/8" x 9
12 short Pins 12- 7/8" x 7

Require bolts for the pins. ↑

Chute: Reg'd 1956 3 wearing bars C-8128
1 Lip Plate E-8128

Saveall: Check & Patch & Weld where necessary.

⑬ Distributor, Tables & Tail/slucies:

Send worn ripples to shop

Reg'd 1955: 24's Mercury stop cover bars 31" long

Patch distributor where necessary.
starting angles on board

Stbd Tail/slucie requires new rubber lining.

2 sets Tail/slucie coverbars 8513

#11-5

"

"

#13-12

⑩ Stacker Machinery:

Require spare stacker belt.

Re Lag Upper Drum in Spring.

check all machinery & Drgs & Rollers
at shutdown.

Require a new par. The present one is
badly worn.

Finish stacker cover in the spring.

⑪ Pumps, Screen & Water Piping:

Open all pumps in full for inspection.
send worn parts to the shop.

Raise 10" Pump box to repair the bottom
of the box.

Repair Table spray Pipes.

Spray Pipe in the screen is badly worn &
needs replacing. send old pipe to
shop to be used for a pattern.

(16) Spud & Suspension:

check in the spring for loose bolts,
rivets & broken plates.

(17) Hull & Housing:

check for loose & broken Tie Rods.

Stern leaks. Requires repair
this fall.

(18) Sand Elevators:

Requires 2 new belts.

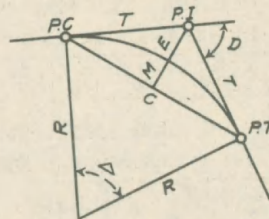
(19) Miscellaneous:

Send gas Tanks to shop this Fall
to be checked.

Boiler was checked & overhauled this
fall.

DIETZGEN'S RAILROAD CURVE AND REDUCTION TABLES

Copyright, 1914, by Eugene Dietzgen Co., New York City



CURVE FORMULAS

$$\text{Radius} = R = \frac{50}{\sin. \frac{D}{2}} \quad (1) \quad \text{Degree of Curve} = D \text{ and } \sin. \frac{D}{2} = \frac{50}{R} \quad (2)$$

$$\text{Tangent} = T = R \tan \frac{\Delta}{2} \quad (3) \quad \text{Length of Curve} = L = 100 \frac{\Delta}{D} \quad (4)$$

$$\text{Middle ordinate} = M = R(1 - \cos. \frac{\Delta}{2}) \quad (5) = R \text{vers } \frac{\Delta}{2} \quad (6)$$

$$\text{External} = E = T \tan \frac{\Delta}{4} \quad (7) = R \div \cos. \frac{\Delta}{2} - R \quad (8) = R \text{exsec } \frac{\Delta}{2} \quad (9)$$

$$\text{Long Chord} = C = 2 R \sin. \frac{\Delta}{2} \quad (10) \quad \Delta = \text{Central Angle}$$

EXPLANATION AND USE OF TABLES

Stations.—Given P. I. = Sta. 161 + 60.35 to find Sta. of P. C. and P. T. $\Delta = 62^\circ 10'$ $D = 8^\circ 20'$. From Table IV for 1° curve $T = 3454.1$ and $\div 8\frac{1}{3} = 414.49$ ft. From Table V correction = .36 or $T = 414.85$ ft. P. C. = Sta. P. I. - $T = 157 + 45.50$. Also from (4) $L = 746.00$ and P. T. = Sta. P. C. + $L = 164 + 91.50$.

Offsets.—Tangent offsets vary (approximately) directly with D and with square of the distance. Thus tangent offset for Sta. 158 on above curve is 2.16 ft. found as follows. From Table III tangent offset for 100 ft. = 7.27 ft. Distance = $158 - \text{Sta. P. C.} = 54.50$, hence offset = $7.27 (54.50 \div 100)^2 = 2.16$ ft. Also square of any distance divided by twice the radius equals (approximately) the distance from tangent to curve. Thus $(54.50)^2 \div (2 \times 688.26) = 2.16$ ft.

Deflections.—Deflection angle = $\frac{1}{2} D$ for 100 ft., $\frac{1}{4} D$ for 50 ft., etc. For c ft. = (in minutes) $.3 \times C \times D^\circ$ or = defl. for 1 ft. from Table III $\times C$. For Sta. 158 of above curve = $.3 \times 54.5 \times 8\frac{1}{3} = 136.2'$ or $2^\circ 16.2'$, or = $2.50 \times 54.5 = 136.2'$ from Table III. For Sta. 159 deflection angle = $2^\circ 16.2' + 8^\circ 20' \div 2 = 6^\circ 26.2'$, etc.

Externals.—May be found in similar manner to tangents. Thus E for curve above is 115.37. For from Table IV for 1° curve $E = 960.6$ for $8^\circ 20' = 960.6 \div 8\frac{1}{3} = 115.27$ and from Table V correction = .10 or $E = 115.37$ ft. Or suppose $\Delta = 32^\circ$ and E is measured and found to be 42 ft. What is D ? From Table IV $E = 230.9$ and $\div 42 = 5.5$ or $D = 5^\circ 30'$.

TABLE I.—MINUTES IN DECIMALS OF A DEGREE.

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

TABLE II.—INCHES IN DECIMALS OF A FOOT.

$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{15}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729	
1	2	3	4	5	6	7	8	9	10	11	
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	

TABLE III.—RADI, ORDINATES AND DEFLECTIONS.

Deg.	Radius	Mid. Ord.	Tan Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan Offset	Def. for 1 Foot	
0°	10'	34377.5	.036	.145	0.05'	7°	819.02	1.528	6.105	2.10'
	20	17188.8	.073	.291	0.10	20	781.84	1.600	6.395	2.20
	30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
	40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
	50	6875.55	.182	.727	0.25					
1		5729.65	.218	.873	0.30	8	716.78	1.746	6.976	2.40
	10	4911.15	.255	1.018	0.35	20	688.16	1.819	7.266	2.50
	20	4297.28	.291	1.164	0.40	30	674.69	1.855	7.411	2.55
	30	3819.83	.327	1.309	0.45	40	661.74	1.892	7.556	2.60
	40	3437.87	.364	1.454	0.50					
	50	3125.36	.400	1.600	0.55	9	637.28	1.965	7.846	2.70
2		2864.93	.436	1.745	0.60	20	614.56	2.037	8.136	2.80
	10	2644.58	.473	1.891	0.65	30	603.80	2.074	8.281	2.85
	20	2455.70	.509	2.036	0.70	40	593.42	2.110	8.426	2.90
	30	2292.01	.545	2.181	0.75	10	573.69	2.183	8.716	3.00
	40	2148.79	.582	2.327	0.80	30	546.44	2.292	9.150	3.15
	50	2022.41	.618	2.472	0.85	11	521.67	2.402	9.585	3.30
3		1910.08	.655	2.618	0.90	30	499.06	2.511	10.02	3.45
	10	1809.57	.691	2.763	0.95	12	478.34	2.620	10.45	3.60
	20	1719.12	.727	2.908	1.00	30	459.28	2.730	10.89	3.75
	30	1637.28	.764	3.054	1.05	13	441.68	2.839	11.32	3.90
	40	1562.88	.800	3.199	1.10	30	425.40	2.949	11.75	4.05
	50	1494.95	.836	3.345	1.15	14	410.28	3.058	12.18	4.20
4		1432.69	.873	3.490	1.20	30	396.20	3.168	12.62	4.35
	10	1375.40	.909	3.635	1.25	15	383.07	3.277	13.05	4.50
	20	1322.53	.945	3.718	1.30	30	370.78	3.387	13.49	4.65
	30	1273.57	.982	3.926	1.35	16	359.27	3.496	13.92	4.80
	40	1228.11	1.018	4.071	1.40	30	348.45	3.606	14.35	4.95
	50	1185.78	1.055	4.217	1.45	17	338.27	3.716	14.78	5.10
5		1146.28	1.091	4.362	1.50	18	319.62	3.935	15.64	5.40
	10	1109.33	1.127	4.507	1.55	19	302.94	4.155	16.51	5.70
	20	1074.68	1.164	4.653	1.60	20	287.94	4.374	17.37	6.00
	30	1042.14	1.200	4.798	1.65	21	274.37	4.594	18.22	6.30
	40	1011.51	1.237	4.943	1.70	22	262.04	4.814	19.08	6.60
	50	982.64	1.273	5.088	1.75	23	250.79	5.035	19.94	6.90
6		955.37	1.309	5.234	1.80	24	240.49	5.255	20.79	7.20
	10	929.57	1.346	5.379	1.85	25	231.01	5.476	21.64	7.50
	20	905.13	1.382	5.524	1.90	26	222.27	5.697	22.50	7.80
	30	881.95	1.418	5.669	1.95	27	214.18	5.918	23.35	8.10
	40	859.92	1.455	5.814	2.00	28	206.68	6.139	24.19	8.40
						29	199.70	6.360	25.04	8.70
						30	193.18	6.583	25.88	9.00

NOTE. Chord Deflection=2 times tangent deflection.

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10'	58.34	.30	10'	560.11	27.31	10'	1070.6	99.16
20'	66.67	.39	20'	568.53	28.14	20'	1079.2	100.75
30'	75.01	.49	30'	576.95	28.97	30'	1087.8	102.35
40'	83.34	.61	40'	585.36	29.82	40'	1096.4	103.97
50'	91.68	.73	50'	593.79	30.68	50'	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10'	1598.0	218.7	10'	2151.7	390.7	10'	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.8
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.4	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
61°	3375.0	920.2	71°	4086.9	1308.2	81°	4893.6	1805.3
10'	3386.3	925.9	10'	4099.5	1315.6	10'	4908.0	1814.7
20	3397.5	931.6	20	4112.1	1322.9	20	4922.5	1824.1
30	3408.8	937.3	30	4124.8	1330.3	30	4937.0	1833.6
40	3420.1	943.1	40	4137.4	1337.7	40	4951.5	1843.1
50	3431.4	948.9	50	4150.1	1345.1	50	4966.1	1852.6
62	3442.7	954.8	72	4162.8	1352.6	82	4980.7	1862.2
10	3454.1	960.6	10	4175.6	1360.1	10	4995.4	1871.8
20	3465.4	966.5	20	4188.5	1367.6	20	5010.0	1881.5
30	3476.8	972.4	30	4201.2	1375.2	30	5024.8	1891.2
40	3488.3	978.3	40	4214.0	1382.8	40	5039.5	1900.9
50	3499.7	984.3	50	4226.8	1390.4	50	5054.3	1910.7
63	3511.1	990.2	73	4239.7	1398.0	83	5069.2	1920.5
10	3522.6	996.2	10	4252.6	1405.7	10	5084.0	1930.4
20	3534.1	1002.3	20	4265.6	1413.5	20	5099.0	1940.3
30	3545.6	1008.3	30	4278.5	1421.2	30	5113.9	1950.3
40	3557.2	1014.4	40	4291.5	1429.0	40	5128.9	1960.2
50	3568.7	1020.5	50	4304.6	1436.8	50	5143.9	1970.3
64	3580.3	1026.6	74	4317.6	1444.6	84	5159.0	1980.4
10	3591.9	1032.8	10	4330.7	1452.5	10	5174.1	1990.5
20	3603.5	1039.0	20	4343.8	1460.4	20	5189.3	2000.6
30	3615.1	1045.2	30	4356.9	1468.4	30	5204.4	2010.8
40	3626.8	1051.4	40	4370.1	1476.4	40	5219.7	2021.1
50	3638.5	1057.7	50	4383.3	1484.4	50	5234.9	2031.4
65	3650.2	1063.9	75	4396.5	1492.4	85	5250.3	2041.7
10	3661.9	1070.2	10	4409.8	1500.5	10	5265.6	2052.1
20	3673.7	1076.6	20	4423.1	1508.6	20	5281.0	2062.5
30	3685.4	1082.9	30	4436.4	1516.7	30	5296.4	2073.0
40	3697.2	1089.3	40	4449.7	1524.9	40	5311.9	2083.5
50	3709.0	1095.7	50	4463.1	1533.1	50	5327.4	2094.1
66	3720.9	1102.2	76	4476.5	1541.4	86	5343.0	2104.7
10	3732.7	1108.6	10	4489.9	1549.7	10	5358.6	2115.3
20	3744.6	1115.1	20	4503.4	1558.0	20	5374.2	2126.0
30	3756.5	1121.7	30	4516.9	1566.3	30	5389.9	2136.7
40	3768.5	1128.2	40	4530.4	1574.7	40	5405.6	2147.5
50	3780.4	1134.8	50	4544.0	1583.1	50	5421.4	2158.4
67	3792.4	1141.4	77	4557.6	1591.6	87	5437.2	2169.2
10	3804.4	1148.0	10	4571.2	1600.1	10	5453.1	2180.2
20	3816.4	1154.7	20	4584.8	1608.6	20	5469.0	2191.1
30	3828.4	1161.3	30	4598.5	1617.1	30	5484.9	2202.2
40	3840.5	1168.1	40	4612.2	1625.7	40	5500.9	2213.2
50	3852.6	1174.8	50	4626.0	1634.4	50	5517.0	2224.3
68	3864.7	1181.6	78	4639.8	1643.0	88	5533.1	2235.5
10	3876.8	1188.4	10	4653.6	1651.7	10	5549.2	2246.7
20	3889.0	1195.2	20	4667.4	1660.5	20	5565.4	2258.0
30	3901.2	1202.0	30	4681.3	1669.2	30	5581.6	2269.3
40	3913.4	1208.9	40	4695.2	1678.1	40	5597.8	2280.6
50	3925.6	1215.8	50	4709.2	1686.9	50	5614.2	2292.0
69	3937.9	1222.7	79	4723.2	1695.8	89	5630.5	2303.5
10	3950.2	1229.7	10	4737.2	1704.7	10	5646.9	2315.0
20	3962.5	1236.7	20	4751.2	1713.7	20	5663.4	2326.6
30	3974.8	1243.7	30	4765.3	1722.7	30	5679.9	2338.2
40	3987.2	1250.8	40	4779.4	1731.7	40	5696.4	2349.8
50	3999.5	1257.9	50	4793.6	1740.8	50	5713.0	2361.5
70	4011.9	1265.0	80	4807.7	1749.9	90	5729.7	2373.3
10	4024.4	1272.1	10	4822.0	1759.0	10	5746.3	2385.1
20	4036.8	1279.3	20	4836.2	1768.2	20	5763.1	2397.0
30	4049.3	1286.5	30	4850.5	1777.4	30	5779.9	2408.9
40	4061.8	1293.6	40	4864.8	1786.7	40	5796.7	2420.9
50	4074.4	1300.9	50	4879.2	1796.0	50	5813.6	2432.9

TABLE IV.—TANGENTS AND EXTERNALS TO A 1° CURVE.

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10'	5847.5	2457.1	10'	6971.3	3294.1	10'	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92°	5933.2	2518.5	102°	7075.5	3374.9	112°	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93°	6037.8	2594.0	103°	7203.2	3474.4	113°	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94°	6144.3	2671.6	104°	7333.6	3576.8	114°	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95°	6252.8	2751.3	105°	7467.0	3682.3	115°	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96°	6363.4	2833.2	106°	7603.5	3791.0	116°	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97°	6476.2	2917.3	107°	7743.2	3902.9	117°	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98°	6591.2	3003.8	108°	7886.2	4018.2	118°	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99°	6708.6	3092.7	109°	8032.7	4137.1	119°	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	6808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100°	6828.3	3184.1	110°	8182.8	4259.7	120°	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

TABLE V.—CORRECTIONS FOR TANGENTS AND EXTERNALS.

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table IV) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

FOR TANGENTS ADD

Central Angle	DEGREE OF CURVE															
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°		
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46		
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68		
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90		
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14		
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39		
35°	.11	.22	.34	.47	.58	.69	.81	.92	1.04	1.29	1.42	1.54	1.66			
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94		
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21		
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48		
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77		
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07		
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39		
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72		
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09		
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46		
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89		
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32		
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83		
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34		
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60		
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22		

FOR EXTERNALS ADD

Central Angle	DEGREE OF CURVE															
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°		
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020		
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051		
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083		
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135		
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188		
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264		
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341		
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445		
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550		
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700		
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851		
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01		
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17		
75°	.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39		
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62		
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91		
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20		
95°	.174	.350	.522	.706	.885	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.53		
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96		
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96		
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32		

TABLE VI.—CORRECTIONS FOR SUB-CHORDS AND LONG CHORDS.

FOR SUB-CHORDS ADD										Excess of arc per 100 ft.	LONG CHORDS				
D	10	20	30	40	50	60	70	80	90		D	200	300	400	500
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02	1	199.99	299.97	399.92	499.85
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05	2	199.97	299.88	399.70	499.39
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08	3	199.93	299.73	399.32	498.63
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13	4	199.88	299.51	398.78	497.57
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18	5	199.81	299.24	398.10	496.20
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25	6	199.73	298.90	397.26	494.53
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33	7	199.63	298.51	396.28	492.57
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41	8	199.51	298.05	395.14	490.31
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51	9	199.38	297.54	393.86	487.75
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62	10	199.24	296.96	392.42	484.90
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74	12	198.90	295.63	389.12	478.34
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86	14	198.51	294.06	385.22	470.65
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00	16	198.05	292.25	380.76	461.86
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15	18	197.54	290.21	375.74	452.02
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31	20	196.90	287.94	370.17	441.15
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48	22	196.32	285.44	364.06	429.30
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66	24	195.63	282.71	357.43	416.53
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86	26	194.87	279.76	350.30	402.89
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06	28	194.06	276.59	342.69	388.42
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28	30	193.18	273.20	334.61	373.20
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50	32	192.25	269.61	326.08	357.28
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74	34	191.26	265.81	317.12	340.73
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99	36	190.21	261.80	307.77	323.61
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24	38	189.10	257.60	298.03	305.99
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52	40	187.94	253.21	287.94	287.94
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80	42	186.72	248.63	277.51	269.54
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09	44	185.44	243.87	266.78	250.85
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.20	.74	4.40	46	184.10	239.93	255.78	231.95
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72	48	182.71	233.83	244.51	212.92

NOTE.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25'.06 for each chord. Long chords are useful in passing obstacles.

TABLE VII.—MIDDLE ORDINATES FOR RAILS IN FEET.

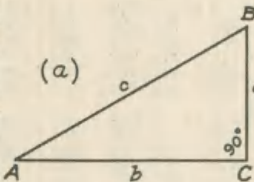
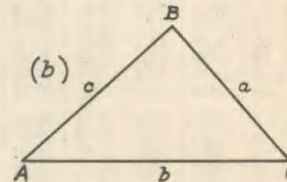
Deg. of Curve	LENGTH OF RAILS							Deg. of Curve	LENGTH OF RAILS						
	32	30	28	26	24	22	20		32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.067	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.241	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

SLOPE REDUCTIONS.

When distances are measured on a slope that may be reduced to the equivalent horizontal distance by the following approximate rule:—subtract from the slope distance the square of the rise divided by twice the slope distance. Thus for a slope distance of 250.3 ft. and a rise of 15 ft. correction = $15^2 \div 2 \times 250.3 = .45$ (by slide rule) or horizontal distance = $250.3 - .45 = 249.85$. When vertical angle = V. A. is measured horizontal distance = slope distance—slope distance (1—Cos. V. A.). Thus for slope distance of 248.7 ft. and V. A. of 4° 20' from Table VIII Cos = .99714 and correction = $1 - .99714 = .00286$ per foot or total of $.286 \times 2\frac{1}{2}$ (near enough) = .57 and horizontal distance = $248.7 - .57 = 248.13$ ft.

See fig. (a).

TRIGONOMETRICAL FORMULAS.

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

FORMULA FOR SOLVING TRIANGLES.

Given	Sought.	Right triangles. See fig. (a).
a, c	A, B, b	sin. $A = \frac{a}{c}$, cos. $B = \frac{a}{c}$, $b = \sqrt{(c+a)(c-a)}$
a, b	A, B, c	tan. $A = \frac{a}{b}$, cot. $B = \frac{a}{b}$, $c = \sqrt{a^2 + b^2}$
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	$B = 90^\circ - A$, $a = c \sin. A$, $b = c \cos. A$
Given	Sought.	Oblique triangles. See fig. (b)
A, B, a	b	$b = \frac{a \sin. B}{\sin. A}$
A, a, b	B	sin. $B = \frac{b \sin. A}{a}$
a, b, C	A — B	tan. $\frac{1}{2} (A - B) = \frac{a - b \tan. \frac{1}{2} (A + B)}{a + b}$
c, b, c	A	$\left\{ \begin{array}{l} \text{If } s = \frac{1}{2} (a + b + c), \sin. \frac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} \\ \cos. \frac{1}{2} A = \sqrt{\frac{s(s-a)}{b(s-b)}}, \tan. \frac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} \\ \sin. A = \frac{2 \sqrt{(s-a)(s-b)(s-c)}}{b+c} \end{array} \right.$
A, B, C, a	area	area = $\frac{a^2 \sin. B \sin. C}{2 \sin. A}$
A, b, c	area	area = $\frac{1}{2} b c \sin. A$
a, b, c	area	$s = \frac{1}{2} (a + b + c)$, area = $\sqrt{s(s-a)(s-b)(s-c)}$

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
0°	0	0	00	1	90	8°	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	.99998	50	10	.1421	.1435	6.968	.98986	50
20	.0058	.0058	171.9	.99996	40	20	.1449	.1465	6.827	.98944	40
30	.0087	.0087	114.6	.99993	30	30	.1478	.1495	6.691	.98902	30
40	.0116	.0116	85.94	.99989	20	40	.1507	.1524	6.561	.98858	20
50	.0145	.0145	68.75	.99985	10	50	.1536	.1554	6.435	.98814	10
1	.0175	.0175	57.29	.99981	89	9	.1564	.1584	6.314	.98769	81
10	.0204	.0204	49.10	.99979	50	10	.1593	.1614	6.197	.98723	50
20	.0233	.0233	42.96	.99973	40	20	.1622	.1644	6.084	.98676	40
30	.0262	.0262	38.19	.99966	30	30	.1650	.1673	5.976	.98629	30
40	.0291	.0291	34.37	.99958	20	40	.1679	.1703	5.871	.98580	20
50	.0320	.0320	31.24	.99949	10	50	.1708	.1733	5.769	.98531	10
2	.0349	.0349	28.64	.99939	88	10	.1736	.1763	5.671	.98481	80
10	.0378	.0378	26.43	.99929	50	10	.1765	.1793	5.576	.98430	50
20	.0407	.0407	24.54	.99917	40	20	.1794	.1823	5.485	.98378	40
30	.0436	.0437	22.90	.99905	30	30	.1822	.1853	5.396	.98325	30
40	.0465	.0466	21.47	.99892	20	40	.1851	.1883	5.309	.98272	20
50	.0494	.0495	20.21	.99878	10	50	.1880	.1914	5.226	.98218	10
3	.0523	.0524	19.08	.99863	87	11	.1908	.1944	5.145	.98163	79
10	.0552	.0553	18.07	.99847	50	10	.1937	.1974	5.066	.98107	50
20	.0581	.0582	17.17	.99831	40	20	.1965	.2004	4.989	.98050	40
30	.0610	.0612	16.35	.99813	30	30	.1994	.2035	4.915	.97992	30
40	.0640	.0641	15.60	.99795	20	40	.2022	.2065	4.843	.97934	20
50	.0669	.0670	14.92	.99776	10	50	.2051	.2095	4.773	.97875	10
4	.0698	.0699	14.30	.99756	86	12	.2079	.2126	4.705	.97815	78
10	.0727	.0729	13.73	.99736	50	10	.2108	.2156	4.638	.97754	50
20	.0756	.0758	13.20	.99714	40	20	.2136	.2186	4.574	.97692	40
30	.0785	.0787	12.71	.99692	30	30	.2164	.2217	4.511	.97630	30
40	.0814	.0816	12.25	.99668	20	40	.2193	.2247	4.449	.97566	20
50	.0843	.0846	11.83	.99644	10	50	.2221	.2278	4.390	.97502	10
5	.0872	.0875	11.43	.99619	85	13	.2250	.2309	4.331	.97437	77
10	.0901	.0904	11.06	.99594	50	10	.2278	.2339	4.275	.97371	50
20	.0929	.0934	10.71	.99567	40	20	.2306	.2370	4.219	.97304	40
30	.0958	.0963	10.39	.99540	30	30	.2334	.2401	4.165	.97237	30
40	.0987	.0992	10.08	.99511	20	40	.2363	.2432	4.113	.97169	20
50	.1016	.1022	9.788	.99482	10	50	.2391	.2462	4.061	.97100	10
6	.1045	.1051	9.514	.99452	84	14	.2419	.2493	4.011	.97030	76
10	.1074	.1080	9.255	.99421	50	10	.2447	.2524	3.962	.96959	50
20	.1103	.1110	9.010	.99390	40	20	.2476	.2555	3.914	.96887	40
30	.1132	.1139	8.777	.99357	30	30	.2504	.2586	3.867	.96815	30
40	.1161	.1169	8.556	.99324	20	40	.2532	.2617	3.821	.96742	20
50	.1190	.1198	8.345	.99290	10	50	.2560	.2648	3.776	.96667	10
7	.1219	.1228	8.144	.99255	83	15	.2588	.2679	3.732	.96593	75
10	.1248	.1257	7.953	.99219	50	10	.2616	.2711	3.689	.96517	50
20	.1276	.1287	7.770	.99182	40	20	.2644	.2742	3.647	.96440	40
30	.1305	.1317	7.596	.99144	30	30	.2672	.2773	3.606	.96363	30
40	.1334	.1346	7.429	.99106	20	40	.2700	.2805	3.566	.96285	20
50	.1363	.1376	7.269	.99067	10	50	.2728	.2836	3.526	.96206	10
					82						74
	Cosin.	Cotg.	Tan.	Sine.	Angle		Cosin.	Cotg.	Tan.	Sine.	Angle

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
16°	.2756	.2867	3.487	.96126	74	24°	.4067	.4452	2.246	.91355	66
10	.2784	.2899	3.450	.96046	50	10	.4094	.4487	2.229	.91236	50
20	.2812	.2931	3.412	.95964	40	20	.4120	.4522	2.211	.91116	40
30	.2840	.2962	3.376	.95882	30	30	.4147	.4557	2.194	.90996	30
40	.2868	.2994	3.340	.95799	20	40	.4173	.4592	2.177	.90875	20
50	.2896	.3026	3.305	.95715	10	50	.4200	.4628	2.161	.90753	10
17	.2924	.3057	3.271	.95615	73	25	.4226	.4663	2.145	.90631	65
10	.2952	.3089	3.237	.95545	50	10	.4253	.4699	2.128	.90507	50
20	.2979	.3121	3.204	.95459	40	20	.4279	.4734	2.112	.90383	40
30	.3007	.3153	3.172	.95372	30	30	.4305	.4770	2.097	.90259	30
40	.3035	.3185	3.140	.95284	20	40	.4331	.4806	2.081	.90133	20
50	.3062	.3217	3.108	.95195	10	50	.4358	.4841	2.066	.90007	10
18	.3090	.3249	3.078	.95106	72	26	.4384	.4877	2.050	.89879	64
10	.3118	.3281	3.048	.95015	50	10	.4410	.4913	2.035	.89752	50
20	.3145	.3314	3.018	.94924	40	20	.4436	.4950	2.020	.89623	40
30	.3173	.3346	2.989	.94832	30	30	.4462	.4986	2.006	.89493	30
40	.3201	.3378	2.960	.94740	20	40	.4488	.5022	1.991	.89363	20
50	.3228	.3411	2.932	.94646	10	50	.4514	.5059	1.977	.89232	10
19	.3256	.3443	2.904	.94552	71	27	.4540	.5095	1.963	.89101	63
10	.3283	.3476	2.877	.94457	50	10	.4566	.5132	1.949	.88968	50
20	.3311	.3508	2.850	.94361	40	20	.4592	.5169	1.935	.88835	40
30	.3338	.3541	2.824	.94264	30	30	.4617	.5206	1.921	.88701	30
40	.3365	.3574	2.798	.94167	20	40	.4643	.5243	1.907	.88566	20
50	.3393	.3607	2.773	.94068	10	50	.4669	.5280	1.894	.88431	10
20	.3420	.3640	2.747	.93969	70	28	.4695	.5317	1.881	.88295	62
10	.3448	.3673	2.723	.93869	50	10	.4720	.5354	1.868	.88158	50
20	.3475	.3706	2.699	.93769	40	20	.4746	.5392	1.855	.88020	40
30	.3502	.3739	2.675	.93667	30	30	.4772	.5430	1.842	.87882	30
40	.3529	.3772	2.651	.93565	20	40	.4797	.5467	1.829	.87743	20
50	.3557	.3805	2.628	.93462	10	50	.4823	.5505	1.816	.87603	10
21	.3584	.3839	2.605	.93358	69	29	.4848	.5543	1.804	.87462	61
10	.3611	.3872	2.583	.93253	50	10	.4874	.5581	1.792	.87321	50
20	.3638	.3906	2.560	.93148	40	20	.4899	.5619	1.780	.87178	40
30	.3665	.3939	2.539	.93042	30	30	.4924	.5658	1.767	.87036	30
40	.3692	.3973	2.517	.92935	20	40	.4950	.5696	1.756	.86892	20
50	.3719	.4006	2.496	.92827	10	50	.4975	.5735	1.744	.86748	10
22	.3746	.4040	2.475	.92718	68	30	.5000	.5774	1.732	.86603	60
10	.3773	.4074	2.455	.92609	50	10	.5025	.5812	1.720	.86457	50
20	.3800	.4108	2.434	.92499	40	20	.5050	.5851	1.709	.86310	40
30	.3827	.4142	2.414	.92388	30	30	.5075	.5890	1.698	.86163	30
40	.3854	.4176	2.394	.92276	20	40	.5100	.5930	1.686	.86015	20
50	.3881	.4210	2.375	.92164	10	50	.5125	.5969	1.675	.85866	10
23	.3907	.4245	2.356	.92050	67	31	.5150	.6009	1.664	.85717	59
10	.3934	.4279	2.337	.91936	50	10	.5175	.6048	1.653	.85567	50
20	.3961	.4314	2.318	.91822	40	20	.5200	.6088	1.643	.85416	40
30	.3987	.4348	2.300	.91706	30	30	.5225	.6128	1.632	.85264	30
40	.4014	.4383	2.282	.91590	20	40	.5250	.6168	1.621	.85112	20
50	.4041	.4417	2.264	.91472	10	50	.5275	.6208	1.611	.84959	10
					66						58
	Cosin.	Cotg.	Tan.	Sine.	Angle		Cosin.	Cotg.	Tan.	Sine.	Angle

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
32	.5299	.6249	1.600	.84805	58	30	.6225	.7954	1.257	.78261	30
10	.5324	.6289	1.590	.84650	50	40	.6248	.8002	1.250	.78079	20
20	.5348	.6330	1.580	.84495	40	50	.6271	.8050	1.242	.77897	10
30	.5373	.6371	1.570	.84339	30	39	.6293	.8098	1.235	.77715	51
40	.5398	.6412	1.560	.84182	20	10	.6316	.8146	1.228	.77531	50
50	.5422	.6453	1.550	.84025	10	20	.6338	.8195	1.220	.77347	40
33	.5446	.6494	1.540	.83867	57	30	.6361	.8243	1.213	.77162	30
10	.5471	.6536	1.530	.83708	50	40	.6383	.8292	1.206	.76977	20
20	.5495	.6577	1.520	.83549	40	50	.6406	.8342	1.199	.76791	10
30	.5519	.6619	1.511	.83389	30	40	.6428	.8391	1.192	.76604	50
40	.5544	.6661	1.501	.83228	20	10	.6450	.8441	1.185	.76417	50
50	.5568	.6703	1.492	.83066	10	20	.6472	.8491	1.178	.76229	40
34	.5592	.6745	1.483	.82904	56	30	.6494	.8541	1.171	.76041	30
10	.5616	.6787	1.473	.82741	50	40	.6517	.8591	1.164	.75851	20
20	.5640	.6830	1.464	.82577	40	50	.6539	.8642	1.157	.75661	10
30	.5664	.6873	1.455	.82413	30	41	.6561	.8693	1.150	.75471	49
40	.5688	.6916	1.446	.82248	20	10	.6583	.8744	1.144	.75280	50
50	.5712	.6959	1.437	.82082	10	20	.6604	.8796	1.137	.75088	40
35	.5736	.7002	1.428	.81915	55	30	.6626	.8847	1.130	.74896	30
10	.5760	.7046	1.419	.81748	50	40	.6648	.8899	1.124	.74703	20
20	.5783	.7089	1.411	.81580	40	50	.6670	.8952	1.117	.74509	10
30	.5807	.7133	1.402	.81412	30	42	.6691	.9004	1.111	.74314	48
40	.5831	.7177	1.393	.81242	20	10	.6713	.9057	1.104	.74120	50
50	.5854	.7221	1.385	.81072	10	20	.6734	.9110	1.098	.73924	40
36	.5878	.7265	1.376	.80902	54	30	.6756	.9163	1.091	.73728	30
10	.5901	.7310	1.368	.80730	50	40	.6777	.9217	1.085	.73531	20
20	.5925	.7355	1.360	.80558	40	50	.6799	.9271	1.079	.73333	10
30	.5948	.7400	1.351	.80386	30	43	.6820	.9325	1.072	.73135	47
40	.5972	.7445	1.343	.80212	20	10	.6841	.9380	1.066	.72937	50
50	.5995	.7490	1.335	.80038	10	20	.6862	.9435	1.060	.72737	40
37	.6018	.7536	1.327	.79864	53	30	.6884	.9490	1.054	.72537	30
10	.6041	.7581	1.319	.79688	50	40	.6905	.9545	1.048	.72337	20
20	.6065	.7627	1.311	.79512	40	50	.6926	.9601	1.042	.72136	10
30	.6088	.7673	1.303	.79335	30	44	.6947	.9657	1.036	.71934	46
40	.6111	.7720	1.295	.79158	20	10	.6967	.9713	1.030	.71732	50
50	.6134	.7766	1.288	.78980	10	20	.6988	.9770	1.024	.71529	40
38	.6157	.7813	1.280	.78801	52	30	.7009	.9827	1.018	.71325	30
10	.6180	.7860	1.272	.78622	50	40	.7030	.9884	1.012	.71121	20
20	.6202	.7907	1.265	.78442	40	50	.7050	.9942	1.006	.70916	10
							.7071	.1	1.	.70711	45
											o/
	Cosin.	Cotg.	Tan.	Sine.	Angle		Cosin.	Cotg.	Tan.	Sine.	Angle

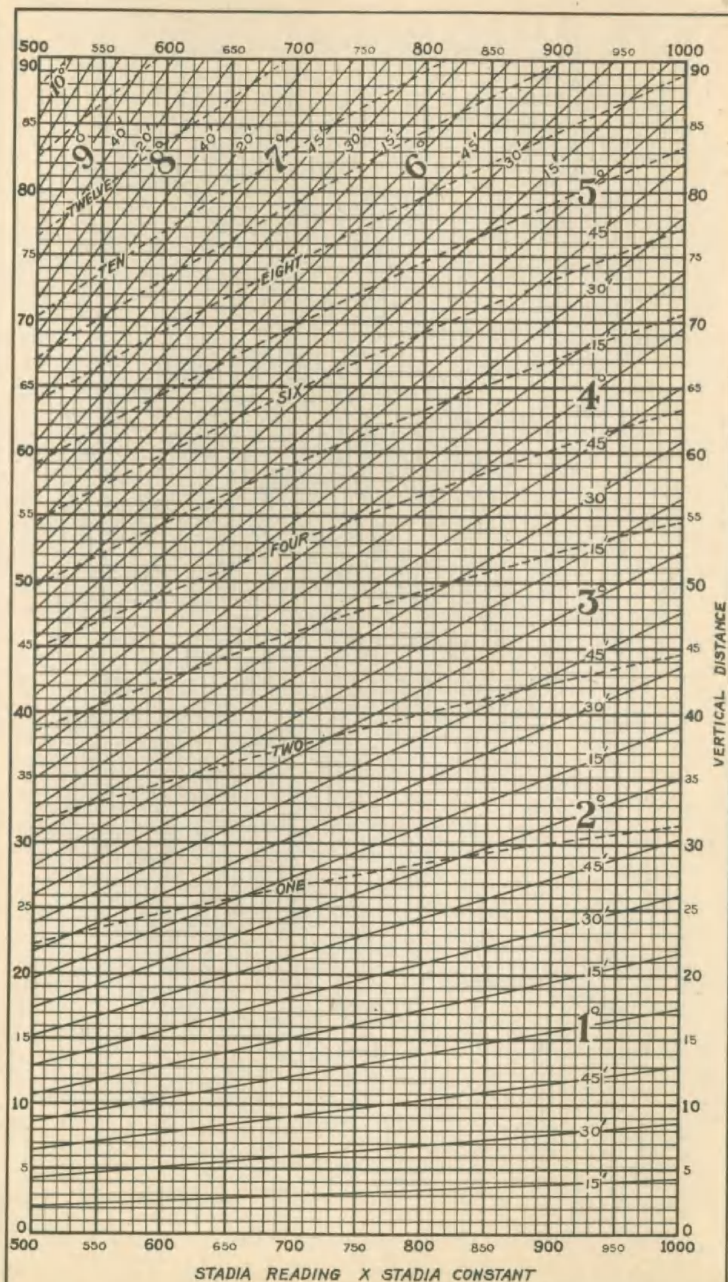
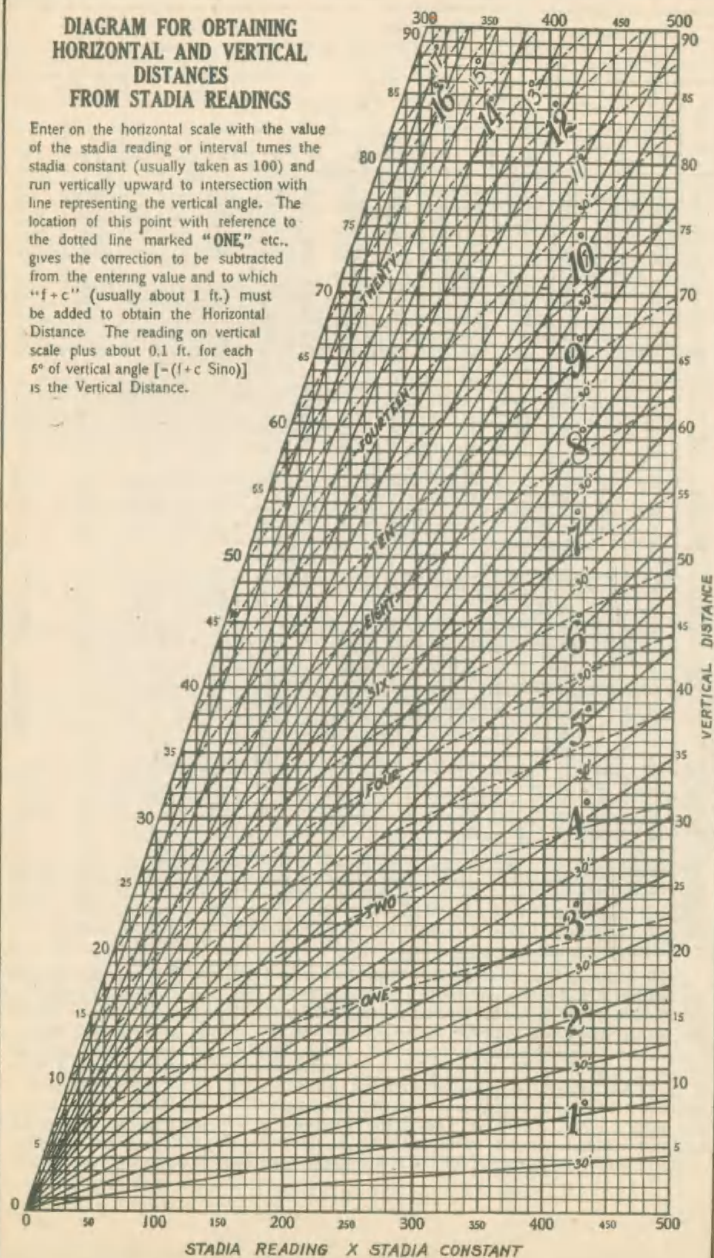
TABLE IX.—CALCULATION OF EARTHWORK.

Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if $w=16.2$ and $h=5.3$, cu. yds. = $1.48 + .018 + .089 = 1.587$ cu. yds. or practically 159 cu. yds. per 100 ft. If w exceeds 40 ft., use one half and multiply result by 2, if both w and h are large use one half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) = h , and $\frac{1}{2}$ the roadbed = w , add the triangles formed by taking the distance out to each break in turn (= w 's) by the difference between the cuts (or fills) on each side of it (= h 's) always subtracting the outer from the inner.

DIAGRAM FOR OBTAINING HORIZONTAL AND VERTICAL DISTANCES FROM STADIA READINGS

Enter on the horizontal scale with the value of the stadia reading or interval times the stadia constant (usually taken as 100) and run vertically upward to intersection with line representing the vertical angle. The location of this point with reference to the dotted line marked "ONE" etc., gives the correction to be subtracted from the entering value and to which " $f+c$ " (usually about 1 ft.) must be added to obtain the Horizontal Distance. The reading on vertical scale plus about 0.1 ft. for each 6° of vertical angle [$=(f+c \sin \alpha)$] is the Vertical Distance.

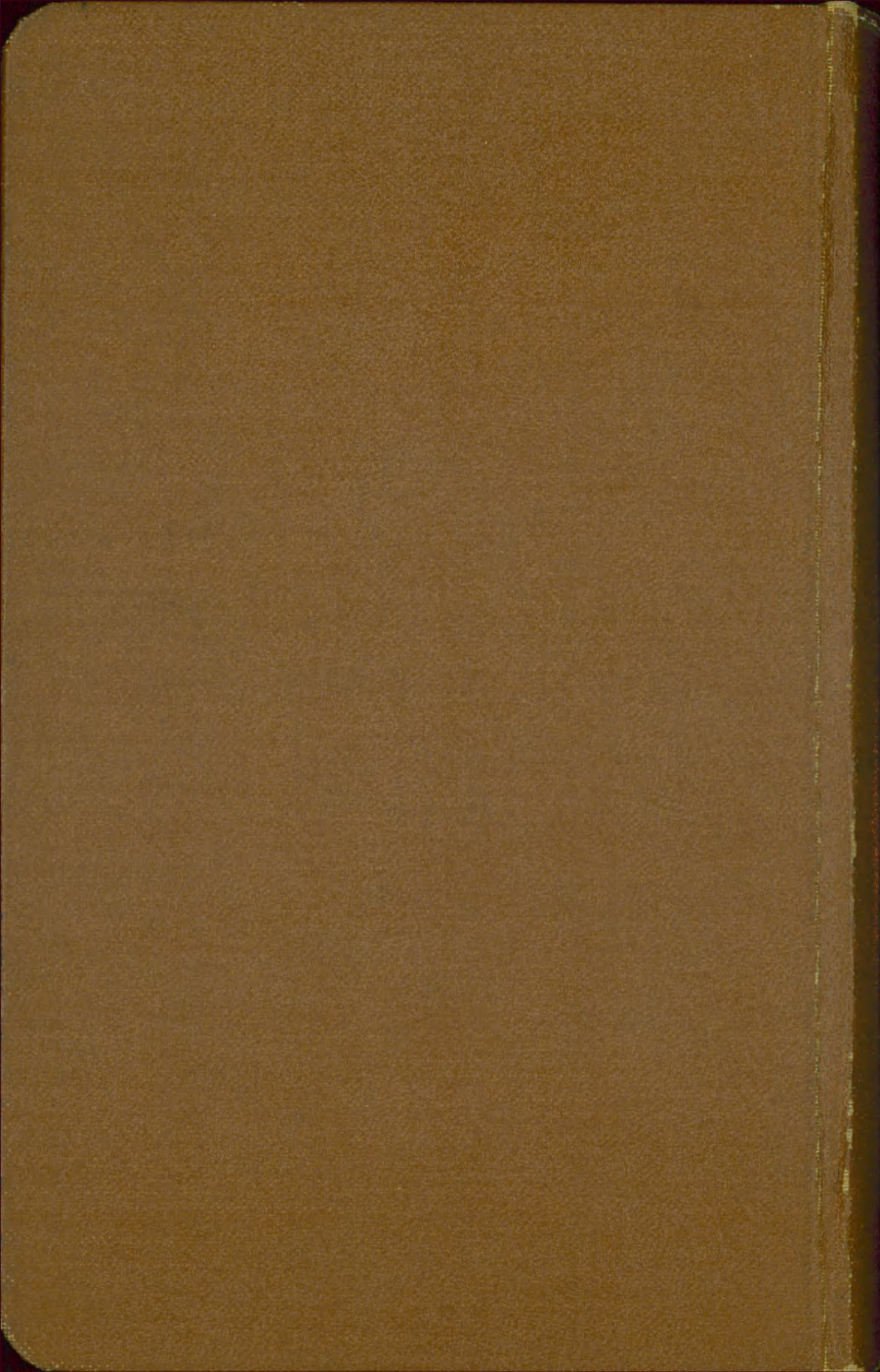


DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

Roadway 16 feet wide. Side Slopes 1 on 1½
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.2	8.3	8.5	8.6	8.8	8.9	9.1	9.2	9.4	0
1	9.5	9.7	9.8	10.0	10.1	10.3	10.4	10.6	10.7	10.9	1
2	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.4	2
3	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.9	3
4	14.0	14.2	14.3	14.5	14.6	14.8	14.9	15.1	15.2	15.4	4
5	15.5	15.7	15.8	16.0	16.1	16.3	16.4	16.6	16.7	16.9	5
6	17.0	17.2	17.3	17.5	17.6	17.8	17.9	18.1	18.2	18.4	6
7	18.5	18.7	18.8	19.0	19.1	19.3	19.4	19.6	19.7	19.9	7
8	20.0	20.2	20.3	20.5	20.6	20.8	20.9	21.1	21.2	21.4	8
9	21.5	21.7	21.8	22.0	22.1	22.3	22.4	22.6	22.7	22.9	9
10	23.0	23.2	23.3	23.5	23.6	23.8	23.9	24.1	24.2	24.4	10
11	24.5	24.7	24.8	25.0	25.1	25.3	25.4	25.6	25.7	25.9	11
12	26.0	26.2	26.3	26.5	26.6	26.8	26.9	27.1	27.2	27.4	12
13	27.5	27.7	27.8	28.0	28.1	28.3	28.4	28.6	28.7	28.9	13
14	29.0	29.2	29.3	29.5	29.6	29.8	29.9	30.1	30.2	30.4	14
15	30.5	30.7	30.8	31.0	31.1	31.3	31.4	31.6	31.7	31.9	15
16	32.0	32.2	32.3	32.5	32.6	32.8	32.9	33.1	33.2	33.4	16
17	33.5	33.7	33.8	34.0	34.1	34.3	34.4	34.6	34.7	34.9	17
18	35.0	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	18
19	36.5	36.7	36.8	37.0	37.1	37.3	37.4	37.6	37.7	37.9	19
20	38.0	38.2	38.3	38.5	38.6	38.8	38.9	39.1	39.2	39.4	20
21	39.5	39.7	39.8	40.0	40.1	40.3	40.4	40.6	40.7	40.9	21
22	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1	42.2	42.4	22
23	42.5	42.7	42.8	43.0	43.1	43.3	43.4	43.6	43.7	43.9	23
24	44.0	44.2	44.3	44.5	44.6	44.8	44.9	45.1	45.2	45.4	24
25	45.5	45.7	45.8	46.0	46.1	46.3	46.4	46.6	46.7	46.9	25
26	47.0	47.2	47.3	47.5	47.6	47.8	47.9	48.1	48.2	48.4	26
27	48.5	48.7	48.8	49.0	49.1	49.3	49.4	49.6	49.7	49.9	27
28	50.0	50.2	50.3	50.5	50.6	50.8	50.9	51.1	51.2	51.4	28
29	51.5	51.7	51.8	52.0	52.1	52.3	52.4	52.6	52.7	52.9	29
30	53.0	53.2	53.3	53.5	53.6	53.8	53.9	54.1	54.2	54.4	30
31	54.5	54.7	54.8	55.0	55.1	55.3	55.4	55.6	55.7	55.9	31
32	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1	57.2	57.4	32
33	57.5	57.7	57.8	58.0	58.1	58.3	58.4	58.6	58.7	58.9	33
34	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	34
35	60.5	60.7	60.8	61.0	61.1	61.3	61.4	61.6	61.7	61.9	35
36	62.0	62.2	62.3	62.5	62.6	62.8	62.9	63.1	63.2	63.4	36
37	63.5	63.7	63.8	64.0	64.1	64.3	64.4	64.6	64.7	64.9	37
38	65.0	65.2	65.3	65.5	65.6	65.8	65.9	66.1	66.2	66.4	38
39	66.5	66.7	66.8	67.0	67.1	67.3	67.4	67.6	67.7	67.9	39
40	68.0	68.2	68.3	68.5	68.6	68.8	68.9	69.1	69.2	69.4	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 41.9. For same slopes but other widths of roadbed correct above figures by one-half difference in width of roadbed; thus in example above for 20 ft. roadbed distance will be $41.9 + (20 - 16) \div 2$ or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.





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