

69

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 1½ see inside of back cover.

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W.D. Johnston



Handwritten calculations and notes:

$$\begin{array}{r} 1.16 \\ 1.25 \\ 1.17 \\ \hline 3.58 \\ 20.25 \end{array}$$

$$\begin{array}{r} 4.17 \\ 4.40 \\ 3.00 \\ \hline 11.57 \end{array}$$

**BLACK HAWK COUNTY
ENGINEER'S OFFICE
COURT HOUSE
WATERLOO, IOWA 50703**

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I.C.R.R. Xing - Pr Rd No 40. 2 Mi South of IRMA - 46
Saklabergs crossing.

Note: Except as noted above, contents of this Book are
diary and construction notes F.A.P No 62.

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BLACK HAWK COUNTY
ENGINEER'S OFFICE
COURT HOUSE
WATERLOO, IOWA 50503

Index

Survey for Loc. S. Line of S. 10 Acres
of N.E. $\frac{1}{4}$ of N.E. $\frac{1}{4}$ Sec. 21-89-13 for
F.H. Fluent

56

P.A.P. 2562 -

1932.

6-20 - P.M.

Paint lot - Templeton & Party, stopping tile
 G.H. Easton Saw P. Berg about beginning
 on tile west of Elk Run bridge -
 He will begin work day morning -

6-24 - A.M. went with Shirley, Decker & Allen
 to look at Gravel Pit on Will Evans' Farm
 In NW 1/4 of NE 1/4 Sec 32 E. 2000 Twp
 approx. 1 acre depths 12 ft. and more. Holes
 stopped in gravel. Tract long parallel with
 Elk Run at 400' NE 1/4 therefrom beg. about
 100 ft. from the hole trap Rd. thru Sec 32
 trap at 150' wide by approx 400' long.

6-24 - P.M. Paint lot

Gravel S. side, 4' in rd -

Saw Geo Baker he agreed to go out
 Thursday A.M. and see alt survey
 fence on S. side west of Elk Run
 Brge.

6-21 - Fred Peterson
1420 4th Ave South.
Put Dodge - abt. moving fence
on north side of G. River.
mailed fence removal notice
to above address.

6-22. Fair hot.
Party slope staking & setting
tile stakes.

6-23. Fair hot.
Geo. Baker moving fence. G. Shauls
moving tel. poles on S. side of road
near Elk Run bridge.
Notified Mr. Bailey abt. mowing &
clearing up R. of W. west of Cedar Hill
also Matt Alder abt. patrolman
mowing - Lewis section - and
Joe Shirley abt. mowing Waterloo
section.

6-24 - A.M. Shaver at 9:00 A.M.
Cooler in ops all day.
Grading gang working at site of plant
set up on C. & G.W. Ry. north of Hospital.

6-26 - Cloudy & cool - In ops. in A.M.
Mr. Atkins with Ford & 1 set surveying
equipment reported for duty on R.A.P.
No. 62. Paulsen was in talked abt. detours.
P.M. went with O. Board to look over
land involved in relocation of Pr No. 10
near Laporte.

Right of Way - Relocation - W100 - LaPorte Rd. - Prim Proj No. 323 5

acres, acres, amt. = { amt. to be paid for R. of W. for road and
also land for borrow pits plus cost of
math. for fence.

① A. E. Osborne

1150
800
21950
975
1000 X 66
73
43560
800 X 20
43560 =

1.5
1.7

0.367

300- (not agreed to by owner.) By condemnation
(73.40) = amt. to be refunded to Blk. Hk. Co.

Borrow Pit in tract near old gravel pit.

② O. A. Bawn

4.5

3370-

R. of W. 63' in width past barn & orchard. (Purchase)

2519 X 20
43560 = 1156 A.

1.156

(231.20) = amt. to be refunded to Blk. Hk. Co.

③ S. O. Smalling -

(no refund) 1400 X 83
(regd.) 1400 X 63
Borrow -

4.7

none

1140- { 39" iron wire + 2 lines barbed wire posts 1200' in
Incl. Borrow Pit & fence.
If more R. of W. is regd. shall be at rate of
\$100 - per acre. or \$300 - providing nothing
is gotten from Ct. or P. Co.

④ Helmer Sell

1400 X 63'

2.0

0.643

\$485- Incl. cost of fence. owner to do fencing Co. to furnish
math. for fence.
(128.60) = amt. to be refunded to Blk. Hk. Co.

W. A. Briggs

⑤ A. A. McNaughton

1400 X 46'
(85 Rods)

1.5

385-

(128.60) = amt. to be refunded to Blk. Hk. Co.

⑥ E. L. Wheeler.

2300 X 66'

3.5

1.056

1000-

(211.20)

⑦ Nicholas Frost

650 X 73
1300 X 83
1185 X 95

1.1

5.0

1200-

(3035)

Burt fund.

(24.0)

1.395

(7960)

(?) (should also incl old cedar & valley etc. land.)
0.6975 A. @ 100.00 per A. = \$69.75
0.6975 A. @ 200.00 " = 139.50
amt. to be refunded = \$209.25

(cont on pg 6)

↓
 ⑧ Annie Young plot
 ✓ 2107' X 73'
 (127 rods)

acres
for
refund 7960)
acres.
24.0
 3.5

0.967

830

193.40 = amt to be refunded to Elk, Hk, Co.,

2 (How about Sta. grounds
150' X 1600')

↓
 ⑨ Thomas Steile \$200-
 15'18' X 73'

2.5 0.697
(30.0)

6.924

\$590

139.40 = " " " " "

93 50

\$1314.45 = Total amt to be refunded to
 Black Hawk Co.

6-28- A.M. Fair & warm.

Board meeting with Prof. Overman
R. of W. Wood Lumber Co. P.M. still on
R. of W.

Olson drove #639 to Ames for repairs
and expects to return with a
usable car.

Templeton took Car No. 636 and
started for Allamakee job.

Grading outfit

4 Shovels 4 horse sack

2 plow teams

1 Dumpman 1 foreman

9-29- A.M. Imp. No. 62. - Grading outfit
same as on 28th. - Felt line (8") west
of Seneca Rd. to be topped into RCB,
curb west of Seneca Road inton.
Instructed grade foreman to blast a rock
and work them into road grade.

Went up to Logan Ave gravel job.
at 11:30 A.M. too much gravel left
in middle of road - Gravel some-
what fine.

6-30 - Cloudy & showers in A.M.

Went out with Elkins to look at drainage cond.
at W. 9th & 21st crossing East of Hospital.
Talked with City Engineering dept. at
parking across Idaho St. at Independence
Ave. Kilpatrick stated it would be all-
right to erect signs at Idaho &
Colorado St corners.

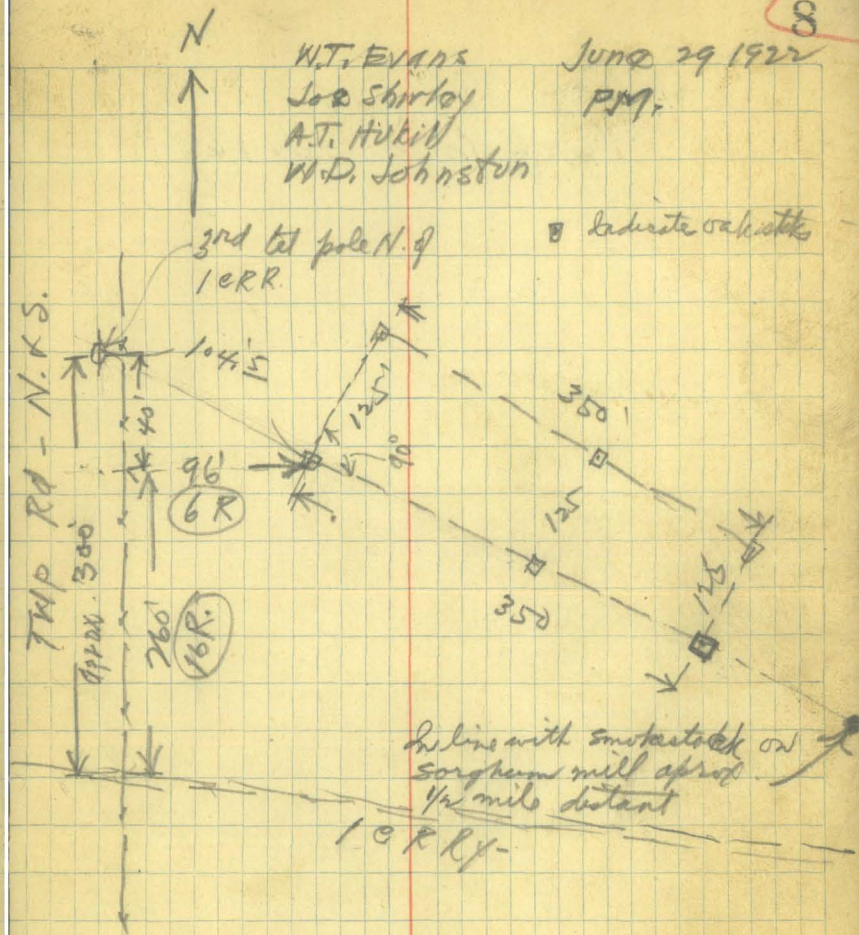
Talked with Mayor & Bldg Comm.
also. also saw Morris Collins & Lee Smith
at police dept.

6-30 P.M. cloudy & threatening.

Watter & engineer went out to look at
steam roller in shop at Sewart's shed.
Engineer will put of water glass injector
gov. felt etc and fire up to start out on
Monday July 3. Agreeable with @ board
to permit Northern State Co. to use roller
on daily rental for time actually in
use.

"EVANS" Gravel pit.
located in - NW 1/4 of NE 1/4
of sec 32 - 89 - 12
(see later survey)

This is chain survey only.



7-1- AM. out with Spencer Shirley &
Mr. Shier stating out Grand Pit on
E. Dierke Farm.

PM on job. 62 8" tile up to 234400
proceeding OK.

Grading west of E. cor, Sec 21 E. 2000-

4 - 4 wheel fuses -

2 - 2 horse plow teams

1 - foreman

1 - Graderman

1 - Survey holder

2 - laborers - clearing Rock W.

7-2 PM. Fair & Cool.

Drove to Grading work east on no 5.

and to gravel job on no. 59 -

no spreading being done. Dumping
on one side only.

Grading with fuses - job rough.
to get roller out to job on Monday
July 3rd

7/3 Sta 132400

Refer. lat. shows @ 1 which should
50. fill stake F. 0.8 it is

Posted detour sign large at Colorado
2nd Ave & Idaho & 2nd Ave.

Roller on job east. Instructed graderman
to roll fill in layers.

7/4 no work Holiday
Fair & warm

7/5 PM Fair & warm - Board meeting
2nd op. all day.

7/6 PM - Rain all day. Board in session -
Talked over matter of getting new
equipment. Decided to get prices
on new transit.

Chas. Jones of L & H. was in conference
with the board.

7-7- Fair & lite clouds cool.
 wet heavy rain on both odd. day and
 most of night. No gravel on Toxas h.
 Elkins slit slope staking - re-staking
 some of other work. got new lat. &
 new ~~tipson~~ coils. on frd. $\frac{130}{2.15} \approx 33.45$
 Grading gang laid off. too wet.

7-8- 6" T&B in to sta 242+00
 8" line in except. 30' at box culvert -
 3 men on job.

7-8- P.M. Hukill. Shirley & Johnston.
 Hand rail - 160' on west side of Rainbow D.
 from So. end -

7/8- Grading gang -
 4 Fresno
 1 plow team
 2 slip scrapers -

7-8 Fair + cool -
 Plant equipped to date -
 2 - Elevated bins - bottom hoppers -
 1 - Cement dry shed - 50' X 20'.
 1 - 15T locomotive crane -
 Math. off.
 1 - Cor 2" pipe
 1 - Cor ring steel -

7/10 - Monday - cloudy & fair -
 new RCB.

Replace 15" X 16' corr. pipe at $\frac{1}{3}$ mile west
 of East cor. Sec. 20-29 orange
 with 4' X 3' X 22'.

No gravel hauling today. Went with -
 Miller, Dicker & Ahles to look at Flickenger,
 & Brandhorst gravel pit also looked at a
 proposed pit on Geo Platt farm in
 Sec. 29 Blk 7k trip. Found good prospect
 on the W.C. Brandhorst farm - talked with
 him and he will meet committee on
 Tues. Lunch at Hudson. Drove so. of
 Hudson on bridge ins. trip. looked
 over grading work of C.H. Chaney.
 Approximately mileage from proposed
 pit to middle of stretch to be graded = 6.6 mi.

7-10-

7-11 - at Independence La
Western app Const. Co. (4.05 miles)
Began cone - May 1.
Completed to July 11. = 4.05 m.

worked 17 days in May
" 20 " June.

7-12 Tile cuts to Nels Lorengson on
H.A. R. 62 - across flat. Laid new grade
line for them & made it deeper
out and shifted line toward E
of hiway.

Mr Dow inspector reported
and went to Independence for
balance of the week. will
report here again on Monday.

7-13 - Fair & warm.

Inspector - Mr. Carty reported for duty
at 5:00 P.M.

out Cator 62 tiling saw C. Hansen abt.
proposed tile outlet at Hiway no 5.

P.M. with Spencer on Bridge investigation
ac 33-34 mt. Vermo. top also Elk River Soundings
or new truss Sec 33. E. Col.

7-14 / Fair & warm

In A.M. went out with J.E. Rusk & Spencer to
ulvert of 1/4 mi. east of Hospital. Located culvert
P.M. Logan Ave. Good job. found trucks
dumping in 1/2 mile instead of the 6th
mi instructed. Stated them dumping
back at end of 6th mile. Then went
out with R.D. McCarty - on no. 62 -
Grading and assembling, mach. a

7-15 Cloudy & Showers in A.M. Sultrey in P.M.
Elkins went to Independence to see abt. check.
Francis & Wade on Twin signs. In ofc. all
day. Repair transit in P.M. trouble with
main limb & vernier plates & made up the
reports.

Hard rain & wind storm at 8:00 P.M.

7-17 - Fair & warm

M. Poir. reported ret. from Independence
went with Co. board to buy piece of right of
way on Pr. No. 5 west. of Cedar Falls
In afternoon. Bal. of day. Rd. passed
resolution to Adv. for bids on W. L. -
Eagle center road thru Eagle Reef -
at 1:30 P.M. Aug 3rd. also
bid for painting or repainting Primar
Rd. markers, also on metal Culverts
and Conc. bridge & Culverts -

7-18 Fair & cool - with board on trip to
East end of No 62 to purchase R. of W.
for rounding corners. Lunch at Camp -
Rt. to Waterloo at 11:45 P.M. Stopped
to look at bulkhead no 9 -
23 trucks hauling gravel on Logan Ave Rd.

7-19 - Fair & warm drove over \$50 P 62
no steel forms on ground - pump in set
pipe line ready, conc. tamper & finisher
ready. Binder erected. Crane ready. New
mixer being assembled at Plant 201.
water & sand interferes with tiling across the
flat - Chas Tarkel drove into Ford car at
5th & western at 7:00 A.M.

7-19 (con).

Drove out to bring him in at 1:30 P.M. to transfer
frames to upper end to check gravel. went
with Hoff. to look at grade on Rd. east of Hudson
blading the 1st mile toward Hudson getting
ready for gravel. Found grade 1 ft. too wide
in places.

7-20. Fair & warm.

1. Grilling at culvert near Gallaway Farms.
2. Cut hill in front of - Shaulis & fill over
new culv. to west -
3. Clean ditches and raise grass near
Geo. Call's place - (water stuck on
north side of road).
4. Grilling on each side of wood bridge
west of School Red brick bldg.

7-20 P.M. with Hoff on reconnaissance
tilt & bridge survey. of W. L. C.

7-21 a.m. data for Mr Ryan
 of Dist. of Omaha
 Data on Paving Co's organization
Grading - Gang - Rate
 2 Foremen 70¢
 19 Teamsters & laborers 30¢

Paving Gang
 3 Foremen 70¢
 60 mach-men 57¢
 30 laborers 37¢
 18 Tr. drivers 40¢
 2 Repairmen 55¢
 2 Clerks 35¢

Weighted % of f.o.p 62

Grading -	6.38
Paving -	93.13
Totals -	0.49
	100.00%

Cedar River Bridge 7-21-1921
 at LaPorte City - J.D. Foster
 3 span hi truss @ 148' = 444'
 148 c.to. c. and bearing -
 Total length approx 351' overall.
 Floor system 18'5" b.to. c. joist support,
 Floor joists clear span 18'0"
 17 joists spaced at 12' c.to. c.

7-22 Rain in A.M. Cloudy & sultry
moving mules out to job. In ops in
A.M. & P.M.

7-24- A.M. went with C. Board to look
at rd. bridge E. of Dunkerton. See opp. pg.
Steel forms being hauled
to job began setting for noon
P.M.

7-24-22 A.M.

with C. Board at bridge E. of Dunkerton

Wd. Br. 4 @ 20 = 80

1 @ 16 = 16

approach 16' = 16

112'

Build 5 @ 16' across main stream as south

" 3 @ 16' across mud hole at north-

Total 8 @ 16' e. to e. 120'

Decided to straighten top. rd.
Trustees to do grading.

7/25/22 In ops all day - on work for bridge &
Cul. letting and painting primary Rd.
markers.

P.M. laying grade line on rd. E. C.
Rd. thru Eagle trap.

Rain at night.

7/26 - Roads too wet to haul gravel in A.M.
Drove over M59 - north - one truck hauling -
will begin at noon today.

7/27/ a.m.

check on wto of matl at Plant-

Gravel - 112 # Sand 100 #.

2 runs -

For 10 bag batch 16.1 - 29.8

computed contents bin by J.C. Dow.	{	W. S.	29.32	Cy.
		x E. Sand	16.22	Cy.
		x E. S.	29.46	Cy.
		W. Sand	16.32	Cy.

matl reqd - concrete
2-st, edges

7/28 Fair moderate
Laid 330 ft. of 18 ft. paving.
Shortage of trucks -

7-29- Paving laid - (27 x 28)

no. sq. yds paving

876 0' dpt.

197.2 cy.

Extra conc. on Exp. joints (Diag)	3.78	Cy.
" rubs 6@10' [6"x8"]	1.00	
	4x78	4.78

Regd. sax. Cement. - 1293 -

201.98 cy.

wasted conc. 12 -

Total regd. sax = 1305 - sax

Actual total used = 1308 - sax

Check on cement Plus 3 sax.

Rain all a.m. cloudy & threatening
in P.M. in op all day.

7-30 - Fair & warm threatening toward
evening Hard rain during night

7-31 - wet grade no work -

8-1-22 Ghosts-

2-10' st. edges on job in P.M.
 Paving laid approx 300 lin. ft.
 Road badly rutted under trucks.
 Gave to job in P.M. and at 4:00
 P.M. x Tractor x blade at work
 all day x used ~~250~~ 845.00 x. regd. 845.00 x.

8-2-22 mix (1:1.71:3.47)

105.7 lbs. cu. ft. gravel

95.2 Cu. ft. sand (damp)

weighed 1 batch of sand-

" " " gravel-

Gravel -

Total wts = 968 1046.5 1052 1058

Tare wts = 262 262 260 263

Net wts = 706 784.5 792 795

Total batch wt. gravel

in 3077.5 lbs. 104.4 # cu. ft.

Sand -

Total wts 945 953 430

Tare " 262 262 262

Net " 683 691 168

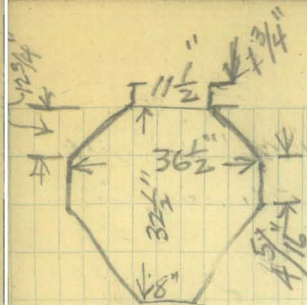
Batch wt. sand - 1542 lbs.

3077

95.20 lbs. cu. ft. 4620. - lbs

Sand Bin (East) 16

8-2-



End Elev.

Side Elev.

$$11\frac{1}{2} \times 2 \times 36\frac{1}{2} = 2'$$

$$\left(\frac{11.5 + 36.5}{2}\right) \times 12.37 \times 36\frac{1}{2} =$$

$$\left(\frac{8 + 36.5}{2}\right) \times 15.63 \times 36\frac{1}{2} =$$

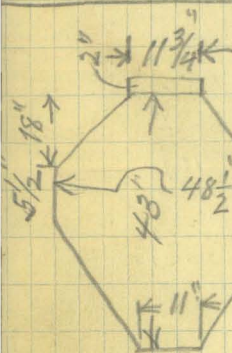
$$4\frac{1}{2} \times 36\frac{1}{2} \times 36\frac{1}{2} =$$

$$831.91 \times 36\frac{1}{2}$$

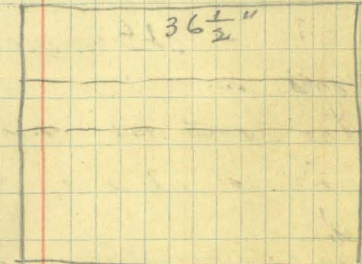
$$30,364.72 \text{ cu. in.}$$

$$17.57 \text{ cu. ft.}$$

or



Rock Bin (East)



$$11\frac{3}{4} \times 2 = 23.50$$

$$\left(\frac{11.75 + 48.5}{2}\right) \times 18 = 542.16$$

$$5.5 \times 48.5 = 266.75$$

$$\left(\frac{11 + 48.5}{2}\right) \times 19.5 = 580.13$$

$$1412.54$$

$$\frac{1412.54 \times 36.5}{1728} = 29.82 \text{ cu. ft.}$$

Butler 15.8

Butler 28.6

8-2- Paving laid 411 linft.
 119 118 truck loads. sap=1130. used.
 822. - 1169 reqd.

no cement finishers.
 no floats

8-3- Gave list - out to job in a.m.
 It laid - 407 cement + 900x
 Sap used 1170 - 117 loads
 Reqd sap - 1160 ✓

8-4- a.m. - 9:05 a.m. -
 wet mix - 78.6
 Loose dirt on sub grade - 87.7
 91

Laid 316 ft.) used -
 (Probably 4005 sap) Reqd. - 901
 Wanted

8-5- a.m. Gave work -
 Grading on west end Kinnison outfit
 7 teams & 1 dump truck 1 foreman

Provide roller for grading gang on
 west end.

Independence Ia

Grading crew - 5 men -
 subgrade 7 men -
 Steam roller & tractor & blade
 covering with dirt 4 men.

8-5- Paved 147 ft. 3 trucks -
 Bulk cement 940 lbs to batch (42 trucks loads)

8-6 Sunday no work laid.

8-7- Cool & cloudy } new Rhine concrete
 Used in steam roller 20" } on job all day.
 125 + 50 -
 Report from no 224.

8/7 P.M. 326 ft. laid 927 Regd
 92 loads. 920 used -
 Leave report blanks at No 720
 Walnut St.

8/8 - 267 ft. laid. - to Sta (122+39)
 76 load used. Regd -
 (70 sat + bulk) used -
 99.7%

8/9 - Fair cool - showers in P.M.
 It laid 309 ft. laid. Regd 879
 87 loads - Used 870
 wt. of sand in E. bin - 1609 lbs.

8/10 Steel recd to date 102 tons
 119+30 115+23 - 40.7 ft x 1156 Regd.
 115 loads. 1150 used.

Trip to west end with "Rhine" in P.M.
 Grading with 7 teams & 11 men.
 Sta. 700 to 720 + on.

Drove to Logan Ave. - talked with
 checker Garbell. began hauling to
 north end.

8/11 -

Genue notices -
 I.B. Moore Les Belden, Powers.
 H.C. Percull Con Kirby.

8/11 It laid 378 - Regd. 1075
 1060 loads used 1060 = -15 sat 98.6%

Rain at 4:30 P.M. stopped work
 out to job with County Board -
 stopped at plant on way in.
 Took Mr Rhine to train at 7:00 A.M.

8/12 In ops. all day - too wet no work.

8/13 Sunday fair & cool all day.

8/14 Fair hot - 14 trucks hauling -
 In ops in A.M. Annibal began mixing
 paint for road markers & W.B. Scott has filed.
 bond covering bridge & culvert work.
 But on job in P.M. subgrade settling badly.
 no tillers on road E. of Elk River Bridge.
 Talked with McCalland & McCarty at plant.

8/14 - 637 ft.

-10 sax.

S. Bin Sand - 6:00 P.M. - 8/14
Sand - 1571 1607.4
Brw - 3262 3261.8

8/15 706 ft.

202 batches

Regd. sax = 7005

had checks at Sta 102+00

H.K. Davis arrived on job at 3:30 P.M.

Found apparent shortage of water for wetting down. Not prompt enough with canvas covering.

8/16 Otisland 782' (Batch 221).

8/17 - no spreading for one week
Truck driven Murphy. gravel hauler not giving share of road.

19

8/17 am fair & hot. very hot day
Drove to job 9:10 A.M. - Inlet down to have ring. steel raised & supported by blocks ahead of core. H.K. Davis on job nearly all day
Left for Independence at abt 4:00 P.M.

8/18/ Cor board in service in A.M.

Mr Davis Dir Engr of CR & P Ry was in to go over proposed relocation on 2040. Davis Gordon & Johnston drove to proposed change at 10:30 A.M. Davis stated that matter would be reported & action made in week or ten days. County official went to J. Rowding funeral at 2:00 P.M.

Went to core. gang first thing in A.M. made slight grade change Sta. 60+00 to abt. 70+00. apparent shortage of dirt.

At. laid 438 -

1.3 loads

Reg. Sta. 82+19

to pt Sta 77+81.

Core, stop at 2:00 P.M. acct. later trouble core. gang struck.

CR & PRC - R of W -

Sta 275 + 84 to
332 + 77

55 + 93 X 20 = 2,576
43,560

4/19 Fair & hot.

Truck no - 15 Butlers
Republic

Drove with Spencer to Lagan Ave.
Gravel job. Del. checks to Darbell
returned over top road one mile
East of No 39 found road for most
part in fair cond 3 spots somewhat
rutted - the half mile of road
E & W to road to pit was in bad
shape rutted & loose - seemed
to show entire lack of maintenance.
Some of the trucks still hauling
over the gravel road.

4/20 Sunday fair & warm -
Rain Sunday nite -

4/21 Cloudy & wet no core laid

4/22 " & threatening no core.

4/23 Fair & hot core all day.
903 ft. laid.

4/24 Fair & hot. 9th laid 1008.
best day so far. (Hard show at nite)

4/25 no core today grading.
Set off lat Elec pole west of Cor -
on n. side of Rd. for C. & E. Co -
at inter 1 mile east of Hudson.

4/26 Math recd by G. Morris for
Co. faxes - 1 - rise 1 kg steps 1 kg nail
round point shovels; 2 lanterns;
mil. 1 pick axe; 1 portable forge.
shov. cans & grass.
4/26 fair & cool all day. on grade in A.M.

4/24/ Matt 4th. fair & warm
375 cy rock. vs sand
11 cars cement @ 260 Bbl to car
1900 Bbl cement.

Running cons. - delayed 2 hours in
con. a/c. no water. Connected with
City water supply at Hyd. at cor.
of Adams & Madison - Pump at
Elk Run On down.

4/24/ Fair warm all day.

St. laid = 1208'

went to job in a.m. ordered cons. wet down
until covering could be provided.

Gravel Service found cemented cons.
side track laid but not connected up.
two cars cement on hand & some steel

Phone.
No. Name
alt. plank:

28.4 loads
57 - cy.
8 1/2
29.5
45.6
5 1/2
47 1/2 = 190
190

4/30/ Cloudy - cool - Sept-1
Foreman - 5
Comlab 95 4/27
" 57
" 75
3 1/2 1/2
Common = 77

Plant - 1 - foreman
13 laborers. 1 super foreman
1 - checker 1 blacksmith
Plant - 17 total -

Plank reqd for King at Bishop
laid by Saturday

4/31 Del to N. S. Contg Co - (A.M.)
1 copy running line - 190 to 238045
on 4/28/ 150 to 190 - Del to
N. S. Contg Co

4/31 - west End Cedar falls Ltp (F+15%)
west of Bridge - road borrow = 1045 cy.
East of " " " = 2036 cy.
3081

Sta. 167+50 to 169+00 Extra yardage
150 X 20 X 0.5

at Sta. 165+00 alt. 50' each way.
100 X 20 X 0.5

August Estimate
Northern States Contg Co. -

Earthwork, No. 1.

- 16,000 Earth

No. 2. - (Kennison)

- 5,000 Earth

Rock

No. 2.

"

Solid 2.0 Line 5.0

Solid 2.5 " 7.0

Extra reinforcing Steel.

Sta 100 to 101+50 = 26 bars @ 17'-8"

9.7

" 31+50 to 43+50 = 68 bars @ "

25.5

0.85 lbs per ft rate 1 1/2¢ per lb.



Koehring Pacer 32-E

Shipping Wt 28 tons (without motor in tank)

3+00

3+50

4+00

4+50

5+00

5+50 - + 7"

6+00 + 8"

+ 50 + 6"

7+00 + 3"

7+50 + 3"

car no 86162 CR 21P by car - coarse ag -

9/1 Fair hot -

Laying cone. Rd. in joint session with
Buchanan Co. Rd. in A.M.

went to west end to provide borrow
pits in P.M.

9/2 Fair warm - In office on reports and
estimates.

went to job in P.M. arranged with inspectors
to finish at hospital on Sunday A.M.

9/3 Fair hot Sunday

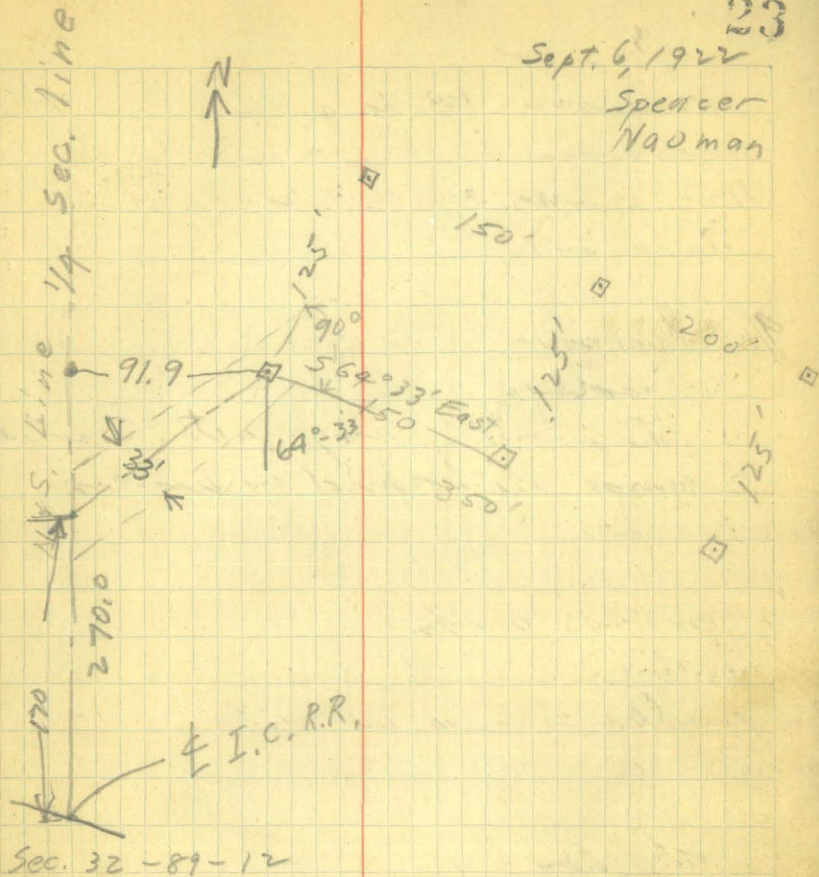
Completed paving to corp line of 1900
Sunday A.M. at alt. 10230.

9/4 Labor day -

Moving equipment to Dewar-
miser to Elk Run Bridge.

9/5 Fair hot Co. Rd in session -
Grading & setting forms -

9/6 Fair hot began conc. going
east from Elk Run Bridge at 8:00 A.M.
laid abt 700 ft today -



See Page - 8 -

9/6 fair & hot
conc laid 620 ft

9/7 fair & hot
conc laid 673 ft -

9/8 Fair & hot -

no conc. laid today - acct failure to
get shipments of aggregate, reported
95 cars of sand and gravel in
manlay Ia.

Painters began on house in eve P.M.
made repairs & fin garage door for
painting.

H.K. Davis came on at abt 2 P.M.
staid all mite with children. we drove
to Dewar and later to Cedar Falls
with, at C.F. 1 car cement.
McCusick equip - arrived - found, mixer
roller - trucks etc. shovel for handling
aggregate.

Sept. 11 - P.M., 24

Data off - H.S. Percerill corner
Sec. 29 Barclay -

Sta 345 $26ft + 4ft = 30'$
" 346 $+ 37 - 29ft = 28'$
" 347
" 348

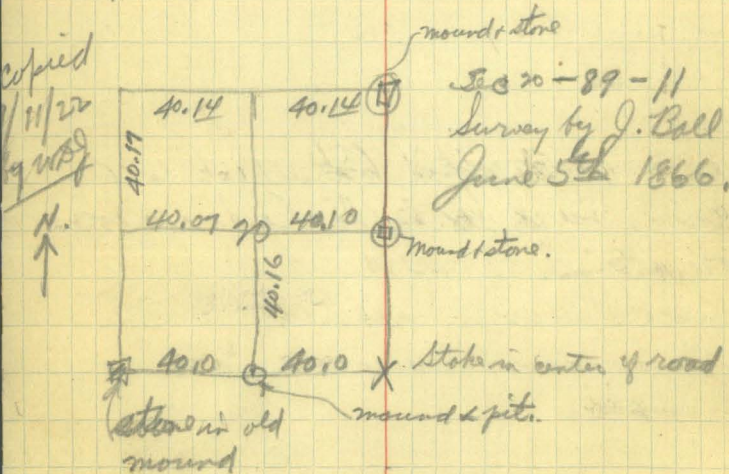
$345 + 37 = E. fence line of K road -$

26' South to fence line and 28' N. to fence line
at 345 + 37.

Sec. 20 - 89 - 11 page 53

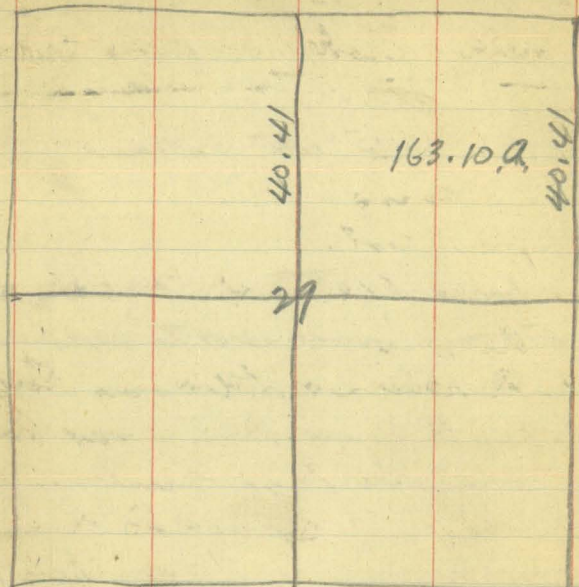
Sec 29 - 89 - 11 " 23

copied
11/20



(See next page).

Sec 29-89-11



Surveyed April 6th 1866.
by John Ball Co. Surveyor

Sta 189+00 + 00
shoulder stake 8.5 ft out on north

9/ no core laid too wet to haul.

Rain in evening.

10 hrs. fair & cool.

11 J.B. Durham relieved Dow on cone camp for the day. Dow called to Cedar Rapids in suit. He returned following day.

Laid 363 ft. this day. Road badly rutted by trucks & rough hauling. met C. Bd. in P.M. at Peroville corner to decide on row of evergreen trees. Peroville agreed to move his fence if C. Bd. would protect the trees.

Sta 702+00.

719+00 off back of shore too much cut for 4 sta.

9/12/22
 working force - East end -

<u>trucks</u>	<u>teams</u>	<u>Total</u>
22	26	54

West end -

<u>trucks</u>	<u>men</u>	<u>teams</u>
18	19	14

17 Plant
 Total men not incl truck = 90 men
 Drivers

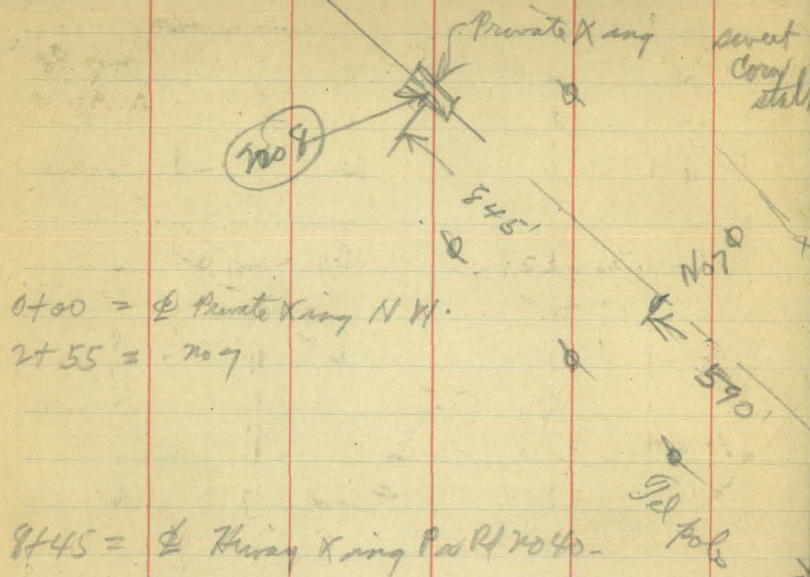
Car. L.C. 86639 OK

9/13/22 J.H. Elkins int. man left
 Wednesday nite. stated he was going
 to Omaha.

Sketch King accident Sept 9-10-89 Blk Hk Q.

9/15/22 Am. 27

W.D. Johnston
Smith claim agt.
Tanner Photographer



0+00 = Private Xing N.H.

2+55 = No 7

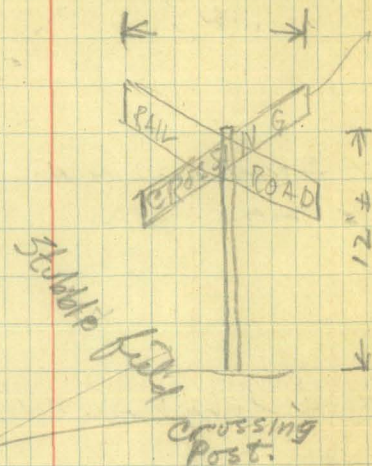
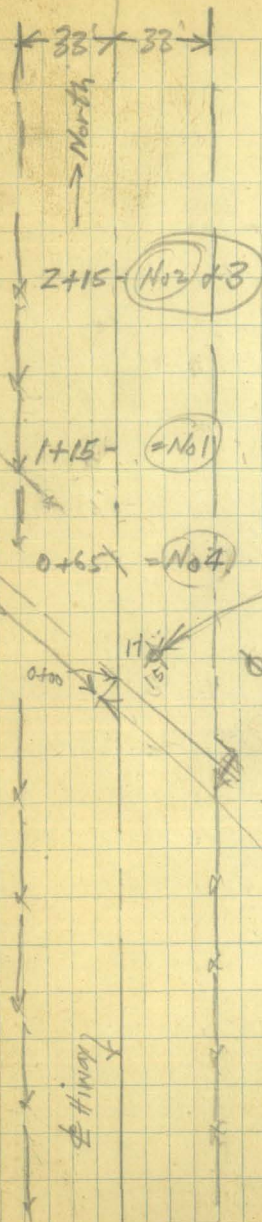
8+45 = Private Xing Railroad No 10.

Data

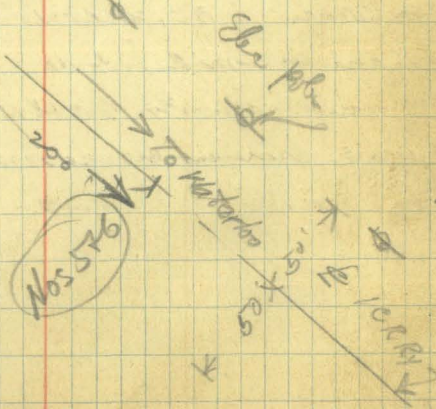
Lack pass. Train struck
auto at 2:00 P.M. on Sept 14th
John Cordes & W.C. Wilbur
occupants were killed.

Roadway smooth gravel surf.
24' wide crossing clear view
both ways unobstructed.

Corn stalk



Stubble field



9/14 - Fair cool.

Laying cones math coming in OK. (934 ft. low)
E.B. Rhine out on job. Tues. P.M. & Wednesday A.M.
accident on E. side C.F. Rd. - "Order" will be called
at 1st deep crossing at 2:00 P.M.

9/15/22 Fair cool. (1037 ft.)

made meachay by crossing accident at 1st
for drainage. Smith of Lopy.

went to see demonstration of maintaining
on color-top of rd. also to see Mr. Miller
alt. R. of w. for borrow pits out to job
in P.M., all OK.

9/16/22 Fair cool. ft. 800?

math. on hand at Lenoir Plant.

Gravel - 70 cy. + 17 cars =

Sand - 40 cy. + 11 cars =

Cement - 11 cars - @

average car cement 40 Bbls.

Let from Mr. Orum to have Lambert report
to Clarksville for plant work. Phoned Lambert
at 1:00 P.M.

9/17 Fair cool Easterly wind. ft. laid 684.

Remaining conc. all day - at Lenoir and at
wiper in A.M. - Michel; McCarty & Law on
the job. Put in extra transverse steel over
berry stretch in grade.

18 Rain all day - in ops. on eye
quantities.

19 Cloudy & threatening all day. H.K. Davis
Douglas came in toward evening.

Purham from C.F. reported cars and gravel
recd. - w. Lc. 910 36 sand; Lc. 176 089 sand;
Lc. 115031 Grav.; Lc. 94634 Grav.; Lc. 127 451 Sand;
Lc. 200386 Grav.

No test reports on some road.

Low sand & gravel plant Clarksville
Paul Graham

B.W. Shaulis to move pole at Percerville

20 Cloudy & cool roads drying slowly
Ester Hall in A.M. with Douglas H.K. Davis
stopt at C.F. No. Conc. laid

9/21/ Fair & cool - sunny in P.M. - mud drying up.

Drove over Logan Ave. Rd in A.M. Mr Polow
called in A.M. P.M. got samples of steel
from along rd on west end - also from 1/2 of Fair & warm - running cone, all day
took pile at Raymond. Took 3 bare prefabricated to Dewar cross road at
each length (17'8") and (40') same from 5:00 P.M. then
Raymond lot.

Grading on both east & west ends
No conc. laid.

County 10 m. 7062. 58 m.

Bas. pt. Sta 354. to 352 approx. 400+

9/22 Fair & warm - met Able at Dewar corner.
Drove east over road - arranged for borrow
pit at Mr. Garton's near corner Sec. 19 Sunday
P.M. met Able at 2:00 P.M. drove east to look
over road. Investigated thing at Sherman's Place
near east end of project. Returned over
detour - thence north into top rd 34-35

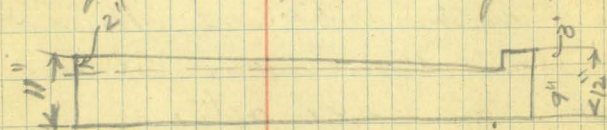
9/23 Fair warm - began rain again first
since rain on night of Sept. 17. Subgrade
soft & rutting badly in spots.

9/24 Sunday Fair & cool - running cone, all day.
at home 9:00 a.m. out to job in P.M. subgrade better
hope - still pretty in spots - seems to average

9/25 Fair & warm - running cone, all day
moved east to Sta 367+00

9/26 Fair & cool Mr Poling, Mason City arrived
we drove to Dewar and to Cedar Falls. Began conc.
after moving east, at 1:30 P.M.

9/27 Fair & cool. Running cone, all day. Subgrade at
upper dry & hard. Began cutting out cone at
bridge ends at Payson Creek Pony Truss. Bridge
floor apparently has wearing surf. already in place.
at 900 ft



Copy from Bridge Plan
PAYSON CR. PONY TRUSS.

Set form & rail for Dewar

10/14 Fair cool - no cone on East end -
set back cement. out with Shirley,

Hukill & Ahles to buy extra dirt for
shouldering paving east of town.

P.M. saw Bowers & Dawson made deal
with Bowers for strip 2 rods & 1 rod wide
on north side of road off "Dawson's"

10/15 Sunday no work on road.

10/16 Cloudy cool - shivery in P.M. & some
drizzle. cement. Bridge app. gang at
Bd. in session. Drove with C. G. Santee to
make deal for extra dirt east of town.

In ops in P.M. no cement east. Putting
at Cedar Falls.

10/17/9339 m. In 10 gal.

out 9339 m In @ 9343 m. 54 m

went with Ely to look at possibility of
getting math along to Cedar R. by track.

Drove to C. G. to see Lyons & party.

Paving at Cedar and shut down at 2:30

Acct. broken mixer. Went out east in
P.M. to look over grading work. (m. 54)

10/18 Fair cool - Road shipment of cement. and began
In @ 9440. 57 m

Along Bradley's

To 93450

10/19 Fair moderate

In 9467 54 m

9/19 Fair warmer. Concreting both at
Ex. W. ends. open 9 a.m.

Porter blew out stump ③ along Dawson's -
has Adria abt. extra right of way along the
Bradley farm. out to Conc. gang until.
Lark - trouble in getting water.
miles 54.

No Fair warmer - cone both Ed W. East gang
work on Ithaca at Sta 95+00?

In A.M. P.M. drove to paving gang east
with E. Esker.

Colterman's grading gang prepared to
commence first turn south.

9/21 Fair warm - 1320 sup. 704 down 57 and
A.M. began @ Sta 277+91.

Fair moderate cone. both Ex W. -

East gang 850 ft. laid. 4 cars cement on hand
at Dawson at noon. Staked borrow pit for
Grader on Bowers place north of Dawson.
saw Bradley abt. borrow along his place.

9/22 Sunday - Showers at 10:30 A.M. and
show in P.M. no cone. some men at
work on grade.

10/23/ Monday. Board in session
In afternoon P.M. drove east to
gang shoveling up paving & saw
bl-phone men aft moving back poles
along Bradley's place on out to cone
gang. Some hair checking.
Get data on car, if cement too
In @ 9568 -

10/24 Fair moderate -
out East with party Board in P.M.
In P.M. over to Cedar Falls & west end
job - In @ 9598 - 30 m

10/25 In @ 9634 36 m
Fair moderate - wheelers shoveling
open to 1200 frames along Bradley's
farms

10/26 Temp. min 34° max. 62°
car. - no 15113 C.H.B. Cement
Fair warm - conc. on both E. & W. ends.
Found considerable hair cracking on conc.
out east. after noon hr. had them floored out and

ster sprayed at corners. Get sample of
cement & sand from stock at Dewar.
Cement for Cedar Falls (CBQ 78734)
Porter got 50 lbs dynamite & 100 ft fuse
from Jaup - In @ 9656 (25 m)

10/27 J. Porter finished at noon on Oct. 27th
ret 4 5 6 7 9 10 11 12 13 14 15 17 18 19 20 21
out 23 24 25 26 27 1/2 \$4.00 per day & board.

Fair & warm
out @ 9656 m In @ 9680 - (24 m) no 2
Finished at Dewar corner from the east
at 11:30 A.M. moving to next set up.
Drove to C.B. job running until 9:50 P.M.

10/29 Fair warm slightly cloudy.
In 9709 m. no. 62. 30 m D.
Paving bridge section at Payson Creek, moving
pipes & bins to next setup. Drove to Payson
Creek by job then east to farm setting gang and.
in. Expect cement & sand samples to Jones who
written report on hair cracks.

10/29 Fair warm - moving prop. plant on
east job.

10/30 Fair moderate. Drove with J. Shirley, out ^{Bradley} east to Bradley farm to look at trees. Decided to cut Bradley's - Porter on stumps. 3 more cut down all trees from driveway west & two trees to cut cottonwood to the east. ordered 300 lbs dynamite. Graders working from 1st bridge hauling to 1st Chas. Shire to straighten out fence along Bradley's east. Cornfield.

Inc 9742 40 m / cloudy roads muddy Rain in P.M.
no core laid.

10/31 Rain in A.M. - H.K. Davis Paulson went to C. Sunday showing in A.M. very hybrid fair in P.M.
west end paving to Sta. 724 + 05
grading to Sta. 860 + 12

Paving on east end.

To Sta. 372 + 65 on east end at noon. Teams at work with wheeling w. corn to 1st bridge. Porter blasting stump at Bradley's farm. I ordered 100 lb more dynamite sent out to him.

11/1/r Raining all day. In op. on muddy extended all day.

11/2 cloudy & cooler. muddy roads no core laid no grading.

11/3 Fair cooler
J. Wilson Thomas Wilson

11/4 cloudy & cool - In op. in A.M. Drove east in P.M. Grading gang at 1st bridge east - J. Porter fell. finish on stumps - Porter in 1 a.m. & cross cut saw. Inc 9797 m -
Prod. Truck - 3000. lbs 3000
Batch sand & gravel - 1461 2982
Cement - 564
Prod Trucks - 150
6696

11/8 - Cloudy & cool. Easton No. 5. with Shirley 11/

about driveway culverts returned and got
block & tackle rope for cleaning cul.
Went to C. Hall & west end job. McQuinn
had poured bridge floor on 7th. Covered
with canvas & straw. Instd Durham
not to cover with dirt but to use canvas
and plenty of straw - pouring done.
trouble with mixer motor.

Ln @ 9876 m

Ln @ 9860 m

11/9/22 Cloudy & cool. off in am.

East in PM Grading gang cleaning off
paving & shouldering.

11/10/22 Fair moderate

J. Porter's time on blasting at Bradley's

Garnon.

10/31	mor.	2	3	4	5	7	5/100	4.00
1		1	1	1/2	1	1		

Made out J. Porter's time on blasting.

74, 62 no 1

Ln @ 9887 - 27 m

Notified Chas Shiere to blade off
borrow pit at Dawson's Place.

I.C.R.R. Xing lin
Winthrop, Ia.
Nov. 17 - 1922.

Main St.

$$\frac{27}{65} = \frac{27}{90}$$

B/K of shop

51k5

65

Elac. st. lt.

Nov. 19 9 AM.

36

Tanner
Smith Ch. 9d. N.
W.H. Prvis Ry Eng
W. Johnston
Moss Notes.

Sig. post

stock Yd.

Yard Bldg. 1941.

Seed Bin,

Coal shed.

2

28

271

3

水

2

~~House track-~~

Ek choto

Main Line

sta

Winthrop

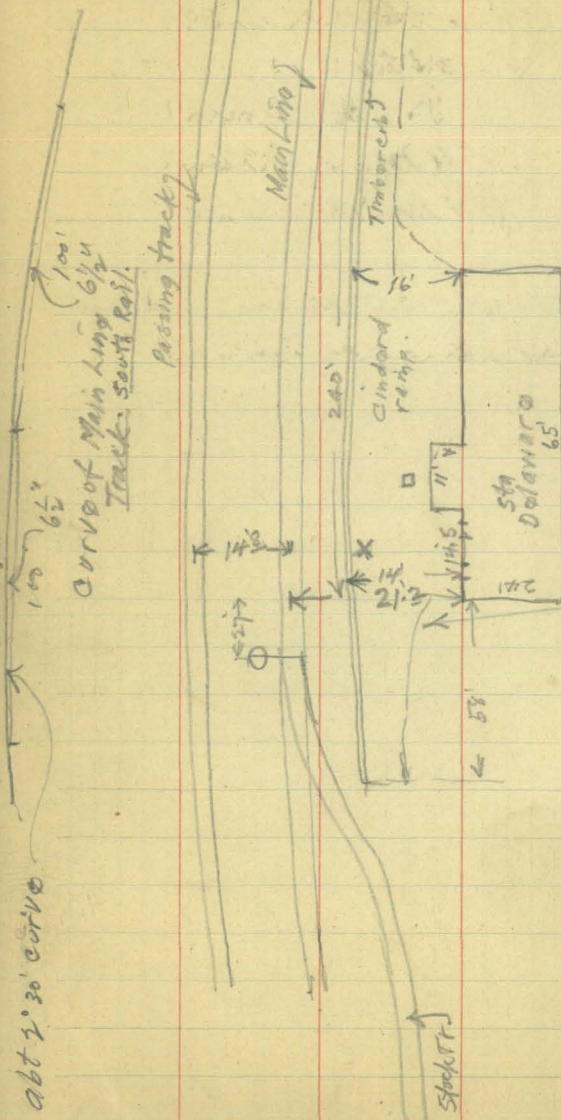
Field work & dr.	-	\$ 6.00
of & matl.		5.-
		\$ 11.00

Blue Print to Smith of Dec. 14th.

16.5.19.

C. Maiti J

1st St.



Moas. at Sta Delaware

Nov. 17

37

12:00 Noon
W. Johnston notes: W.H. owns tape.
Tanner's Photo.

Top of timber crib is 6" above the south rail of main line track. with crib top 7".

accident.

H. Lutharson apt -
Date Nov. 4. 7:25 A.M. L.P. Fleming
mail carrier fell under train.

Tanner's top two views one looking east and one looking west along platform.

Field memo sketch - 7:50

(Blue print of Delaware Sta. h.w. to
F.D. Smith at Dec. 14th 22.)

11/2/27 Count of cracks in cone paving.

Count. 51.62 or 44 to 239 + 45

Its - Cracks.

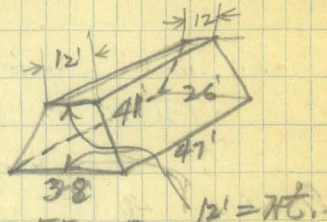
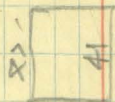
Totals 46 85

11/2/27 Road meeting in of all day. Parker was over and we talked with Rd. at drainage of Pr. Rd. no. 5. across proposed cut no 7.

11/2/27 Wloos Roofing Co. with the kettle began pouring joints on Pr. no 5 east of Wloos - but cold windy and stop in 9 AM. Drove east over paving with Shirley then north over Logan Ave Rd.

11/2/27 mess. up north on hand Johnston & York - P.M. McCusick - Const Co
Cement on hand piled in 5 Ely cor of Townsend-Merrill warehouse.
5125 Bbls - checked OK.

and pile



$$\frac{(7+12)12}{2} + \frac{(26+12)12}{2} \times 44 \times \frac{95}{2000} = 552 \text{ tons}$$

550 = allowed

Gravel pile $42 \times 42 \times 4.5 \times \frac{105}{2000} = 416 \text{ tons}$
400 allowed

Reinf. Steel - $4 \frac{1}{2}$ bars @ 17'-8" = ⁶¹⁷⁶⁰ 60560 #
624 " @ 40'-0" = ²¹²¹⁶ 20940 #
Total steel road 81500 #

Deduct amt used in } $\geq 15,000$
paving completed. } $\geq 66,500 \#$
on hand for Est. =

11/5 - Wloos roofing Co pouring cracks & joints East of Wloos on no 5. 0 to 100 to 160 to 100. Reached alt to 160 E. of Elk River Bridge Sat. evening.
Dr @ 99.85 2W = 27 miles

11/27 (Snow sun. mite.)

Fair & cloudy cooler - Turner went out to stake Right of way past Bradley farm for tel. pole location.

11/28 Fair & moderate - In ops in a.m. took sketch for bridge loading & signate sign painter. Drove to Hicks to get Dots on truck usage.

Drove out east in P.M. Shuler & men putting in metal culverts. Graders shouldering west of Poyner creek. Talked with Shuler aft. putting on more teams for shouldering up.

out @ 9986

In @ 10078 m. 32

11/29 Fair & moderate - In ops in a.m.

P.M. drove east to Co line thru camp & in over So Detour.

7 teams shouldering Sec 24 - Poyner's pipes. Road newly graded east of Gibson cor. is very bad in spots - wrote P.W. Co to cut ditches thru side bank for drainage -

In @ - 10057 m

11/30 - Holiday - Fair & moderate. at home all day.

12/1 Fair cool -

Drove out east with Lordrich to look at the outfit proposed Dist no 7, for estimating cost of road to the outlet.

In P.M. went over grading east of end of Bar. 4 to Co line - notes lengths of earth like on road side when steel scattered -

12/2 C. Bd. in session - ops work all day. Completed estimates for N.S. Co. & sent them over - rather fair & cold.

12/3 Fair & cool - Bd. meeting. working on assent plot for Bd. of approaches for no. 6 v. - notified Root of ops at angles to send out 4 truck trailers.

12/4 ops on assent plot and checking over l.c. with Auditor's copy of abstract of Poyner's pipes. Ditch with thick gaff 6 kegs nails to army etc from C + Burkey deposit places in store room under stairs - cloudy & in & out in evening.

12/5 Cloudy - lay on streets all day - P.M. on assent Plot to No. 6 v. ~~Wick~~ Wick & Burkhardt got Carter Scale from depot and loaded Bk. of oil for use in trucks.

12/8 Fair cold very icy & slippery.

Hoff on cord in Gap.

Young party on Pa no 40 Proj 233 starting over in A.M.
Ref 10.

12/15 Fair cold - C.R. Hoff & party on road in Hoopstap
and A. Young party on Road no. 57. J. & Paulsen

12/9 Saturday - Fair cold - still very icy.

Survey parties as on 8th. Dine to C. Falls and
get J. Bailey & Ashworth of paving co then drove to
Benson - walked over the paving completed. We decide
best to maintain barricades at both ends until
weather changed & ice thawed. (Approaches to
paving ends should be shaped up - set several
posts along line of paving near the bridge
at Benson.)

In @ 10/02 (#62) m 30

12/11 off work - no 62.

12/12

12/13 Cloudy & cold - of in A.M. went with
H.D. Smith to jump in P.M. saw at nite

12/14 Snowing most of day - Benson road
survey on no 57 - Cedar Falls Pike Rd -

42 ✓

W.D. Johnston - P.M.

H. D. Smith.

Cloudy cool -

No snow.

W. G. Smith. Keltzell & Mrs. Grinnell of
Cedar Rapids

Dist. on L of Huray,
now line of visibility east -

60'

43. 8

Dia. poles = 12"

at pt. 60' So. of E of main line can see
305 ft east on main line track

small width top col $9'-3"$ or $\frac{4.62}{2.56}$

Spent cattle guards & wiring fences —
at crossing E. of King's question —

April 6th additional field meas. - 7.50

2 - amended blue prints - 2⁰⁰

1 tracing 19" X 72" at scale -

of 1 inch = 5 ft

Statement on 4/30/73.

1 5.00

\$14.30

$$\begin{array}{r} 43.8 \\ 4.6 \\ \hline 39.2 \end{array}$$

Mess. to elev. & length Mikado Type of
Locomotive at L.P.K. Shop - Dec 18th P.M.

H.P. Smith &
E.P. Johnston

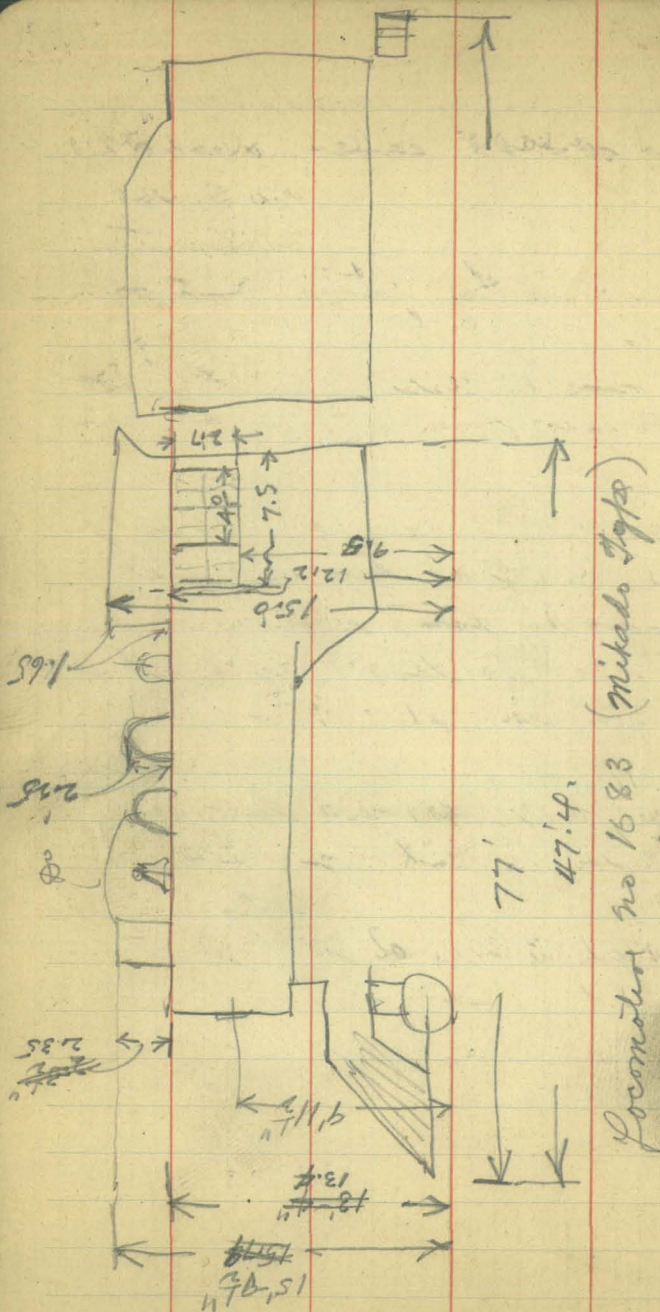
Made tracing same day got blue print at noon.
on Dec 19th.

Field mens & sketch	=	\$ 2.50
add. mess. locomotive fireman's position	=	2.00

Man in fireman's seat on left side
engine cab. Dist from foot end of cab
to ft. under his eyes = 46.0 ft.
Ht. top rail to line of eyes when
in position is 10.9 ft. -

Obs meas. dist. gauge of track to
outside of engine cab = 2.9 ft
2.35

Distance of track to O.S. of
locomotive cab $\rightarrow 5.25 = 5' - 3''$



Cars piling red - 2 Cars Cypress.

1st car 100 pss.

50 @ 18' lg.

50 @ 26' lg.

2nd car - 125 pss -

Red 1/10/23

45 @ 16' lg.

35 @ 20' "

45 @ 25' "

Mess. of Xing accident ICRM.S. IRMA - & Pr. Rd No. 40. Bremer Co.

Joe Allaway - fatally injured, struck
by train -

Two miles South of "Luna" Jan 24, 1923 -
9:15 A.M.

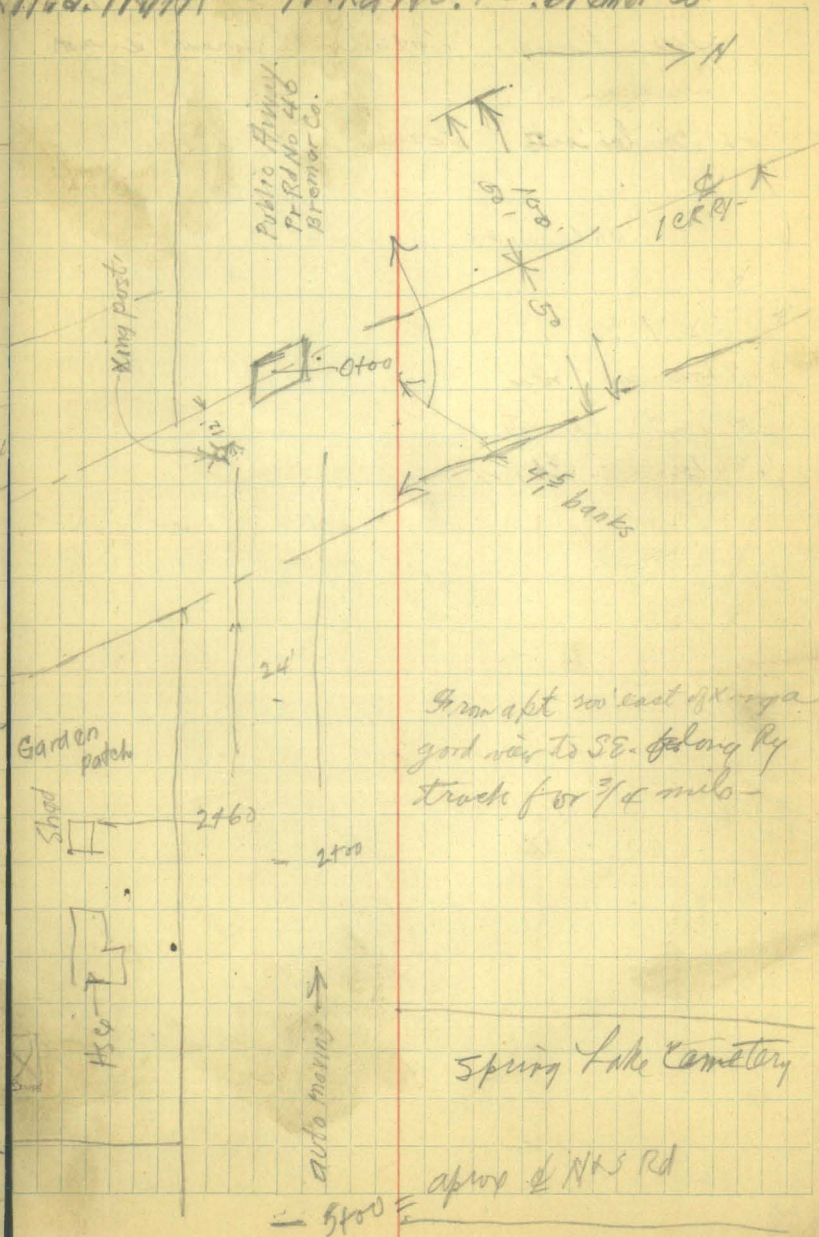
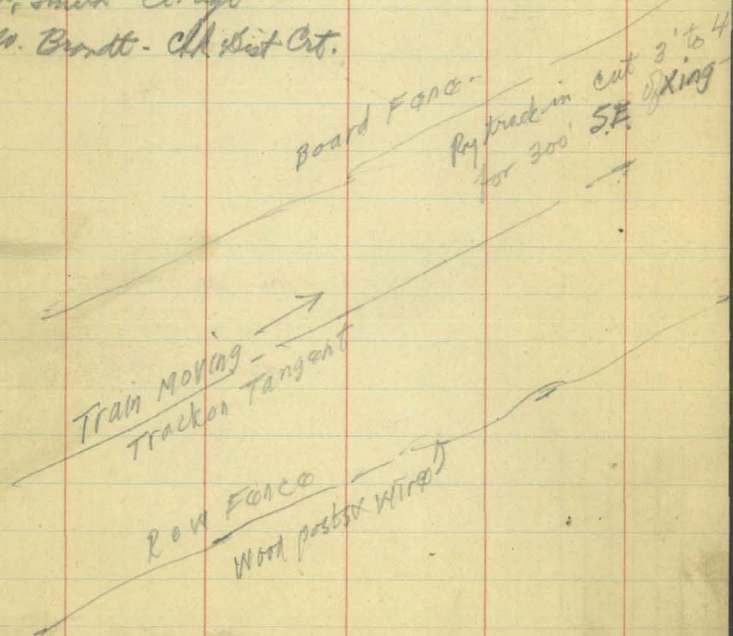
Called "Schlaberg's Crossing"

Feb-5-1923 - 5:30 PM.

W.D. Johnston note

K.D. Smith Cl. Agt

J.W. Brant - Ch. Dist. Ct.



Road gravel hauled by Frank Kennison
 "Krog Pit" to South Waterloo Cedar Falls Road. Apts recd by J.C. Kennison
 January = 259 loads hauled = Knights Knights hauling gravel on to W. & C. Hills Rd.
 December = 131 loads (6 to 8 loads per day)
 Feb. Dec 21 to Jan 3 -
 Dutchman Bacon J. Lamb. Pete Hanson Houshain 3 to 10 -
 Loads 7 15 10 3 8
 Loads hauled during February 1st to 24th incl = 87 to 7/14/
 Total for February - (98 loads)
 3/1/ to 3/26/23 14 " (14/ to 7/21/
 Total loads to date 3/26/23 = 502 $\times 100\%$ 1/1 to 7/26/23

cu. yds	amt.
164 - @ 1.28	- 209.92
154 - 1.28	- 197.12
238 - @ "	- 304.64
62 - @ "	- 79.36
50 - @ "	- 64.00
(668)	(855.04)
60 @ "	76.80
36 @ 1.22	43.92

J. Lamb - 4/14 am. reported that he hauled 81 loads @ 20¢

Located east line of Lot no 62
for H. Hutchinson Prop. of
Martin Cape -

WCF & N R1

63

Found Iron stake

293.5

 $\frac{3}{8}$
352.2

27.0

575.6

1124.6

529.0

 Lot No 62
H. Hutchinson

1119.4

316.0

26.6

26.6

1317.0

61

Found iron stake

292.7

510.8

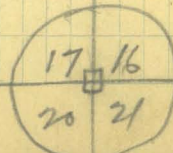
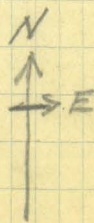
10.2

329.6

33.8

25.3

Whitney Road.



Miller's Dist.
Orange Twp.

May 11-1923.

1. Sec 10-11 old boiler pipe cul.
att. 250' So. of north line of Sec 10
Replace with 8'x4'x22' R.C.B.
2. Sec 14-23 old 2 span wood bridge
att 400' East of west. cor.-
Build new: 20'x20' I.B. angle iron
hand rail.
3. Sec - 26-35 Blk Hawk Twp.-
Replace 15" ? corr. pipe with R.C.B.
4. Sec 11-12 Eagle Twp old wood trestle
att 40 rods north of So Corner.-
Build I.B. - 32'x20' - angle iron hand
rail. $29 = 4480$ a.
 $32 \times 6 = 192$ ft.

Bentley's Dist.

Sec. 15-22 E. Waterloo Twp 16'x16' wood -
Build 10'x8'x22' R.C.B.

Sec. 17-20 E. Waterloo Twp. 10" pipe.
Build 3'x2'x22' R.C.B.

STEEL TRUSS - Bridges.

Data for Painting Proposals -

May 14 - 1923 -

Bridge across Shellrock River East of Windsor.
 3 spans @ 100 ft high truss wood floor -
 17 ft. c to c trusses. Two piers & E. abut are stone
 masonry - West end on steel tubes.

Bridge across West Fork Cedar River at Finchford -
 1-span @ 154 ft high truss with 34' IB approach
 spans at S Ely end - 17' c to c trusses -
 Truss by Wrought Iron Bridge Co Canton Ohio
 Date 1880. masonry pier abut.
 wood joists.

May 14 - 1923

Bridge across Black Hawk Cr at Hudson La
 East span 42 ft. Pony Truss.
 Central span 2 @ 80 ft High Truss.
 West end 1 @ 16' IB wood floor.
 3 Piers - concrete filled steel tubes.
 Floor system - wood floor & joists on truss.

Levels on E Fowler St - W/00 at ICRK. E. Belt Line King —			
T.P.,	3.78	103.78	100.00 ^{assumed} elev
	3.78	100.00	top high rail, left E. Belt at E
			Gowles St. Waterloo La
0+00 = E Ry track	4.07	99.71	Rev. of low rail.
+25	5.1	98.7	Elev. going East
+50	5.9	98.0	
1+00	7.0	96.8	
1+50	6.9	96.9	
0+00 = E Ry track			
+25	4.3	99.5	
+50	5.0	98.8	
1+00	5.6	98.2	

5-19-23

A.M.

W. J. Inst.

Bucke Rod.

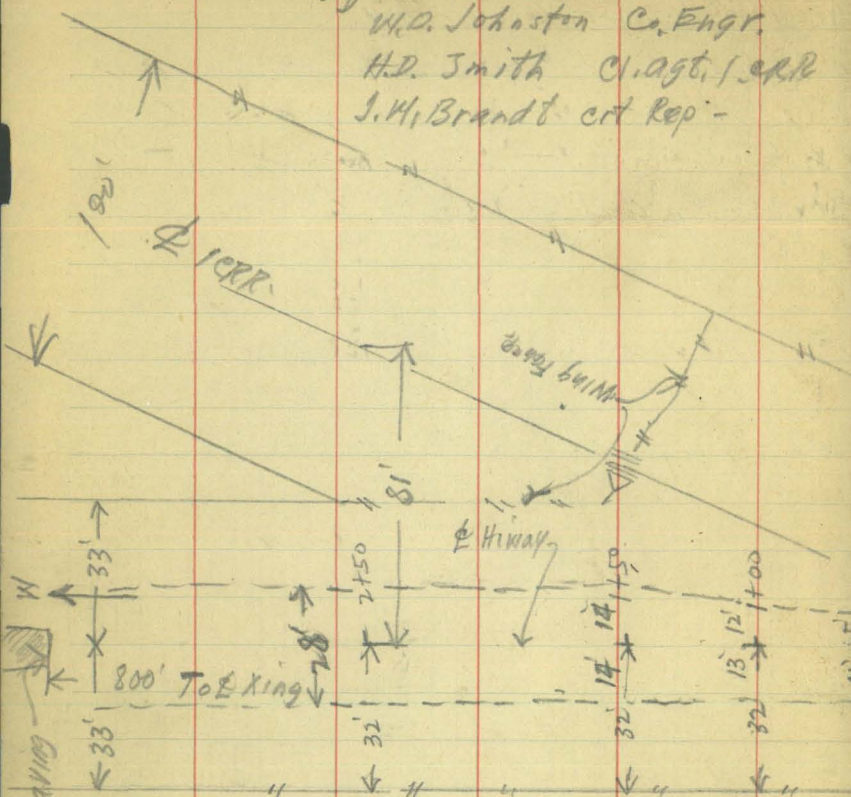
Elev going west on E asphalt paving —

July 25 - 1923 -

W.D. Johnston Co. Engr.

H.D. Smith Cl. Agt. I.C.R.R.

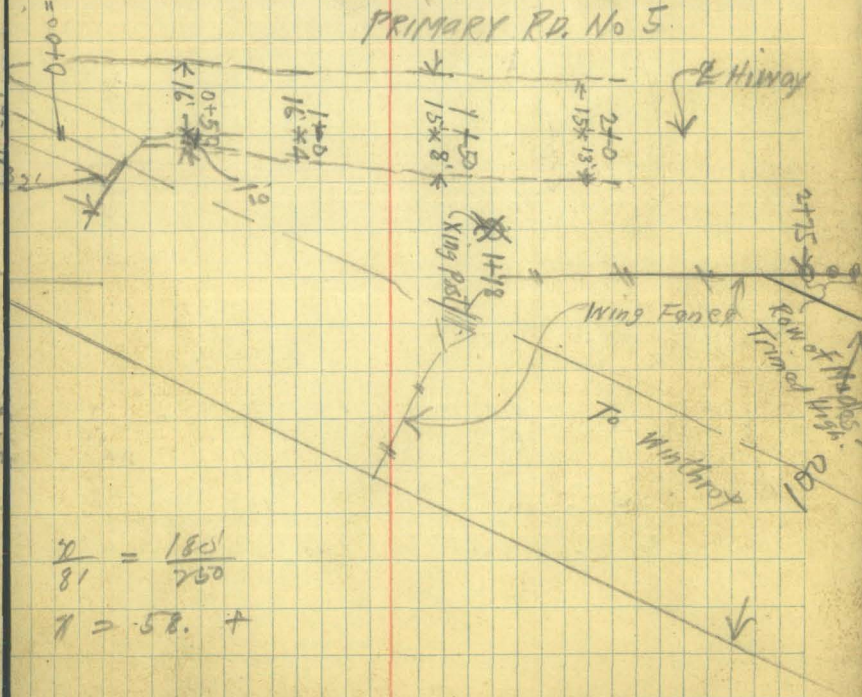
J.H. Brandt crt Rep -

Taylor King 2 miles west of
Winthrop - July 22 8:38 P.M.At pt. 250' east of E King can see rails
of Ry track dist of 1000' S.E. - could see
approaching train for dist of 1500 ft.

E of plank King is on E of highway.

Auto traveling west struck by freight
fatally injuring Mrs Smith & baby.

D+00 = E King and I.C.R.R.



From E Taylor King S.E. along E Lepp #45 to
Preacher King which is 343' So of E of Pr. Rd No.
Ry, being parallel with highway no 5 east of latter King.
Curve ends abt on East R. of W. line of Preacher King -
45.5 Rail lengths @ 33' = 1501.'

$$\frac{x}{81} = \frac{180}{250}$$

$$x = 58.4$$

east of Pasture SW. of Cedar River and in
ast. 1/4 Sec 22 - 88-12 for.

Burt & Jones

Roy A. Burt - Estherville, Ia. 2-12-24

Clear moderate

59. Ft.

Area = $\Delta \quad 435 \times \frac{518}{2} = 112,665 \text{ sq. Ft.}$

$$= 500 \times \left(\frac{586 + 554}{2} \right) = 285,000 \text{ ₹}$$

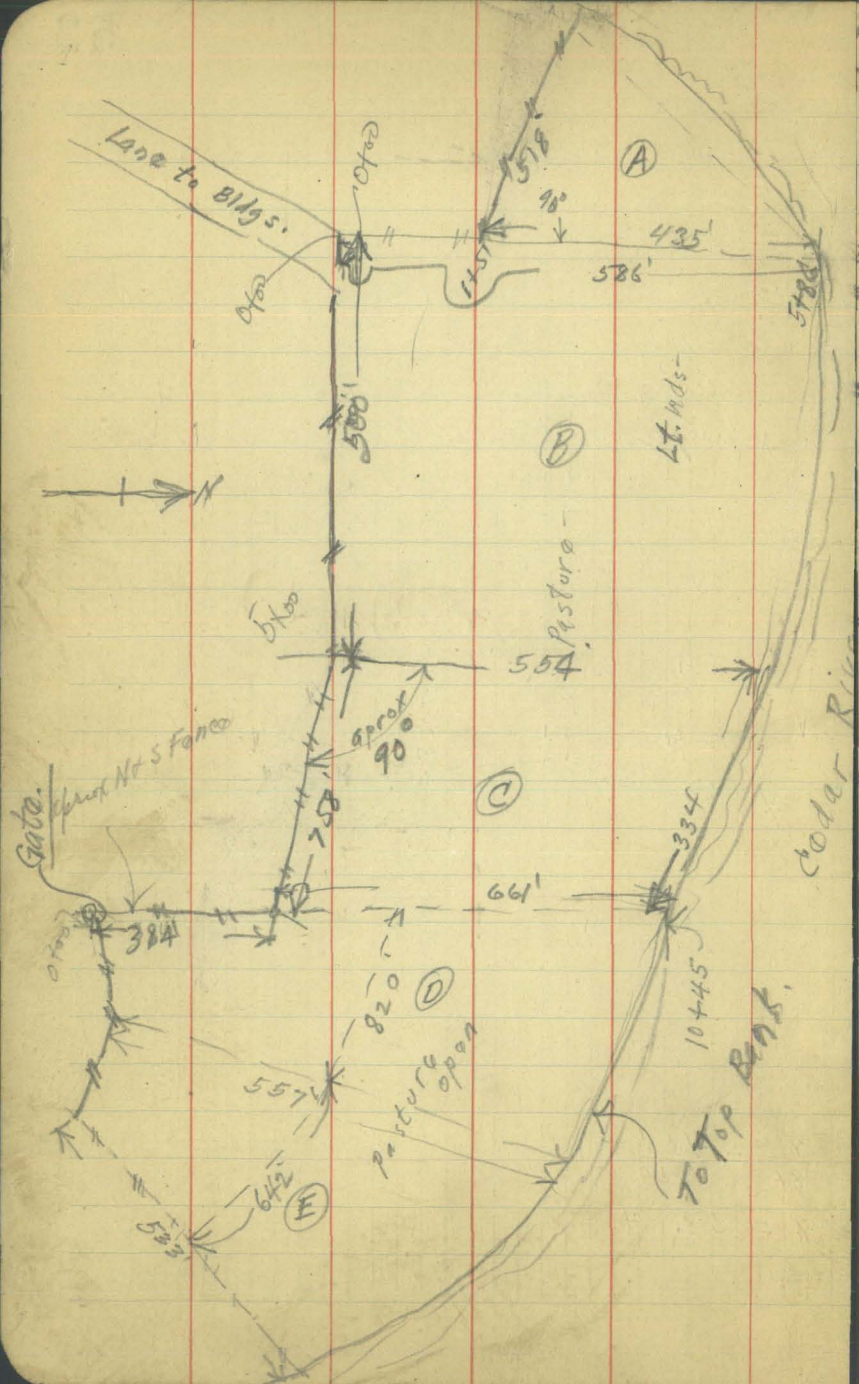
$$= \text{trapezoid} \left(\frac{758 + 334}{2} \right) (554) = 302,484 \text{ m}^2$$

$$\left(\frac{1045 + 557}{2} \right) 820 = 656,820 \text{ ¢}$$

$$\left(\frac{533 + 557}{2} \right) 642 = 349,890 \text{ m}^3$$

1,706,859 $\square$

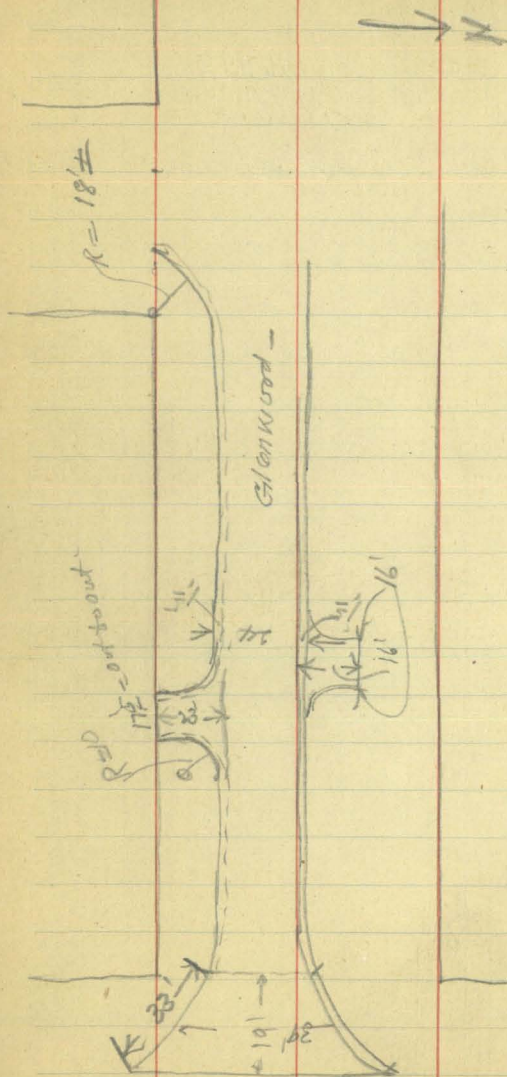
or total of 39.18 acres.



Gravel Pit Contract & Lease -

N. Shick

2nd lease entered into May 17th 1922.
 consideration 50.⁰⁰ for parcel of land
 comprising one tenth of one acre lying
 adjacent to & northeasterly from old
 Shick Gravel Pit.
 Term of 20 months



55
N
↑

Parker

st.

161.4

16

120

150.4

Hold

Proposed Mat'l.
Yd. for BIK HK G.

245.0

38.4

218.2

180

MEHN-Y

5'

185

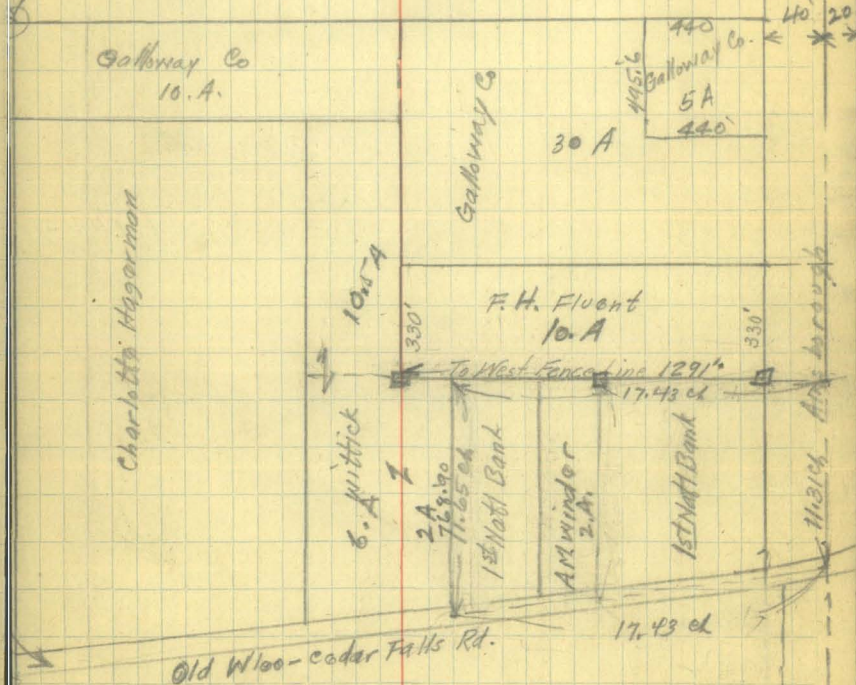
FERRY

162.

Sta.	B.S.	I.I.	F.S.	Elev.
B.M.	4.11	104.11		100.00
0			7.18	
1			6.37	
2			5.74	
3			5.78	
4			5.48	
5			4.23	
6			3.78	
7			3.65	
8			3.60	
8+40			3.38	

Th. Florent. W.D. - Dated 4-1-27
South 10 A of NE $1/4$ of SE $1/4$ Sec 21-89-13.

Enter Sec 21-89-13



□ Indicated ved stakas set.

$$11-65ch = 768.90 \text{ Ft},$$

11.31 @ = 746.46 Ft.

17.43 ch = 1150.38 Ft.

Progress Report - Grading (Waste)

STA.		Orig. Quan.	New Quan.	Est. Quan. placed.
From	To			
780+00	755+32	3484	7090	+
755+32	783+30	1341	2310	+
		(4825)	(9400)	6910 +9

783+30	823+25	1845	4241	3041
		Est. Total $\pm 1. = 9951$		

823+25	860+50	2062	4079	2969
		(8732)	17720	(12920)

860+50	943+70	11104		
		(28,824)	- Estimated Quan. -	

Corrected total by
computations 28000 cu.

Progress Report - Grading.

East End.

Orig. Quan.	New Quan.	Est. Quan. Placed.
7201	19335	
7162	19335	
7123	10619	
6529		
(14324)	(29954)	29354
		29954

+168% on 2
6850 cypd
+62

0+44 149+50

149+50 238+45

357+00 322+00

322+00 308+00

368+00 357+00

2049

1046

377

3508

2295

967

(3472)

(6770)

4970

Total Est. Earth Exc. to Oct 1 = 34324

238+50 308+00

368+00 553+00

3657

7810

6507

15493

(11,467)

22000

17218

Total Est. Earth Exc. to Nov (51,543)

553+00 663+00

238+00 368+00

368+00 663+00

11,180

-20 c.y. per sta. -2600

-25 c.y. per sta. -7425

at south turn -235

Total to Deduct 10,260

0+44 663+05

283+00 333+00

35343

69824

(59,564)

60,564

Est. Dec.

Div. 2

+97.6

Est. 1/30

Paving. Type "A" Conc.

Completed to Nov. 1 - 1922 - ① 74424 D.Yds

② 4810 v

79234 D.Yds

Totals to Dec. 1 - Est

① 74424

② 6028

80452 yds

0+44 to 149+50 = City Limits to West End bridge across Elk Run Creek.

149+50 to 238+45 = Elk Run to Denver-Raymond Rd.

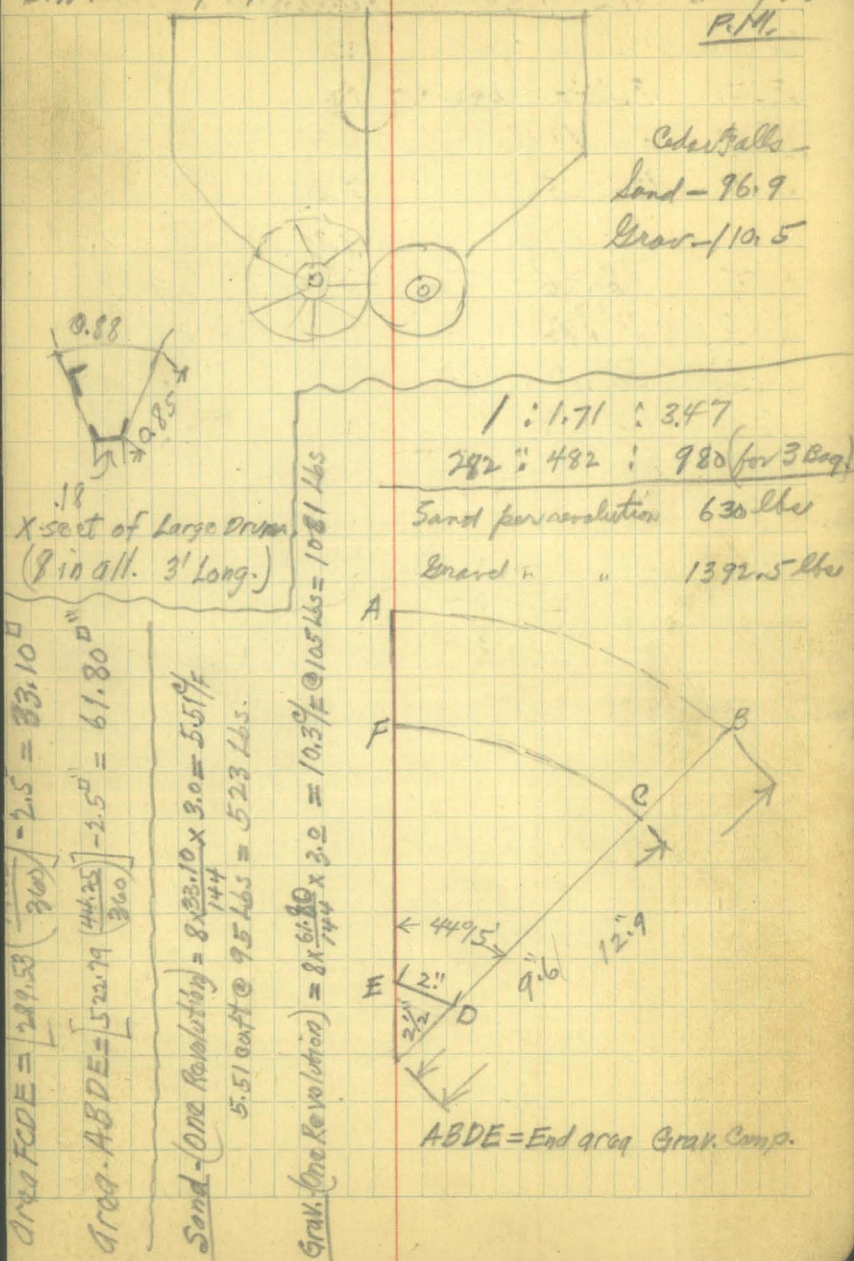
238+45 to 367+00 = Inter. Denver Rd.

Over-run Orig. Quan.
of New Quan.
Sta 238+50 to 368+00 = 82%

Cars. Rej and dumped & reloaded.

Car Initials	Car Number	Destination	Date
R.I.	88643	Dewar	8/31
N.W.	39641	"	8/31
I.C.	122805	"	8/31
N.W.	102937	"	8/31
R.I.	98865	"	8/31
R.I.	86876	"	8/31
R.I.	86239	"	8/31
N.W.	44076	"	8/31

Sketch & Computations - of Steel Matl 59
Bin & drum proportioner at Cedar Falls. 9/26/22 P.M.



$$18 \times 20 = 360 \text{ ft}^2$$

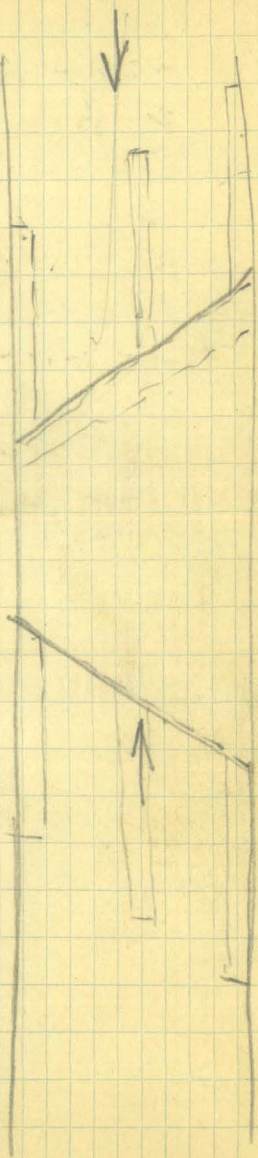
28 tons or 56,000 lbs

uniform load of 155 #s ft²

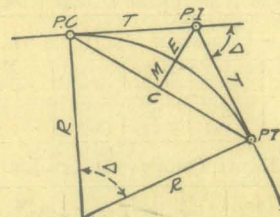
J. B. Lukens for rodman.
618 Linden Ave
Phone - 2111 W.

$$\begin{array}{r} 2107 \\ \times 7 \\ \hline 14749 \end{array} \quad \begin{array}{r} 48560 \\ \times 14 \\ \hline \end{array} \quad \begin{array}{r} 1 \\ 3 \end{array}$$

$$\begin{array}{r} 28 \text{ tons} \text{ lb} \\ 155 \text{ #s ft}^2 \\ 36 \times 20 = 720 \text{ ft}^2 \\ \hline 56000 \text{ lbs} \\ \times 36 \\ \hline 201600 \\ \times 20 \\ \hline 403200 \end{array}$$



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


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

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

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

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

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

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 $+8\frac{1}{8}=414.49$ 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—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 91.37. For from Table IV for 1° curve E=960.6 for 8° 20'=960.6÷8¼=91.27 and from Table V correction=.10 or E=91.37 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° 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.

1-16	3-32	1/8	3-16	1/4	5-16	3/8	1/2	3/4	7/8
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625

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	9	637.28	1.965	7.846	2.70
50	3125.36	.400	1.600	0.55	20	614.56	2.037	8.136	2.80
2	2864.93	.436	1.745	0.60	30	603.80	2.074	8.281	2.85
10	2644.58	.473	1.891	0.65	40	593.42	2.110	8.426	2.90
20	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
30	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
40	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
50	2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
3	1910.08	.655	2.618	0.90	12	478.34	2.620	10.45	3.60
10	1809.57	.691	2.763	0.95	30	459.28	2.730	10.89	3.75
20	1719.12	.727	2.908	1.00	13	441.68	2.839	11.32	3.90
30	1637.28	.764	3.054	1.05	30	425.40	2.949	11.75	4.05
40	1562.88	.800	3.199	1.10	14	410.28	3.058	12.18	4.20
50	1494.95	.836	3.345	1.15	30	396.20	3.168	12.62	4.35
4	1432.69	.873	3.490	1.20	15	383.07	3.277	13.05	4.50
10	1375.40	.909	3.635	1.25	30	370.78	3.387	13.49	4.65
20	1322.53	.945	3.718	1.30	16	359.27	3.496	13.92	4.80
30	1273.57	.982	3.926	1.35	30	348.45	3.606	14.35	4.95
40	1228.11	1.018	4.071	1.40	17	338.27	3.716	14.78	5.10
50	1185.78	1.055	4.217	1.45	18	319.62	3.935	15.64	5.40
5	1146.28	1.091	4.362	1.50	19	302.94	4.155	16.51	5.70
10	1109.33	1.127	4.507	1.55	20	287.94	4.374	17.37	6.00
20	1074.68	1.164	4.653	1.60	21	274.37	4.594	18.22	6.30
30	1042.14	1.200	4.798	1.65	22	262.04	4.814	19.08	6.60
40	1011.51	1.237	4.943	1.70	23	250.79	5.035	19.94	6.90
50	982.64	1.273	5.088	1.75	24	240.49	5.255	20.79	7.20
6	955.37	1.309	5.234	1.80	25	231.01	5.476	21.64	7.50
10	929.57	1.346	5.379	1.85	26	222.27	5.697	22.50	7.80
20	905.13	1.382	5.524	1.90	27	214.18	5.918	23.35	8.10
30	881.95	1.418	5.669	1.95	28	206.68	6.139	24.19	8.40
40	859.92	1.455	5.814	2.00	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
20	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
30	518.08	23.33	20	1027.5	91.40	20	1553.1	206.77
40	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
50	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
	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	483.3	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	.55	.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	.79	.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	4.06
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	.090	.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	.266	.353	.440	.528	.617	.707	.797	.877	.971	1.07	1.18	1.29
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	1.08	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
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	.06	.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	196.96	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	388.43
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	1.21	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	1.26	.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	.037	.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	.239	.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

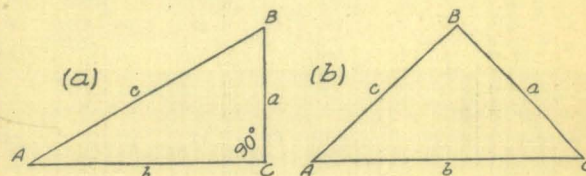
SLOPE REDUCTIONS.

When distances are measured on a slope they 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.

$$\begin{aligned}\sin. & A = \frac{a}{c} \\ \cos. & A = \frac{b}{c} \\ \tan. & A = \frac{a}{b} \\ \cot. & A = \frac{b}{a} \\ \sec. & A = \frac{c}{b} \\ \csc. & A = \frac{c}{a}\end{aligned}$$



FORMULA FOR SOLVING TRIANGLES.

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

TABLE VIII.—NATURAL TRIGONOMETRICAL FUNCTIONS.

Angle	Sine.	Tan.	Cotg.	Cosin.		Angle	Sine.	Tan.	Cotg.	Cosin.	
^{or} 0	0	0	00	1	90	^{or} 8	.1392	.1405	7.115	.99027	82
10	.0029	.0029	343.8	1	50	10	.1421	.1435	6.968	.98986	50
20	.0058	.0058	171.9	.99998	40	20	.1449	.1465	6.827	.98944	40
30	.0087	.0087	114.6	.99996	30	30	.1478	.1495	6.691	.98902	30
40	.0116	.0116	85.94	.99993	20	40	.1507	.1524	6.561	.98858	20
50	.0145	.0145	68.75	.99989	10	50	.1536	.1554	6.435	.98814	10
1	.0175	.0175	57.29	.99985	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
	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.	
^{or} 16	.2756	.2867	3.487	.96126	74	^{or} 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
	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.	
or						or					
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						
40	.5398	.6412	1.560	.84182	20	39	.6293	.8098	1.235	.77715	51
50	.5422	.6453	1.550	.84025	10	10	.6316	.8146	1.228	.77531	50
						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	.5544	.6661	1.501	.83228	20	40	.6428	.8391	1.192	.76604	50
50	.5568	.6703	1.492	.83066	10	10	.6450	.8441	1.185	.76417	50
						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						
40	.5688	.6916	1.446	.82248	20	41	.6561	.8693	1.150	.75471	49
50	.5712	.6959	1.437	.82082	10	10	.6583	.8744	1.144	.75280	50
						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						
40	.5831	.7177	1.393	.81242	20	42	.6691	.9004	1.111	.74314	48
50	.5854	.7221	1.385	.81072	10	10	.6713	.9057	1.104	.74120	50
						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						
40	.5972	.7445	1.343	.80212	20	43	.6820	.9325	1.072	.73135	47
50	.5995	.7490	1.335	.80038	10	10	.6841	.9380	1.066	.72937	50
						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						
40	.6111	.7720	1.295	.79158	20	44	.6947	.9657	1.036	.71934	46
50	.6134	.7766	1.288	.78980	10	10	.6967	.9713	1.030	.71732	50
						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
											or
	Cosin.	Cotg.	Tan.	Sine.	Angle.		Cosin.	Cotg.	Tan.	Sine.	Angle.

TABLE IX.—CALCULATION OF EARTHWORK.

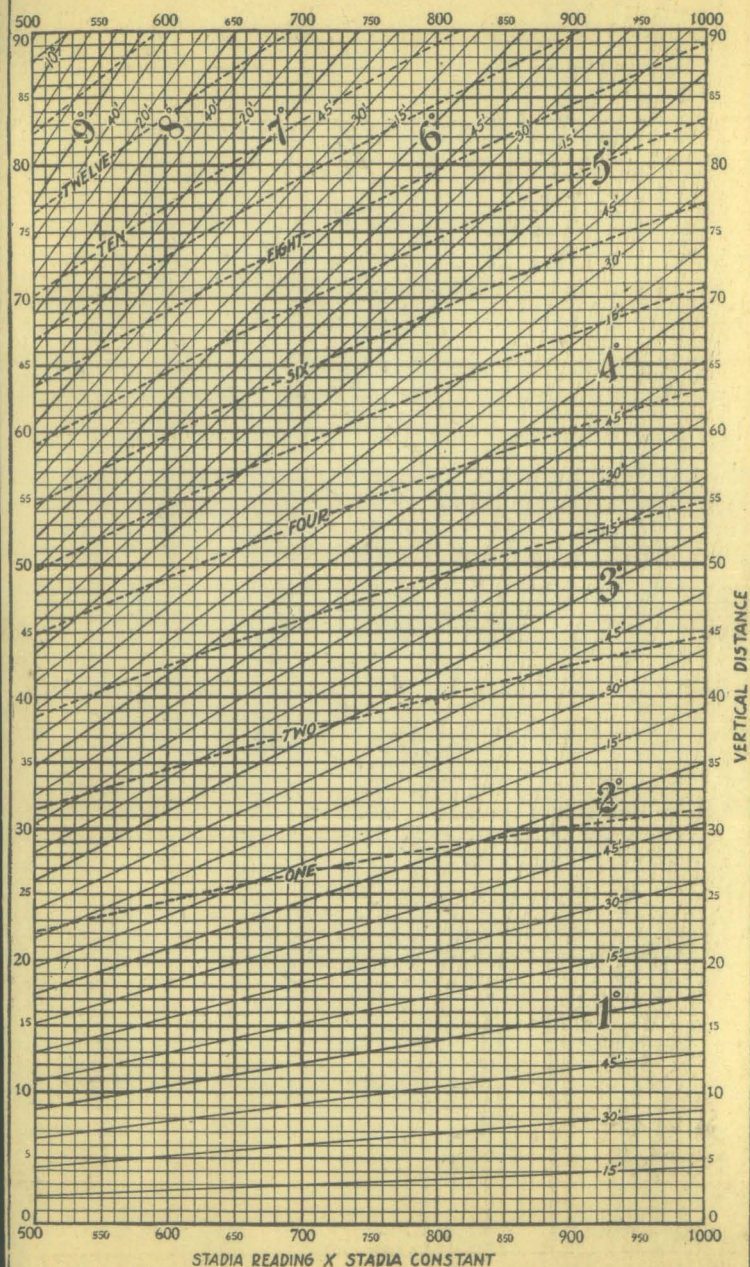
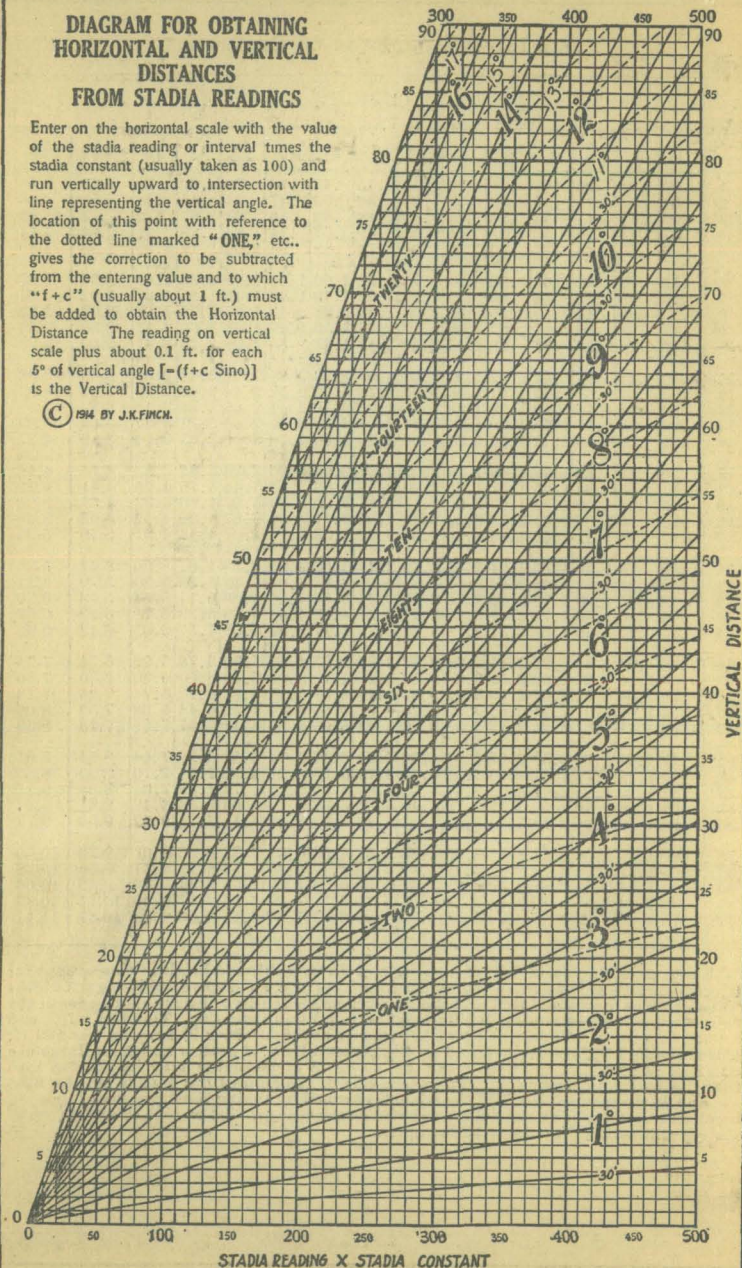
Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	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. $= 1.48 + .028 + .089 = 1.597$ cu. yds. or practically 160 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 (or fills) break in turn ($= w$) 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 5° of vertical angle [$-(f+c \sin \alpha)$] is the Vertical Distance.

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42.6 mileage at Platt Pit.

42.33 " at Brandhart Pit

45.9¹³ to cor. So. of Hudson School

63.0 " " " " "

64.9 to W. end of Hudson-E.C. Rd.

$3.2 \text{ miles} + 1.9 \text{ miles} = 5.1 \text{ miles. average haul.}$

Dead Haul 4.8 miles

5.1^{1.5} 6.3 m. = ave. haul.

$$\begin{array}{r} 350 \\ 125 \overline{) 4350} \\ \underline{375} \\ 600 \end{array}$$

$$100 \times 100 \times 6 = 45$$

$$\begin{array}{r} 2000 \\ 2 \overline{) 6000} \\ \underline{4000} \\ 2000 \\ \underline{2000} \\ 0 \end{array}$$

$$45 \times 200 = 6.4$$

$$\begin{array}{r} 4.8 \times 16 \\ 288 \times 42 \\ \hline 1280 \\ 900 \\ \hline 3800 \\ 200 \\ \hline 4000 \end{array}$$

5.0 Smalley-

Sta 276 + 84

$$\textcircled{1} \quad \begin{array}{r} 290 + 80 \\ 13 + 96 \times 83' = 2.70 \text{ a} \end{array}$$

$$\textcircled{2} \quad \begin{array}{r} 290 + 80 \\ 304 + 69 \\ 13 + 89 \end{array} \times 63 = \frac{2.00 \text{ a}}{4.7 \text{ a.}}$$

O'Dell

$$304 + 69$$

$$318 + 70$$

$$14 + 00 \times 63' = 2.00 \text{ acre}$$

$$\begin{array}{r} 1.9 \\ 3.2 \\ \hline 5.1 \\ 1 \times 5 \\ \hline 6.6 \end{array} \quad \begin{array}{r} 376 \\ 9 \\ \hline 94 \times 3 \times 9 = 279 \end{array}$$

$$\begin{array}{r} 28 \\ 104 \\ \hline 112 \\ 165 \overline{) 21070} \\ \underline{165} \\ 457 \\ 330 \\ \hline 1270 \\ 1115 \\ \hline 155 \end{array}$$

1700
117 rods

32

4220
 940
 5560443560700+00
 109-
 1000
 73
 4386 73000
 4386
 29440
 Sta. 251+39 to
 276+84
 25+45
 1500
 17
 10500
 15
 25500
 2740
 211000 lbs.
 5500
 276500
 9.2 tone
 66+50
 51
 4
 62
 740
 30
 2.9
 17
 16
 47
 10
 55
 57
 94
 28
 5280
 2640
 7920
 1.77 acres = Osborne
 86+00
 860
 35
 0.9. Bawn = 4.50 acres

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) ÷ 2 or 2 ft. added to 41.9 = 43.9. For slopes of 1 on 1 see inside of front cover.

W. D. Johnston

Waterloo, Iowa

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