

70

FIELD BOOK

361

KEUFFEL & ESSER CO.

DRAWING MATERIALS

AND

SURVEYING INSTRUMENTS.

NEW YORK.

CHICAGO. ST. LOUIS. SAN FRANCISCO. MONTREAL.

TABLES FOR EXCAVATIONS AND EMBANKMENTS.

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.

ROADWAY 18 FEET WIDE. SIDE SLOPES 1 TO 1.

FOR SINGLE TRACK EXCAVATION.

"Copyright, 1895, by Keuffel & Esser Co."

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

Calculated by Julien A. Hall, M. Am. Soc. C. E.

For Keith's Railroad Curve Tables see end of book.

70

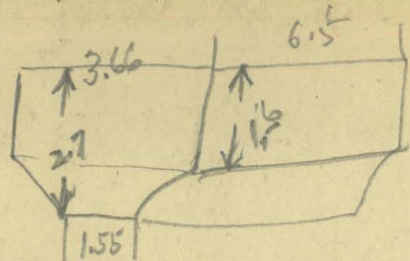
133 82

W.D. Johnston,

Waterloo, Iowa.

County Engr's Offs.

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



#36

Limestone

57. cu. ft

$$\begin{array}{r} 1.55 \\ 3.66 \\ \hline 5.21 \end{array} \times 1.1 \times$$

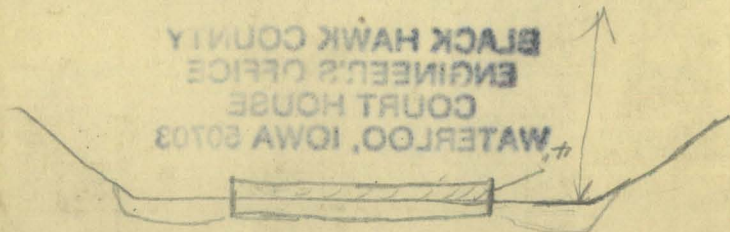
$$\begin{array}{r} 3.66 \\ 1.6 \\ \hline 21.96 \\ 36.6 \\ \hline 58.56 \end{array}$$

$$\begin{array}{r} 5.21 \\ 1.1 \\ \hline 5.21 \\ 5.21 \\ \hline 215.731 \\ 2865 \\ \hline 5856 \\ 8.721 \times 6.5 \\ 65 \\ \hline 43605 \\ 52326 \\ \hline 566865 \end{array}$$

$$\begin{array}{r} 3 \quad 39 \\ 8 \quad 36 \\ \hline 75 \\ \times 200 \\ \hline 150.00 \end{array}$$

E.F.

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



INDEX.

Pago.

Borrow Pits - Pr. Proj. No 331 Cedar Falls - Pike Rd. - 6
Bridge Repair - H.T. Pr. Rd. No 40 - Big Cr. 1-2-3-4-5-6
Bridge - H.T. Spr. Cr. on Co. Rd - LaPorte - Brandon Meas. 43

Gravel Pit. Location surveys.

Mahood Pit. SW 1/4 Sec 15 - 87-12 - 12✓
Rousselow Pit. SW 1/4 Sec 24 - 87-12 - 7✓
Connor Pit. SW 1/4 Sec 8 - 87-12 - 27✓
Gravel Pit Prospect. NE 1/4 Sec 19 - 89-13 - 34✓
Fisher Pit. adjacent to Dunkerton Pit.
Loc. in SW 1/4 Sec 28-90-11 - 54✓
Newton Pit. NE 1/4 Sec 13-87-12 - 55✓
Fehl Pit. SE 1/4 Sec 14-87-11 - 56✓
Griffen Pit. SE 1/4 Sec 7-89-12 - 57✓
Tile proposed on Co Rd SE. of LaPorte - - 50
Lero/s in South road ditch.

Tile trap Road. Sec 5-8 Benn. - 52
Road Survey Trap Rd (part of) to Casebear H&B - 53

Extra matl reqd for repairing Pin Cows.
(4-1-24) Truss La Porte C. (Main battened)

Top chords -

2" x 8 = 16 plates each 10" x 60" x $\frac{1}{2}$ "

Hangers -

2 plates = 6" x 35" lg. x $\frac{1}{4}$ "

Will remove top portion of west abutment
above bridge seat, and rebuild to provide
facing notch and clearance around
roller rest.

1.
H.B. Green at La Porte City -
Am I need 3 lbs to Dyd.

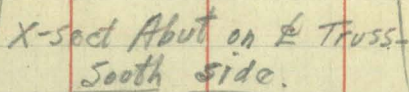
Thickness 8" =

Coarse agg. limestone Dolene -

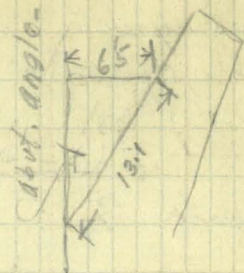
Buffalo Quarries

10.55' west of Bridge -

4-3-24.2.
Fair & moderate.



Plan, old West Abot'nt
at Elav. of Brye Seat.



4' - 8 1/2" Bridge seat up to ladder on ϕ load = 4.70
" " " " " on ϕ walk = 5.9

$$\begin{array}{r} 412 \\ \times 67 \\ \hline 345 \\ 412 \\ \hline 278 \\ \hline 470 \end{array}$$

$$\begin{array}{r} 14.5 \\ 6 \overline{) 87} \\ \underline{60} \\ 27 \end{array}$$

$$\begin{array}{r} 4.12 \\ 3.95 \\ \underline{3.62} \\ 0.50 \end{array}$$

$$\begin{array}{r} 6.75 \\ 12\frac{1}{2} \\ \underline{12} \\ 1 \end{array}$$

Refacing of Sully wing
 Length 24' x 8' thick near 8"
 $\frac{24' \times 8' \times 0.67}{27} = 4.74 \text{ cy.}$ 4.74

Concrete reqd in abutment C.Yds.
 $(25 + 11' + 11' + 9) \times 3.17 \times \frac{5.4}{27} = 21.2$

middle part

$20' \times 2.5 \times \frac{3.53}{27} = 6.56$

walk repair

$2 \times 7 \times 7 \times \frac{0.4}{27} = \frac{1.5}{29.2}$
 4.74

Total estimated conc. 33 x 94

See page 10 this book.

John Frank Chinan of St and alley
 Conn Laporte City.

See him about bid from expansion for
 city paving.

4/9/24 Clean crest concrete abut top
 at Big Creek Bridge Repair job.
 1 former & 10 men completed pouring
 at 4:00 P.M.

4/11 cold & snow all P.M.

4/11 Fair & warmer

Poured concrete floor on Laporte City.
 Bridge repair job. finished concreting
 at 3:30 P.M.

Returns to Loo on 4:33 car -
 Expense 1.20 x 40 = \$1.60

Maintenance of Detour -
No 40 who LaPorte -

1 cods Bridge 20' x 16'
rebuilt thru out

Post at end of narrow Culvert -
Post at turn 1 mile north of mill road
corner.

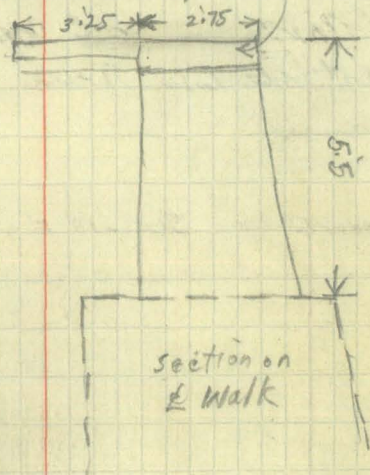
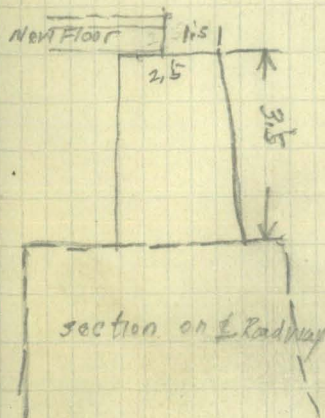
Temporary Guard Rail -
at mill creek crossing.
" Newton Gravel Pit.

Meas. of extra concrete LaPorte City

Bridge Repair job -
Total length new floor = 128.8
" width " " = 20.0'

Paving noted at west end -

20' long x 1.5' wide x 1.4' depth below walk grade.



See page 10.

April 21-

Edgar Fall Const. Co.

Estimate No. 2-

(*) Steel 44000#

Cement 200 Bbls.

(Gravel additional) 40 cu.

8
1278.15

480.-

361.75

85.00

Beginning at East end.

1 span @ 15' c to c pile bents 15'

5 " @ 19' " " " 95'

3 " @ 15' " " " 45'

Total length 155'

Temporary Bridge across
Big Creek in LaPorte City

3/24/29.

Borrow road on Proj. No. 331.

Nels Anderson Cuyds
road-

Sta 7400 to Sta 32+79 = 4356

1.8 acres $\pm$ $\times$ 50 a. = 2x80

{ 0.5 acre at west end $\times$ 60 ft strip on
SE side. Rate = @ \$200. per a.

\$
460.00

Geo Uhl.

Sta 19 to Sta 206+50

Proposed borrow pit on NW side

50' wide $\times$ 1550 ft long. = 178 a

\$
356.00

3188 @ 200 =

T.D. Messier (NW side)

Sta 223 to Sta 243+00 3582

40 ft. strip on NW side.

2¹/₂ a @ 200 = \$460

L.E. Condy - (SW side)

amt. expended for borrow pits
for right of way

\$
1296.00
575.-
1871.-

Extra Rpt. H. Road for rounding corners. Proj No 331.

area - considera
tion

C. Retschlag - Sta 78+33 - 0.138 A 50.00

voucher signed and filed. to G.H.S.

Paid

Gladys E Miller et al. Sta 104+08
Easement on corner

0.088 A \$ 50.00

Edw. Billman et al. Sta 253+45

0.071 A } 300.00

{ Voucher signed
contract made out and mailed to

0.046 A } Paid
0.117

Edw Billman on 7/24.

Billman Heirs

at corner 0.021 A

Bond offered \$150.00

west side
on Hill

0.072 A 175.00

0.21 }
0.09 }
0.30 }

0.113 \$ 575.00

5/7/24 7
Cool & cloudy

L.A. - Gravel pit - in SE 1/4 of
SW 1/4 of Sec 24-87-14. (E.R. Roussellow)
May 7 1924 P.M. Johnston & H.W. Miller.
Made 6 more test holes in plowed field
east of pasture fence. Re staked two acre
gravel pit as shown on opp page -
stripping to be moved north and deposited
along creek bank.

Consideration to be paid = \$1100.00

$$\text{Prod} = \frac{627 \times 33}{43,520} = 0.48 \text{ acres.}$$

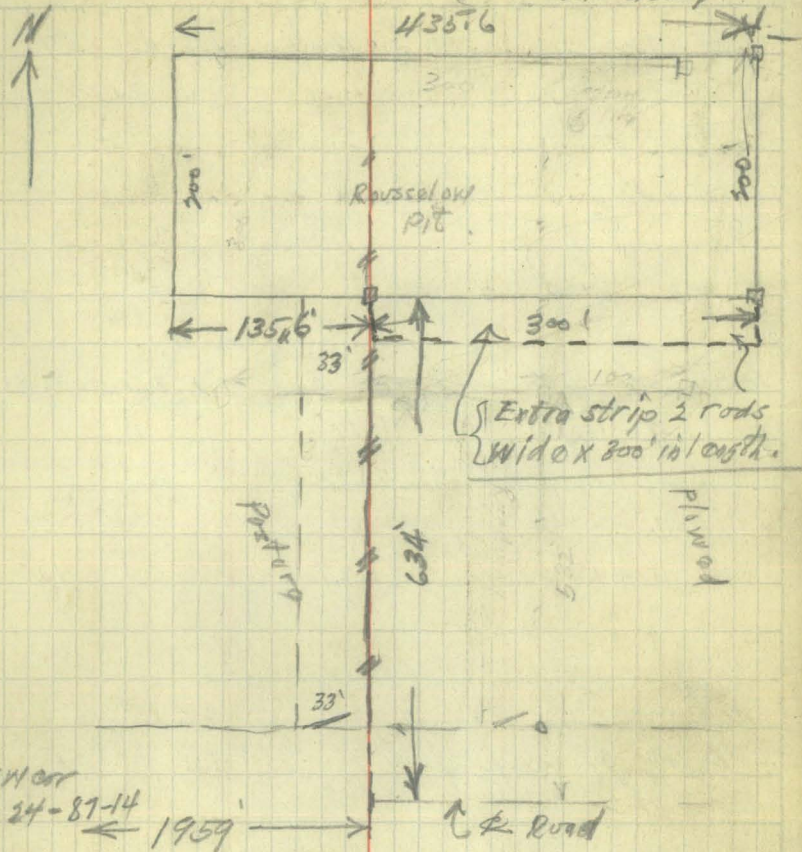
7/19/24

$$430 \times 194 \times D = 11,520 \text{ cu. ft.} \times 27$$

$$D = \frac{11,520 \times 27}{430 \times 194} = 3.72 \text{ ft.}$$

Aug 11-1924

By agreement Co. Rd. to pay E.R. Roussellow for
strip of land 33' x 300' abutting gravel pit on south
at same rate per acre for space to place
stripping upon -



Black Hawk CR Bridges.

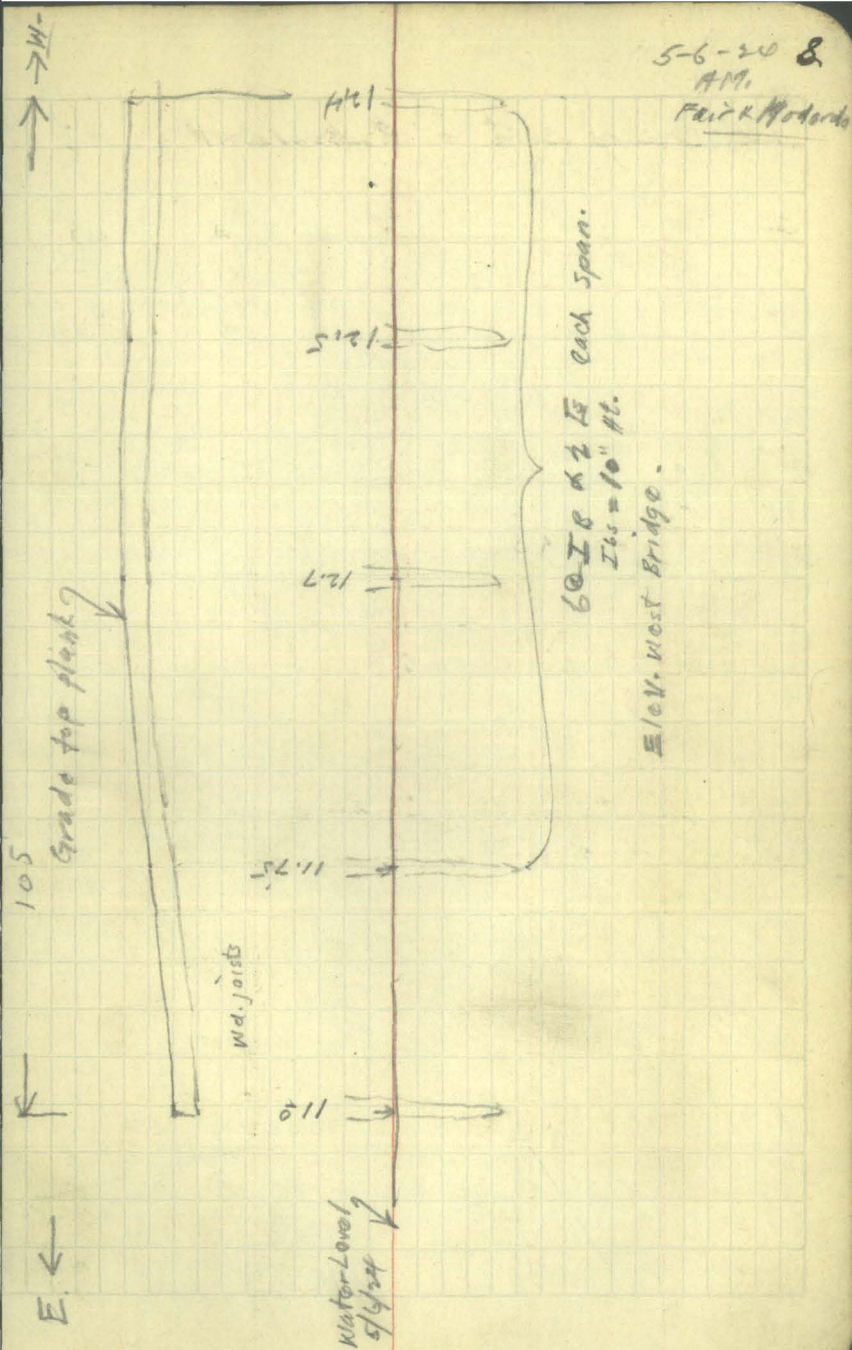
			Total Length
1st Bridge east -	4 spans	wood	73'
2	"	2 " "	39
3	"	1 " "	20
			132'

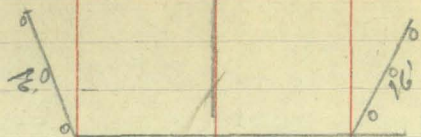
4th

a = 14 ft	Subtance C to C =	19'
b = 7 "		31
c = 3 "		27.5
d = 4 "		27.7

105

Note! Consider adding 15' more bridge at
East end - making whole structure about
120 ft -





5 new piling supporting
span



Rein. conc. in abutment repair
Big Creek Bridge LaPorte City. 9/24.
See measurements on Supplemental Plan.

North end of west abut.

cu. ft.

$$\textcircled{1} \left(\frac{1.17 + 5.52}{2} \right) 5.0 \times \left(\frac{1.83 + 2.75}{2} \right) = 38.13 \checkmark$$

$$\textcircled{2} 14.00 \times 2.92 \times 5.5 = 224.84 \checkmark$$

$$\textcircled{3} 2 \left[2.83 \times 0.9 \times 5.0 \right] + \left[1.0 \times 1.0 \times 3.5 \right] = 32.47$$

$$\textcircled{4} 18.0 \times 2.5 \times 3.5 = 157.50 \checkmark$$

$$\textcircled{5} 2.92 \times 5.5 \times 9.0 = 144.54 \checkmark$$

$$\textcircled{6} 12.0 \times 2.0 \times \left(\frac{5.0 + 1.2}{2} \right) = 72.00 \checkmark$$

Finishing-

$$\textcircled{7} 14.5 \times 9.75 \times 0.75 = 179.16 \checkmark$$

walks - 2 Pcs.

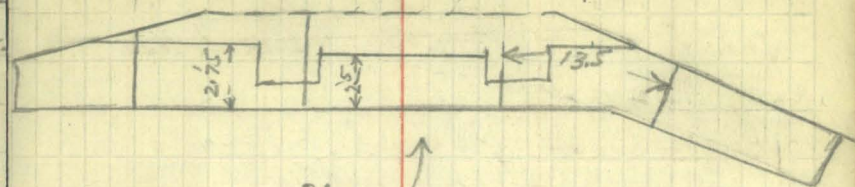
$$\textcircled{8} 2 \left(3.35 \times 7.30 \times 0.33 \right) = 15.64 \checkmark$$

864.28 cu. ft.

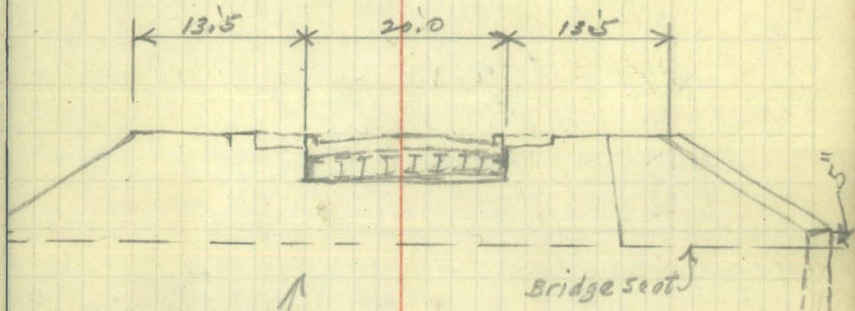
or 32.01 cu. yds

W. Abut; Big Creek Brg. at LaPorte City. 1a.

← 13.5 * 20.0 →



Plan

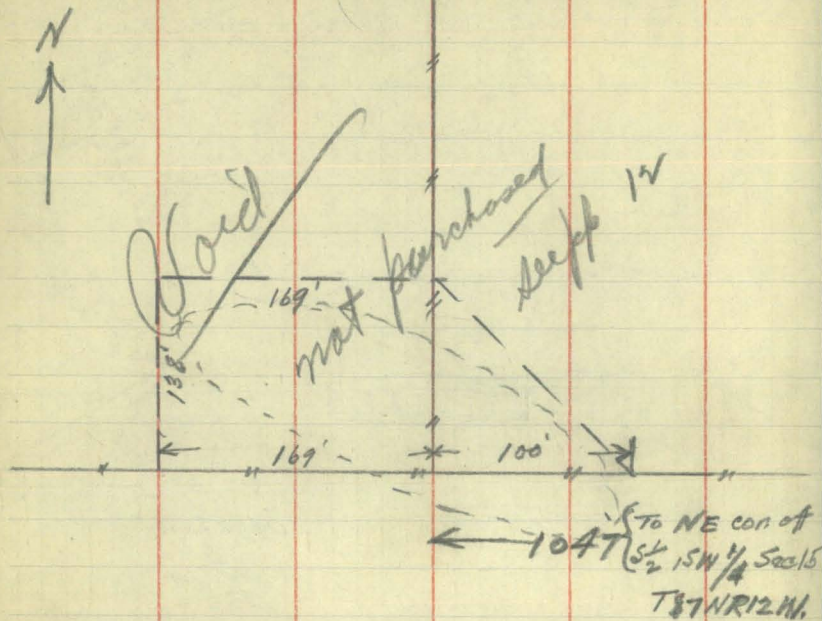


Elevation

(See page 4.)

Steel left over on LaPorte City
Repair job, del. on job but not used
on acct. substituting old steel -
163 Pcs 5/8" @ 21' = 3560 lbs

Henry Mahood Gravel Pit.



Area - 0.695 acres

Estimated Quan. = 2400 cu. yds.

Prospects for Gravel on
H. Mahood Farm - 5-20-24 -

Hole no 1-	1.5 top soil	7.0 sand & gravel
" no 2	2.0 " "	6.5 " " "
" no 3	2.0 " "	6.5 " " "

all holes
top of gravel

6-4-24.

Leased from Henry Mahood LaPorte City
one acre. consideration \$600.00
Term of lease 10 years
Fence to be furnished by Black Hawk
County, math. whenever req'd by owner.

"Mahood Pit" SW 1/4 Sec 15-87-12.

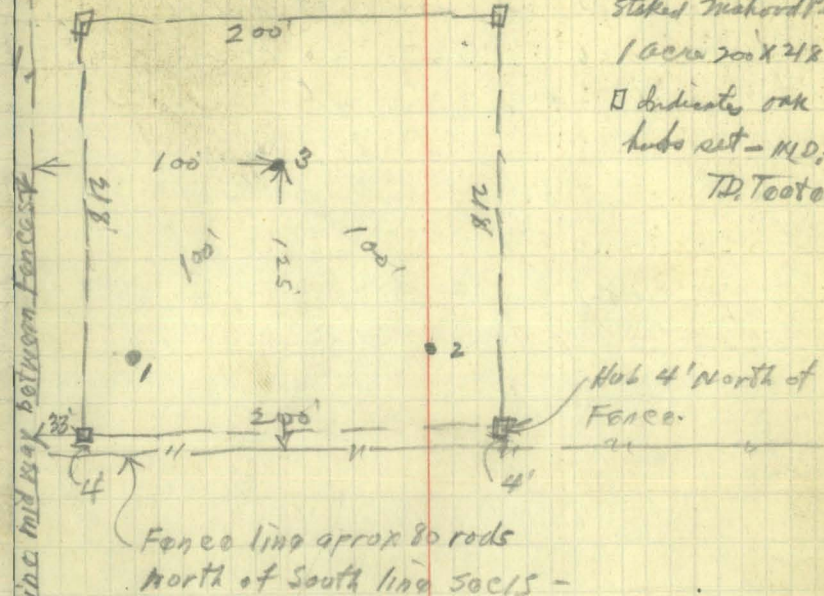
12.

6-6-24 AM.

staked Mahood Pit.

1 acre 200' x 248'

□ indicates oak
hubs set - M.D.,
T.D. Teeter



meadow

cemetary

SW. cor
Sec 15-

5/21/24 - Proposed tile line on LaPorte Brandon
 Co. Rd. Double line from top of hill about
 40 rods west of County Line thence west
 to point west of farm entrance on
 south side of road - thence continue
 one line on south side of road and
 discharge into side ditch where
 possible on hillside to west. sec 13-24
 (Peters, Bentley, Rephauge & Johnston.)

J. D. Tatum Dist LaPorte City.

5/21/24 -

1) Extend present cone box culvert loc. on
 Co. Rd. 5 E. of LaPorte City - at angle pt.
 near So. line sec. 31 Big Creek, with
 2 PCs - 24" cir. cone. pipe - $34' = 8$ ft.

2) Install 18" x 28" circular cone.
~~present~~ culvert located on County
 Rd. abt 90 rods so. of north line sec 30 -
 Big Creek ~~with 2 PCs~~ 18" x 28" cir. cone -
~~8 ft.~~

3) Replace wood bridge loc. twp rd betw sec.
 8 & 9 Spring Creek twp with
 I-B beam & cone abutments skew -

6-10-24 County Road N.E. of LaPorte City.

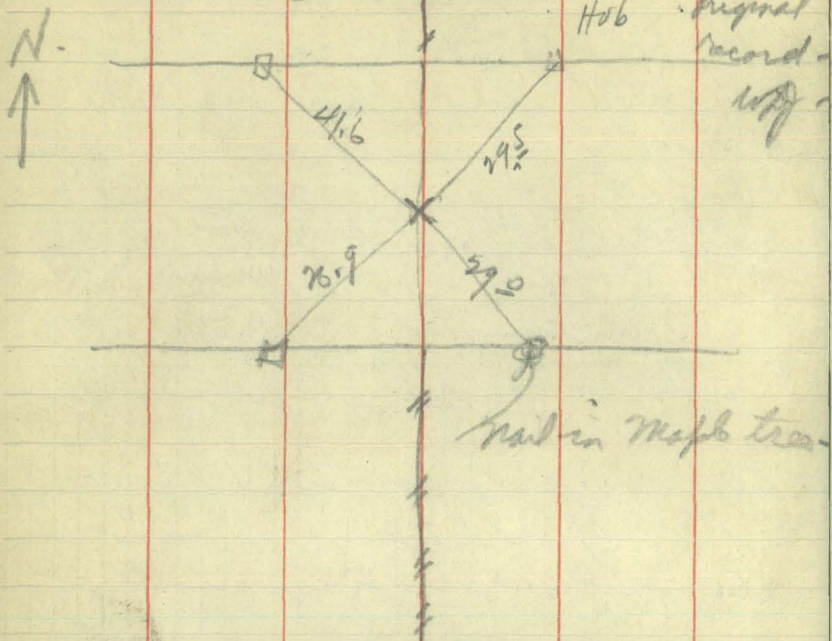
4'3" x 3'0" x 16'5" cone. Box - located about
 15 rods south of house on west side of road

4'3" x 3'0" x 16'7" cone Box - loc. 20 rods
 north of house on west side.

4) Install 18" x 28" cir. cone at pt. approx 1/4 mile
 north of

1/4 corner (15-22) 87 R12

5/21/24
opened from
original
record
map



26.9 north to tel. pole line at 1/4 corner
24.5 " " " " at sec corner (SE) 1/4

Same along Bigby farm is 7.3 into wood at
west line of 80 acres.

$$\begin{array}{r} 26.8 \\ 24.5 \\ \hline 2 \overline{) 51.3} \\ 25.7 \\ \hline 7.3 \\ 33.0 \end{array}$$

$$\begin{array}{r} 25.7 \\ 24.5 \\ \hline 2 \overline{) 50.2} \\ 25.1 \\ \hline 7.9 \end{array}$$

H.W. millers Dist.

5-22-24 Fair + cool -

- ① Replace old rot clay pipe -

2X2X24' R.C.B. S.G. att 157.

Loc - Sec 1 & 2 Blk Hk top att 1/3 mile from north end -

- ② Loc. Betw sec 2 & 11 Blk Hk. near west end

Replace 12" corr. pipe with 2'X2'24" R.C.B.

- ③ Loc. Betw sec 3 & 10 Blk Hk. top - approx 80 rods East of

County Road thru sec 3 -

Replace 4X16' wood bridge with -

R.C.B.

- ④ Loc on Hudson - Cedar Falls Rd - approx 20 rods south of north line sec. 10 Blk Hk top

Replace 12"X20" corr. pipe with

2'X2'26" R.C.B. 24"X32" Conc. cone

- ⑤ Loc. on Hudson - Cedar Falls - at north end of sec 15 Blk Hk

Extend present Conc. 3"X2'X17' to road grade width.

H.W. millers Dist.

- ⑥ Loc. Betw 16-17 Lincoln top approx 1000 ft So of C & N in Ry Co Xing -

Replace old broken down conc. culvert with R.C.B.

- ⑦ Loc. on turf Rd. in sag just south of Tom Strayer's farm entrance -

Const 24"X28" speculor conc. culv.

- ⑧ Loc. on County Rd - approx 60 ft west of east end of mile east of Eagle Center -

3'X2'X18' conc cul - extend as reqd - near east end sec 15 & 22 Eagle top -

Stakes on hand

3" x 1" x 16" -

5/28/24 P.M.
= 2404 stakes

9 rows -

76 Pile 1

49 " 2

52 " 3

46 " 4

45 " 5

217

11 stakes in each tier

217
11
217
217
2387
17
2404

Box Culvert -

6-16-24

North of intersection of P. Rd. No 5 and
Dewar Road -

Skew R.C.B. 32' inside road
Raile. on skew -

175' from west fence line to line
of inner face of west hand rail.

16 East. Repchange Dist. Cedar Falls.
Old Bridge near angle in No. 57.

Joints 3 apart @ 14 each	=	42
Gloor plank	=	50
		92

5-31-24 Repchange, Decked Peter-1039.

① Replace old stone culvert located about
1/2 mile north of so line sec 36 Cedar
Falls Sta. abt 102 - 2'x2'x24 RCB

② Replace old stone culvert on top rd betw sec
29-31 Cedar Falls Twp. approx 800 ft west of
junction with R. No 57.

S.G. approx 1809 - with 5'x2'x24 RCB

③ Old stone culvert near P.A. Lunds place on
13th abt middle sec. 9-16 - Cedar Falls Twp.

(60-1084)

(East Waterloo) F. J. Bentley.

6-5-24 P.M. Bentley Route Decker & W.J.F.

① Replace 15" corr. & pipe with 18" X 28' circular
 Loc. abt 6 rods north of south end sec 18 E. 10th.
 S. 1. alt 6.8 A = 1.8 0' +60 = 138.00

② Carry water north to second sag
 4.5K & Const. 24" X 28' circular concrete pipe.
 5.5K Loc. abt. middle sec 18-E. Waterloo S. 1. = 10.0 A.
 10.2A +75 = 170.00

③ Replace 15" corr. tile & vit. clay pipe with
 new corr. S. 1. alt. 8 acres = 3.0
 Loc. abt 3/4 mile from south end sec 18-
 ✓ 24" X 28' circular corr. +75 = 170.00

④ Two corr. & vit. clay pipes near
 north end of Sec 18 E. Waterloo trap-
 check up S. 1. = 10 A.
 consider 24" circular - if large enough.
 Road alt. - 3 x 8 0'
30" X 28' circular corr. ✓

⑤ Replace 20' X 16' wood bridge located near
 center of sec. 15-16 E. Waterloo with.
 12' X 4' X — skew R.C.B.
 Provide 26' Rd. way.

M. Allen Fox. trap -

6-10-24.

① Replace 18" corr. & pipe located on C. & H.
 near so line sec 11 trap trap with
24" X (36) circular corr. pipe
 (32)

② Replace 18" X 18' corr. & pipe - loc. across
 Billatville Rd. near intersection.
 with 24" X (28) cir. corr. pipe -
 (32)

6-16-24

Pile filed so. of J. Murphy House -

$$108 \times 3 = 324$$

24

$$\frac{100}{448}$$

7-18-24

unloading car this morn full saw
length -

checked lengths ok

$$\text{Pile 12 plank deep more} - (3 \times 1) = 36 \frac{1}{2}''$$

36''

19.

Old Steel Bridge -

County yard -

6-18-24 -

6 - I beams (9" I.Bs) Length = 16'

2 - Ls

2 - Rails -

F. R. Decker's list, list of -
Bridge & Culverts.

6-20-24 Decker Miller Pafshanger & Able Johnson

- ① Extend or repd River Box - located
approx 1/4 mile - east of west end - 18-19
Berm - 2' x 2' x 16'

6-20-24

- ② Replace Box culvert near Whitney farm
where mail man's home was in fire -

Sec. 162 2' x 2' x 24' R.C.B.
Loc 1/4 mi east of west end sec. 23-24 Bennington.

- ③ Replace wood bridge (20' x 16') located approx
1/3 mile west of east end Sec 1-18 Mt. Vernon
old stone abutments failing at both ends.

S.A. approx 1700 acres with 24.5 F.B.

$$\frac{80 + 104}{2} = \frac{184}{2} = 92$$

27.5 24.5

- ④ corr. iron pipe - loc. w/ter road -
alt 1/4 mile north of south end of sec -
31-32 later - S.A. 124 - 2' x 2' x 18' C.B.
Place 18" corr. iron pipe

Metal Culvert laid on March 10th 1924 letter

Piling - on hand Cryard 6/27/24
25 ft long -
50 @ about 16' long -

County Road
12" 15" Feet
30 600
30

Primary Rd.
15" 18"

46 @
4 @ 31'
2 @ 22'
2 @ 31'
920
128
(1048) (108)

6/25/24 on hand Hudson

3 @ 15" X 20 ft. 60'

2 @ 18" X 22 ft 60

4 @ 18" X 16 ft - 64

also 6 @ 15" X 20' - 120' distributed
along prop 357 ft of Hudson.

Primary Road - (Hudson In) Reqd.

50 @ 15" X 20' 1000'

Sharp - additional reqd.

12" = 640'

15" = 1200'

18" = 288'

20 @ 12" X 20 400'

10 @ 15" X 20' 200'

1 @ 18" X 28' 240'

12 @ 12" X 20' 240'

Project 359- Vetter.

1st cut, so. of Hudson -

15 ft. plus ditches - clay - cl: 202.

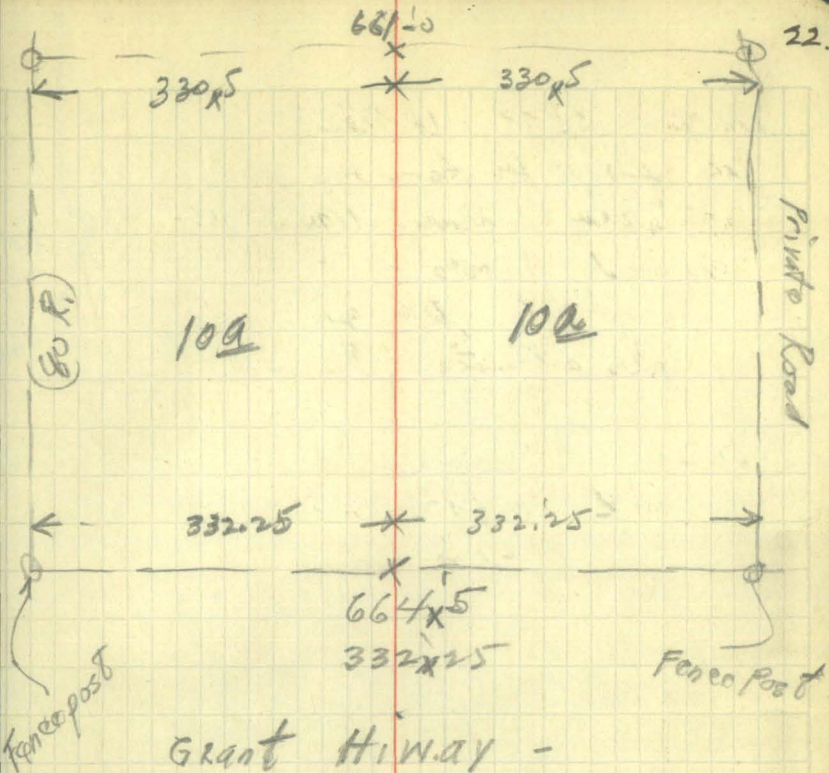
Contract 8% rock -

2nd cut apron - 1500 cy -

Contract estimate 8% rock

3rd cut -

* worst of 3 cuts for rock -
Used 100 lbs dynamite.



June 30, 1924

Made meas. between north & south fence lines at both front and rear. and stakes of the 20 acre patch

Special Provisions, Proj. No. 7-5.

Road No.	Sec.	Cu. Yds.	M/CS Haul	Add. Haul Units
59	(1) T	250	1.75	750
59	(2) U	500	1.75	1500
59	(4) V	250	2.75	1250
		1.87	3.75	1250
		63	3.75	375
59	(5) W	(1250)		
59	(6) X	250	2.75	1250
59	(7) Y	500	1.75	1500
59	(8) Z	500	1.75	500
		2500		8375

250
225
625

Culverts Rainbow Dr - Castle Hill

7-10-24 - Co. Board w/ J. & Mr. Brown

No. 1. Conc. top culvert built in 1912

6' x 4' (2) - conc. top - skew -

Span or skew = 7.5 -

Extend about 22' ft -

Conc. per ft. bl. = 0.57

Total est. conc. = 14 + 13 = 27

27 cy @ \$25.00 = \$675.00

No. 2 alt 20" opening - extend on north end -

No. 3 24" circular vitrified pipe - with conc. head walls - extend on south end -

8' x 6' - 0^{rep.} skew

Span or skew = 9.3 -

Dist. on skew to 9. fence line 22' 0

Estimated quantities for 24'

Conc. 0.98 cy per ft. of bl.

Conc. in bl. 24' @ 0.98 cy = 24.00 cy

" " one head wall & wings = 16.00

Total estimated conc. 40.00 cy

40 cy @ \$25.00 = \$1000.00

Louis Moe -

Stripping on "Dierk Pit"

Sat July 5 - 3 @ 3 horse teams - 8 hours
 Sun " 6 - 1 @ 5 horse " - 8 hours \$ 4.80
 Mon " 7 - 4 @ 3 horse teams - 8 hours 24.00

Hauling rock -

1 team & two men. = 8 hours. \$ 8.00
36.80

Area stripped being to west of open pit

Surf. area - $\frac{150' \times 20' \times 0.90}{27} = 100 -$

Plus 10. cy. in driveway = 10. -

110. cy.

Moving rock

40 cy.

150.

old channel in W. Klingeman's
Pasture - on Pr. Rd no 59 -

$\frac{350 \text{ KGKZ}}{27} = 160 \text{ cy} -$

27

40

200 -

eff estimates amt. req'd
for filling ditch to
1 ft. above low water

Tiling on County Roads -

by Chas Morgan

~~Substate City~~

App Co Auditor's ops -

@ 70¢ rod x

A. L. Connor Gravel
in Teeter, Mr Schrader, A. L. Connor.
with Johnston

Set oak hubs at all four corners as
shown on sketch

Located in NW 1/4 SW 1/4 Sec 8
87-12.

Estate of Margaret Connor
assigned to P. Moore -

0.162 acres

note:

At July 6-1925. Co bond
made agreement with
A. L. Connor as agt for
Mary Connor estate to
lease tract as shown for
period of 10 years for
consideration of \$150.00

October 4-1927 - Teeter, Miller & Decker
Johnston - Bot. 0.31 A + 0.162 A Consideration \$200.00

J. F. Gill & Lena Gill. Term = 10 years.

Pit.

A. Newton's Res.

Oak Hub North of
12" cotton wd.

Fence Line

Twp. Road

Line of Cotton wds to out

NW 1/4 corner of SW 1/4
Sec 8-87-12. 7/27/24

Head point 2' east
of corner point for
pt. on East line of road

N

Gill Gravel
Pit - 0.47 A

Insp. Culverts on P.R.R. No. 57. Aug. 9/24
 O.L. Huffman, Thielke, Johnston & W. Corabes -

1. no fillet strips used on head walls -
 Smooth up.

2. no fillet strips on head walls -
 cut wires & smooth up -

3. - no fillet strips used on head walls -
 cut wires & smooth up

4 - wires cut flush -
 Smooth up -

5. Spt & added R.C.B. - wires cut back
 & inside sll. smooth up.

6 Cut wire in side - & smooth up -

7 wires inside - sll. & on wings -
 smooth up edges -

* Scar at outlet end - should be rockered -

8. cut wires & smooth up -
 Finish up hand rail

9. Fillets ok - wires cut back -

10. Good - cut back wires & smooth up edges -

11 Pretty good shape - trim off wires & smooth up -

12 Smooth up - surfaces

13 no fillets on coping - smooth up edges -
 cut back wires -

14 Cut wire back flush
 & rub down

- 15 Patch hole in sd. wing -
Cut wires - wash & rub - north end -
16. no fillets on wings - smooth up & across
four marks -
- 17 - no weep holes in bbl.
Four marks cutted out
up on down stream end -

Storm on Aug 8 - 1924

Bridge insp -

Aug 26 - 1924

Elk Rk Cr. 1st Bldg - approx - 1 mile north of
Hick on Coline -

4 spans - wood with 3 truss rods total len = 98 ft -

2 @ 30' trussed in center -

2 @ 19' - one on each end of bridge.

Repairs reqd -

Brandy Co agreed to furnish 13 - 3"X16"X22'
std. sawn plank for joints to repair the
north spans.

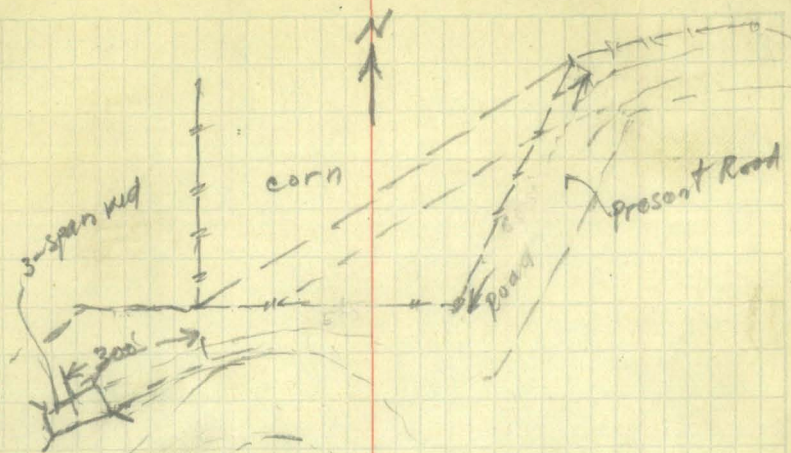
also reqd 10 Pcs 3"X12"X16'

and matls for 20" of railing -

2nd wood bridge (overflow) north of Hicks jet.
5 spans wood @ 19' = 95' over all -
north pile bent & bark plank rotted out - & 2nd
bent from north end undermined.

Legd - 4 Pile @ 30'

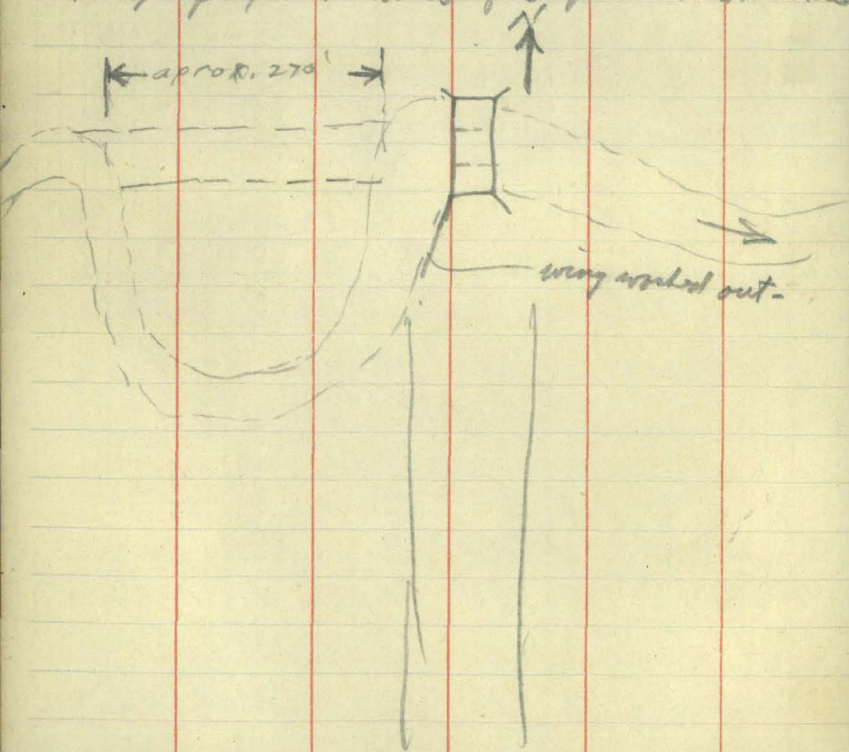
4 " @ 20'



$$\begin{array}{r} 440 \\ 30 \overline{) 1320} \\ \underline{120} \\ 120 \\ \underline{120} \\ 0 \end{array}$$

Sept 11-1924.

1. New wing S.W. corner cone bays on trap road
approx. $\frac{1}{4}$ mile S.W. of Co. Rd.
2. Flow & end washed at R.C.B. located
 $\frac{1}{4}$ mile west of S.E. cor sec 26 Big Creek.
3. Proposed channel change at middle of
east line of sec 32-87+11. channel
change approx 270' west of 3 span wood trestle



Guard Rail - estimate for FHP No 202
on colts - Hudson Rd. 9/14/24

Total

Culv sta 316+02-			248
Bridge sta 273+58	150 ft	325 ft	480
Cul - sta 216+52 ^{1/2}	32 ft	32 ft	64
I.B. Pipe sta 186+18	$\frac{40}{200}$ ft 160	$\frac{40}{312}$ 272	512
Cul, sta 145+51.3	128 ft	128 ft	256
Cul - Sta - 86+88	$\frac{168}{96}$ ft 264	$\frac{152}{96}$ ft 248	512
Cul - Sta - 57+53	$\frac{56}{56}$ 112	48 ft	160
Fb. Sta 33+58 ^{1/2}	$\frac{64}{160}$ ft 224	$\frac{176}{72}$ ft 248	572
Culv. Sta 8+48	64	0	→ 64
			2868

Guard Rail estimate for T.A.P. 200
 voloo- La Porte Rd- no 40. 9/14/24

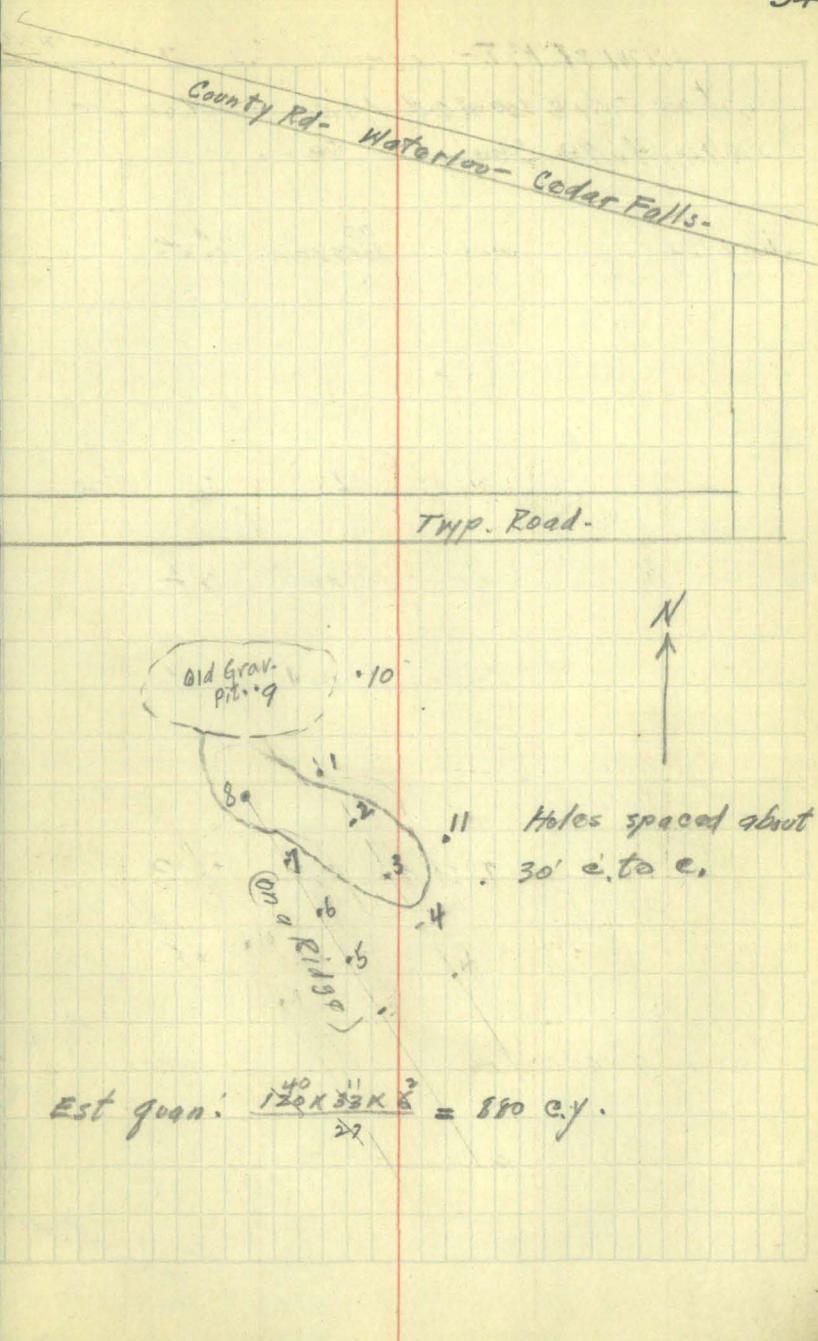
Box Cul 682+25	$\begin{array}{r} 88 R \\ 200 R \\ \hline 288 \\ 220 \\ \hline 200 \end{array}$	$\begin{array}{r} 88 \\ 152 L \\ \hline 200 \\ 200 \\ \hline 200 \end{array}$	528
I-B Sta 637+87	$\begin{array}{r} 220 \\ 200 \\ \hline 160 \\ 200 \\ \hline 260 \end{array}$	$\begin{array}{r} 320 \\ 200 \\ \hline 160 \\ 200 \\ \hline 260 \end{array}$	1040
Box Cul 576+96	$\begin{array}{r} 180 \\ 200 \\ \hline 160 \\ 200 \\ \hline 260 \end{array}$	$\begin{array}{r} 160 \\ 200 \\ \hline 160 \\ 200 \\ \hline 260 \end{array}$	528
I.B. Sta 574+16	$\begin{array}{r} 200 RT \\ 272 \\ \hline 472 \end{array}$	$\begin{array}{r} 200 Lt \\ 248 \\ \hline 448 \end{array}$	$\begin{array}{r} 920 \\ 452 \\ \hline 920 \end{array}$
I-B Sta 457+77	$\begin{array}{r} 96 RT \\ 360 \\ \hline 456 \end{array}$	$\begin{array}{r} 96 Lt \\ 152 \\ \hline 248 \end{array}$	704
R.C.B. Sta	$\begin{array}{r} 48 \\ 96 \\ \hline 144 \end{array}$	$\begin{array}{r} 48 \\ 96 \\ \hline 144 \end{array}$	288
Pony Truss Sta 975+05	$\begin{array}{r} 232 \\ 320 \\ \hline 552 \end{array}$	$\begin{array}{r} 1072 \\ 272 \\ \hline 1344 \end{array}$	1896
Pony Truss Sta 232+15	$\begin{array}{r} 408 \\ 160 \\ \hline 568 \end{array}$	$\begin{array}{r} 352 Lt \\ 40 \\ \hline 392 \end{array}$	950
R.C.B. Sta	$\begin{array}{r} 56 \\ 354 \\ \hline 410 \end{array}$	$\begin{array}{r} 56 \\ 354 \\ \hline 410 \end{array}$	$\begin{array}{r} 820 \\ 7674 \\ \hline 820 \end{array}$
Low Spot Sta 363+44	200	—	200
Lo. of La Porte (estimated)	1376	—	$\begin{array}{r} 1326 \\ 9000 \end{array}$

Gravel Pit- Prospect- 11-13-1924

Traction Ridge located near center of
SW 1/4, NE 1/4 Sec 19-89-13.

C. Lansing and H. Rundle.

Hole No.	Depth Dirt	Depth Gravel	Total Depth	
1	7'	0.0	7'	
2	4.5	3.0	7.5	Fair.
3	3.	5.0	8.	Good
4	7.2	0.0	7.2	—
5	7.2	0.0	7.2	—
6	—	—	—	—
7	7.1 sand	0.0	7.2	—
8	2.0	2.5	4.5	Fair
9	lost old pit.	0.0	3.0 in water	Fair
10	5.0 ^{Dirt &} Sand	0.0	5.0	—
11.	4.0	0.0	4.0	—



SNOW FENCE-

Nov. 22-1924.

Steel.
Posts

Waterloo-Hudson Rd.

- | | | | | |
|----|-------------------------------|---------|-------------|-----|
| ① | G. Klingamann | Picture | 300 | 20' |
| ② | Ray Klingamann | Plowed | 400 | 26 |
| ③ | " " | Pasture | 500 | |
| | north from driveway to main | | | |
| ④ | A. Glenny | | | |
| | 100 n. of cut + 200 s. of cut | | 300 | 20 |
| 5. | A. Glenny | Plowed | 200 + | |
| ⑥ | Smith | Plowed | 300 | |
| 7. | Allison House | | 200 | |
| | Yard- | | | |
| ⑧ | at cut S. end of paving | | 400 | |
| | So. of Hudson | | | |
| | | | <hr/> 2600' | |

Grant Hwy. no 5. East of Waterloo.
at Rogers place.

Hadley n. near Elk Run

Litzons "

Kirby Hill-

Pasture

Meadow

500 ft.

400 "

300

(200)

1000 y

500 v

124 posts

300 v

(1800)

3000 ft

no 5 (east)

~~W. Cedar Falls - (East side) no 40.~~
~~at Howard place.~~

~~Sec 6 - Cedar Falls trip~~

~~200 ft~~

~~(500)~~

County Rd. Ballouay Place 700'

County Rd. - W. - Eagle Center (Miller place) 200
(900)

SNOW FENCE

	No. Ft.	Regd.	Steel Posts.
Cedar Falls - Dike Rd - No. 57 -			38
at Miller place - plowed -	500'		35
Krog Barn NE. of old barn - plowed -	200'		
Krog Place - NE. of X road - plowed -	200		
West of White's grove - plowed -	300		
Billman cut - pasture -	400		
	(1600)	100	
Cedar Falls - New Hartford Co. Rd. No. 5.			
at Howard Place on No 40 E. of Cedar F.	200		
In cut off Rd. Brown's Bldgs.			
near county line	600		
Diggers Place -	300'		
	(2100)	60	
	2700 -	(160)	
Ligan Ave. - Rd - Pa. Rd. No. 59 (north).			
Mrs. Gilbert's Pasture	Pasture	300'	20
100' south of sign boards & 200' north			
John Looche's N. of orchard in Pasture	200'	14	
	200		
Primary 59 (north)	700'		

SNOW Fence erected Dec. 1924 -

Primary No 59 (north)	Gravel -	700 ft
Primary No 59 (south)	Paving -	2600
" Rd No 5 (east)	Par -	3000
" Rd No. 5 west of Cedar Falls - (Par)		900
Primary Rd No 40 (east of Cedar Falls) (Par)		200
Primary Rd No 57	(Gravel) -	1600

County Roads -

Waterloo - Cedar Falls	(Gravel)	700
Waterloo - Eagle Center	"	200

Material on hand - Jan 1. 1925
Waterloo County yard -

26 Pcs 8"X10" - 16' ceps -
29 Pcs 2"X6"X 16' Painted
18 Pcs 2"X8"X 16' Painted
256 Pcs 3"X12"X16' Rph
43 Pcs 3"X12" - 20' Rph
24 Bbls - Jamin Miller -

Metal Culverts

19 - 12"X 20'
14 - 15"X 20'

✓
Twp. Co. ✓
2 - 12"X 20'
1 - 18"X 1-18"

Hudson - H. W. Miller's Dist.

4 Pcs 8"X10"X16' - ceps
30 Pcs 3"X12" - 16' - plank

metal culverts - furnished to -
County Rd. twps ✓

23

Eagle - 26 ✓
Orange - 46 ✓
Blk Hh. - 14 ✓
Lincoln - 19 ✓

A. H. Repsheng - Cedar Falls -
Lumber

191 - Pcs. 3"X12" - 16' Rph
129 - Pcs. 3"X12" - 20' Rph
49 - Pcs. 8"X10" - 16' ceps

metal culverts

2 Pcs 24" - 16'
2 Pcs 12" - 20'

metal culverts furnished to -

Primary Rd. - County Rd. ✓ Twp. Rd. ✓
73 @ 15" - 20' 2 @ 15" - 20' 1 @ 12" - 20'

1 @ 12" - 16'

7 @ 15" - 20'

3 @ 15" - 20'
14

G.R. Rockers Dist No. 1.

window -

27 Pcs 3"X12" - 16'
 11 Pcs 8"X10" - 16' cips -
 3 Pcs 15"X20' metal culvert
 1 " 12"X20' " "

Dunkerton

30 Pcs 3"X12" - 20'
 99 Pcs 3"X12" - 16'
 14 Pcs 8"X10" - 16'
 11 Pcs 4"X4" - 16'
 48 Pcs 2"X6" - 16'
 15 Piling - length 16'-20'

County Home -

123 Pcs 3"X12" - 20'
 44 " 3"X12" - 16'
 7 Pcs 8"X10" - 16'

culvert 4 @ 15" - 20'

2 @ 12" - 20'

Culvert furnished to -

county Rd

1-15" - 20

Twp Rd.

5 @ 15" - 20
 1 @ 12" - 20

Matt Allen

280 Pcs - 3"X12" - 16'

15 Pcs - 8"X10" - 16'

12 Pcs - 3"X12" - 20

Metal culvert furnished to

County Rd.

✓ 5 @ 12" - 20'

✓ 5 @ 15" - 20'

Twp Rds -

Ghostup - 5 @ 12" - 20
 5 @ 15" "

Pogrow - 5 @ 12" "
 5 @ 15" "

Barclay 5 @ 12" "
 5 @ 15" "

J. D. Teeter - Salato City -
Lumber

30 Pcs 3" X 12" - 20'

599 " 3" X 12" - 16'

4 Pcs 8" X 10" - 16'

Culverts 6 @ 15" - 20'

Metal Culvert furnished to -
County Rd - Grp. Rd -

1 - 15" - 20'

11 @ 12" - 20'

5 @ 15" - 20'

3 @ 24" - 20'

Bridge & Culverts matl OK. Jan 1 - 1925 -
Metal Culverts

24 @ 12" - 20'

27 @ 15" - 20'

2 @ 24" - 16'

\$ 0.66

\$

316.80

0.81

437.40

1.50

48.00

(802.20)

Lumber

127 Pcs - 8" X 10" - 16' - 13,550 B.M.

1526 Pcs 3" X 12" - 16' - 73,248

367 " 3" X 12" - 20' 22,020

107,818 B.M. @ 40¢

\$

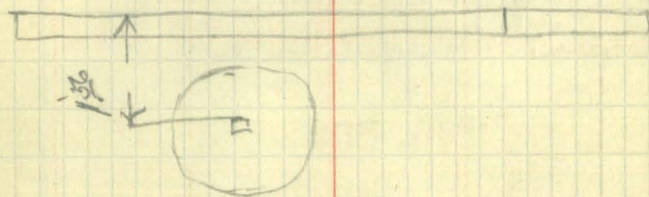
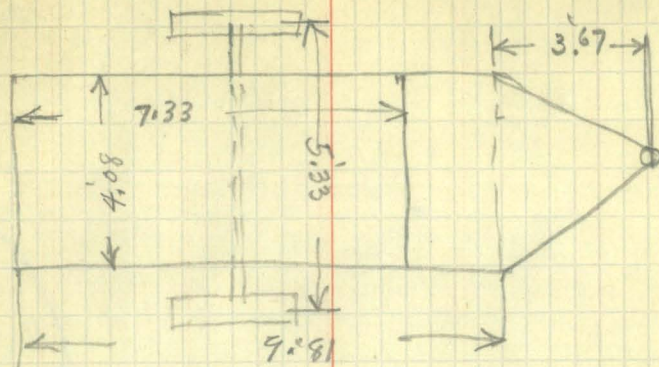
4000.00

43121.80

\$ 5115.00

Estimated Value matl = 4802.20

Sketch - Army Trailer



Feb-27-1925

I-beams in Co. yd. Cedar Falls.

11 = 2 @ 12" x 28'

111 = 5 @ 12" x 27'

1111 = 4 @ 12" x 26'

1111 = 6 @ 12" x 25'

3 steel caps -

3 channels 12" x 28'

1 " 12" x 26'

Wood Trestle bridge repair - location
on Co Line. north of Hicks across Blk Hk C
March 7-1924

① Material furnished by Black Hawk Co -

12 Pcs 3" X 12" X 16' fullwood	576 c ft	23.76
5 Pcs 2" X 6" X 20'	100	
2 Pcs 2" X 4" X 20'	68	9.2
2 Pcs 4" X 4" X 4'	12	
Spikes	180 c ft	3.00

note: Grundy Co furnished 12 Pcs 3" X 14" X 22' joint
Labor performed by J.B. Elliott & crew 80.99
Hauling material 12.5
\$ 129.20

② Bridge repair - Overflow bridge located north
of job no. 1. above on Co line B.M.

42 Pcs 3" X 12" X 16' fullwood	2016 c ft	
8 Pcs 3" X 12" X 20' " "	480 c ft	116.1
3 Pcs 8" X 10" X 16'	320	
8 Cyp. piling @ 24 ft each	2816	
4 " C 30 ft each	192 ft. 2	42.2
10 Pcs 4" X 4" - 4'	54	
6 Pcs 2" X 4" - 16'	64	17.10
6 Pcs 2" X 6" - 16'	96	
6 Pcs 2" X 8" - 16'	128	
Spikes & wire	342 B.M.	12.2
Labor performed by J.B. Elliott & crew		204.17
Hauling		50.00
		516.11

Pin connected High Truss across
Spring Creek.
Sec 14-23 Spring Creek twp
Bentley, Deeter Adles & Johnston

Present Structure 144' span on masonry
abutments. wood floor system.
Truss too light for tractors.

High water 1st point spot on east masonry
abutment - 3' below present floor grade.

$$\begin{array}{r} 821.5 \\ 3.4 \\ \hline 818.1 \end{array}$$

Estimate for 90' X 70' Pony Truss -

Nt. Abut. Grade to bot footing = 19' -

Concrete 223 cu yds @ 20.00 = 4460.

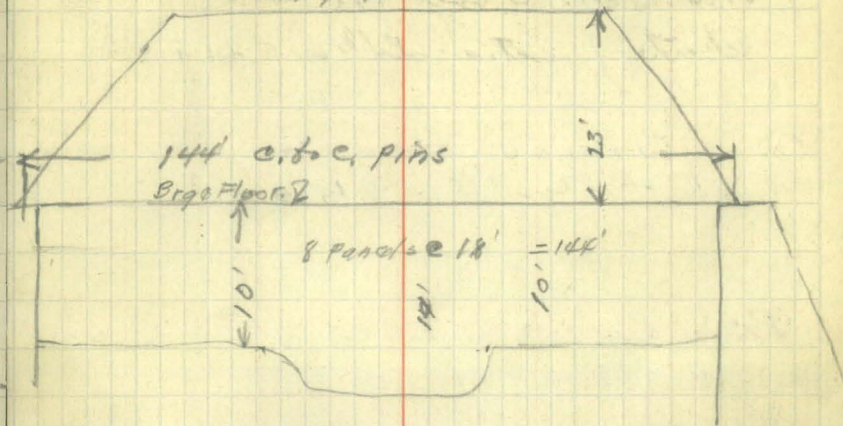
Str. Steel 60,200 @ 7¢ = 4214.00

80 piling @ 16 ft. = 1280' @ 60¢ = 768.

\$ 9442.00

Mar-21-1925.

VARIETY Iron WRS - Cleveland Ohio.
Pin Con. High Truss - Date 1891.
Masonry Abutments -



Drainage area Black Hawk Co - 30 PM.
(estimated) " Buchanan = 25 PM.
Total D.A. = 55 PM

Req'd opening = 632 sq. ft.

7 X 90 = 630'

90' span Pony Truss -

F.R. Pecker
W.D. Johnston

Buck Creek -

1- wd- tracht -

5 spans @ 15' = 75'

1- L. beam @

$$\frac{27.5}{107.5}$$

Bridge Sec No 1 Lester Twp April 3-1925
over Buck Creek.

Viewed site preparatory to const. of new bridge. { Paulson
Blumenschiers
Johnston

2.0

3.0

2.2

2.3

2.7

2.9

2.9

1.8

2.3

2.2

Scaled widths of drainage
area in miles.

$$10 \overline{) 24.3}$$

$$2.43 \times 20 \frac{1}{4} M = 49. \square M. = 8.9.$$

$$\text{Reg'd opening } 100' \times 6' = 600 \square ft.$$

April-8-1925

A. Wilson -

Send paper to 1st natl bank Des Moines
 \$150.⁰⁰ for strip 50' wide:
 Becker, Rappaport, Ahle + Johnston

April 14-1925

Bot corner from M. J. Caville -
 for \$40.⁰⁰ Becker + Johnston

April 17-1925-

wd. bridge out of Rd rec 32 waterholes up
 near Varden -

Present structure

$$D. G. = \frac{640}{3\frac{1}{2}} = 1000 \text{ acres}$$

Black Hawk Cr -

April 17-1925.

Filling reqd - west end of main channel bridge.

$$5 \times 25 \times 50 = 250 \text{ cu. yds.}$$

$$+ 20\% = 50 = 300 \text{ cu. yds. } \$75.⁰⁰$$

Bridges & Culvert April 23-25
Bentley, Miller, Ahler & Johnston

Bridges and Culvert April 24, '25
Pfeiffinger - Peeter, Northey & Johnston.

- ① Replace 15" corr. iron pipe located on trap road approx $\frac{1}{4}$ mile east of @ sec 7 E. 20th change - near Co line - 1 mile north of Primary Rd no. 5.
betn sec 7 & 18. D.O. 35a-
Const. 3' x 2' x 26' R.C.B.
- ② Replace 12" metal pipe located at intersection trap roads at west line Sec 15-22 East Waterloo trap -
with 2' x 2' x 32' R.C.B.
- ③ Const 2' x 2' x 24' R.C.B. on trap road between sec 28 & 29 about $\frac{1}{2}$ mile south of Primary no 5 -
- ④ Inspect bridge located on trap road - near middle north line sec 6 Cedar Falls trap. Place new deck thru out.
- ⑤ met trap trustee on drainage problem at n.w. corner sec 5 Cedar Falls trap.
- ⑥ Replace old stone culvert located on Co Rd - approx $\frac{1}{4}$ mile north of South line Sec 3 & 4 Cedar Falls trap with
8' x 3' x 26' R.C.B. D.O. = 230 a.

Apr. 28-'25

2- Circular conc. culverts

@ 36" in diam -

1- 6' span R.C.B. Epton -

Raymond - Downer Road -

Right of way - acquired -

Henry Payner - consideration \$50.00

Conerby house - @ \$25.00 corner opp. school house 25.00

G. Payner - " 100.00

Bridges & Culverts -

May 7 - 1925 -

1st Box culvert south of schoolhouse extends
to fit proposed grade -2nd culvert south of school house extends
both ends -Box culvert about 30 rods south of
north line sec 35-36-89-12 - Const.
new R.C.B.

Levels Road ditch SWly side Q. Rd SE. from La Porte City
From SE. corpline La Porte City to approx 1/2 mile

May 13-1925

Johnston Inst
Teefer Rod-

B.M.	3.50	<u>103.50</u>	100.00
0+00			5.7 97.8
1+50			6.0 97.5
3+00			6.5 97.0
4+50			6.3 97.2
6+00			5.8 97.7
T.P.	4.94	<u>105.78</u>	2.66 100.84
7+50			7.4 98.4
9+00			7.0 98.8
10+50			6.8 99.0
12+00			6.5 99.3
T.P.	5.10	<u>107.66</u>	3.22 102.56
13+50			7.7 100.0
15+00			6.9 100.8
16+50			5.7 102.0
18+00			6.5 101.2
T.P.	1.63	<u>106.99</u>	2.30 105.36
19+50			7.1 99.9
21+00			7.4 99.6
22+50			6.8 100.2
24+00			5.6 101.4
T.P.	3.01	<u>108.62</u>	1.38 105.61
25+50			7.0 101.6
27+00			7.3 101.3
28+50			10.1 98.5
30+00			13.4 <u>95.2</u>

Spike in NEly side tel pole no 1749 on SWly side of road -
+00 = Point in SWly road ditch off Tel pole No 1749

off pole no 1750

1751

1752

1753

Spike in Wly side Tel pole no 1753
off pole no 1754

1755

1756

1757

Spike in NEly side Tel pole no - 1757

tel pole no 1758

off Tel pole no 1759

" " " " 1760

" " " " 1761

Spike in Wly side tel pole no 1761

off tel pole no 1762

" " " " no 1763

1764

1765

Spike in NEly side tel pole no 1765

1766

off tel pole no 1767

" " " " 1768

" " " " 1769

Proposed tile line on Pa. Rd. No. 5. near Dewar Road corner.

5-15-25.

0+00

7-6"

2+00

8-3 $\frac{1}{2}$ "

2+70

8-6 $\frac{1}{2}$ "

8-9 $\frac{7}{8}$ "

8'0 $\frac{1}{4}$ "

One floor of twin box culvert - So end -

Swegin creek bed

" " "

70. northern
W. Johnston

One floor twin box culvert No. end

5" Tile Twp Road - from Bridge 1100' East W. line sec 5-8 Bern. to point 1500' West.

B.M.

9.81

109.81

100.00

Top m end west conc - abut. of bridge.

W.D. Jr.

R. Parkell

5/25/25

3.50

C.M. 5.2

conc. floor in bridge.

Top plank floor of bridge

0+00

1

2

3

4

5

6

7

T.P. 8

9

10

11

12

13

14

15

-50%

-145%

*

-471%

↓

13.43 96.38.

8.43 101.38. 96.50 4.88.

9.96 99.85. 97.00 2.85.

9.50 100.31. 97.50 2.81.

8.37 101.44. 98.00 3.44.

7.16 102.65. 99.42 3.20.

5.65 104.16. 100.90 3.26.

3.90 105.91. 102.35 3.56.

2.22 107.59. 103.80 3.79.

1.46 108.35. 104.27 4.08.

5.51 108.74. 104.74 4.00.

5.66 108.59. 105.21 3.38.

5.55 108.70. 105.68 3.02.

5.07 109.18. 106.15 3.03.

4.37 109.88. 106.62 3.26.

3.61 110.64. 107.10 3.54.

2.62 111.63. 107.57 4.06.

note: Tile laid 8 ft

South of $\frac{1}{2}$

of road - elevations

taken on tops of stakes

5" conc. tile string

on ground -

using Buckeye tiling

machine.

Hub at surf. of cross road approx on $\frac{1}{2}$ X rd -

T.P.

3.26 110.99

NW cor. lower conc step to School Bldg.

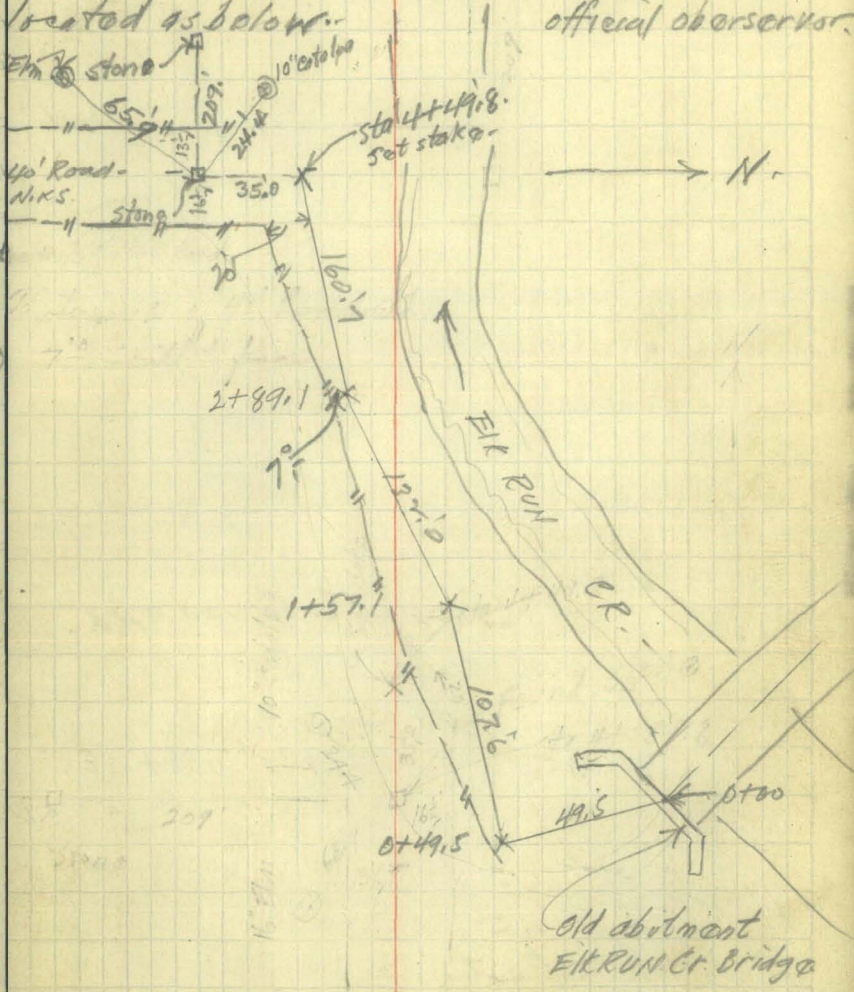
Re-survey Twp Rd- Sec 5-88-12
Sta. Dist. Defl L Needle Bearing- True Bearing

East end old Elk Run Bridge
Truly along creek bank.
Used data from Kieffer notes
Road is 40' wide & being
located as below.

June 19-1925
W.D.J. Inst
Turbell Rod-
F.B. Loftin
official observer.

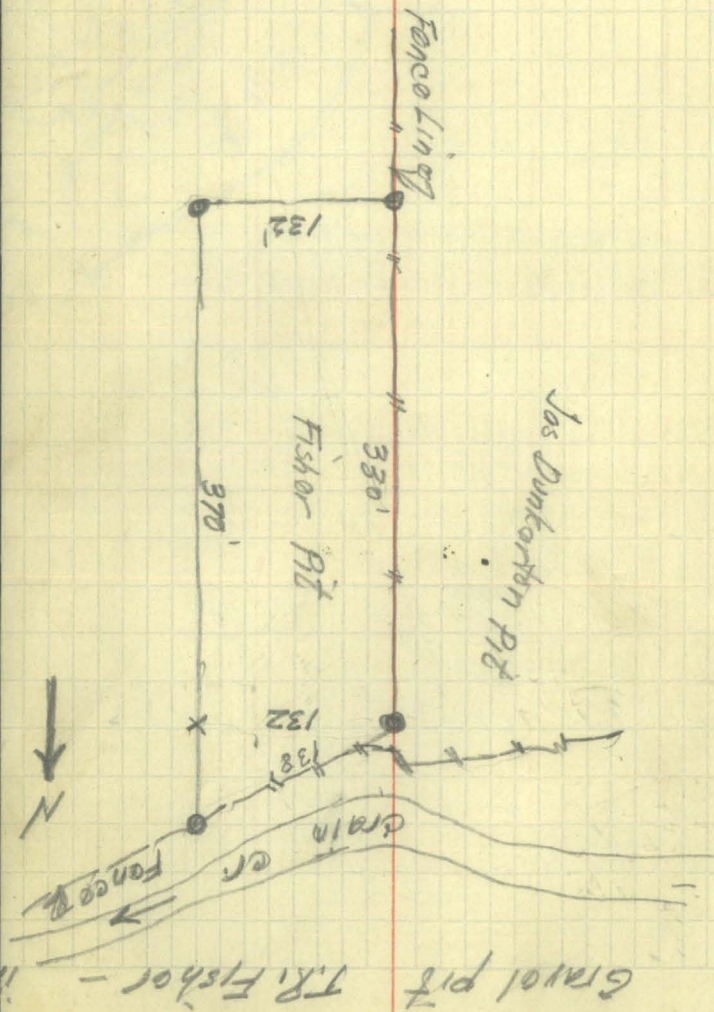
4+84.8			
	35.0	50° E	Stone
4+49.8		572° W	7° south to fence
	160.7		
2+89.1		160° 19'	
	132.0	555° 14' W	
1+57.1		18° 16' Lt.	
	107.6	573° 1/4' W	
0+49.5		89° 36' R	
	49.5		
0+00		<u>516° 0' E</u>	

Sta 0+00 = E back side of old Elk Run
Bridge abutment. Needle declination used
7° E. Sight stake 0+00 used bearing
516° 0' E.



Fisher Pit. SW 1/4 Sec 28-90-11.

• Indicate iron stakes
at corners -



Area =

$$\frac{330 + 370}{2} \times \frac{132}{43560} = 1.06 \text{ acres}$$

$$\text{Consideration } \$503.50$$

$$\text{Rate per acre} = 475.5$$

July 2 1925
W.D.J.
Robt T. Fisher
T.R. Fisher

Gravel pit T.R. Fisher - SW 1/4 Sec 28-90-11

NEWTON GRAVEL PIT

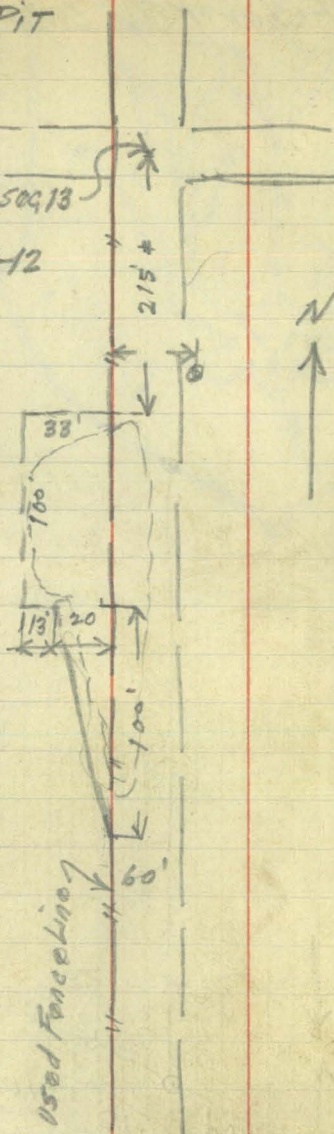
Jul 7-1925-

Teeter, Ahlos, Bentley

TWP Rd.

NE cor. Sec 13

Loc: NE 1/4 Sec. 13-87-12



Area 1-

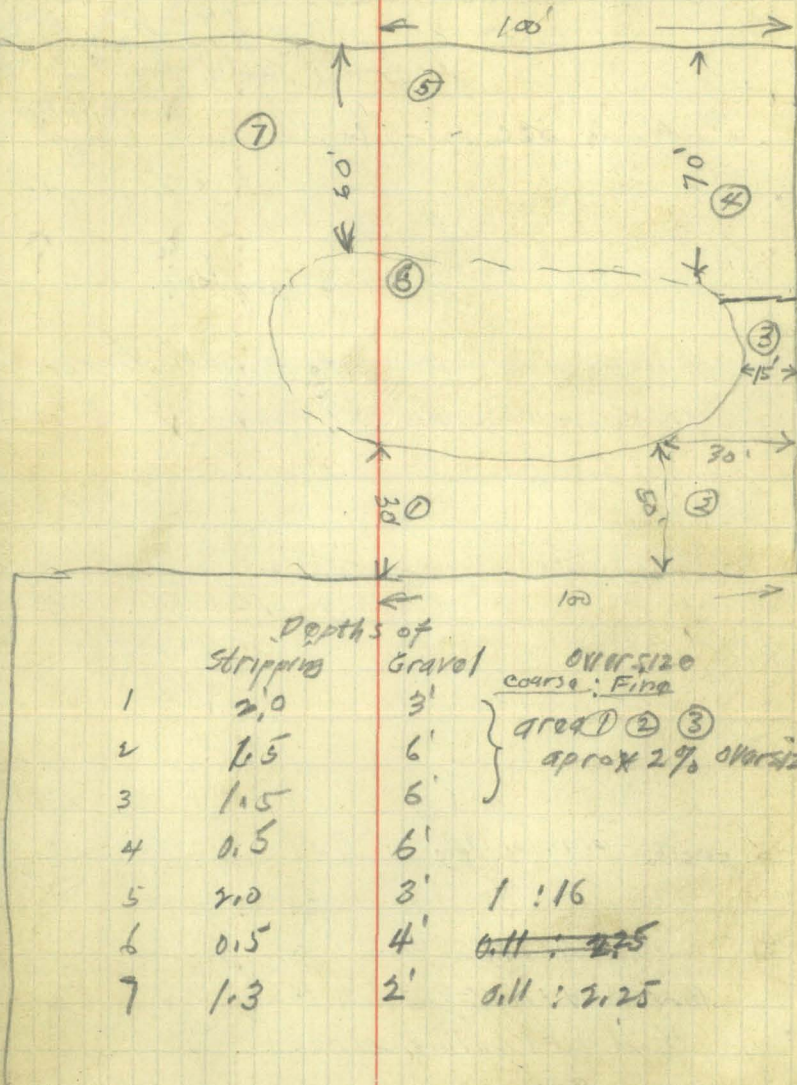
$$33 \times 100' = 3300 \text{ sq'}$$

$$\frac{20}{3} \times 100 = \frac{1000}{3} = 430 \text{ sq'}$$

Approx. 0.10 acre

a.c. Newton - agrees to
consideration of 100.00 in
payment for all material
taken from this pit.

WIRTZ Gravel Pit Loc SE Raymond

Johnston & Tarkenton
P.M. Sept 2-25N.
↑

	Depth of Stripping	Gravel	OVERSIZE Coarse: Fine
1	2.0	3'	area ① ② ③ approx 2% oversize.
2	1.5	6'	
3	1.5	6'	
4	0.5	6'	1:16
5	2.0	3'	
6	0.5	4'	
7	1.3	2'	0.11 : 2.25

Aug. 4-1925

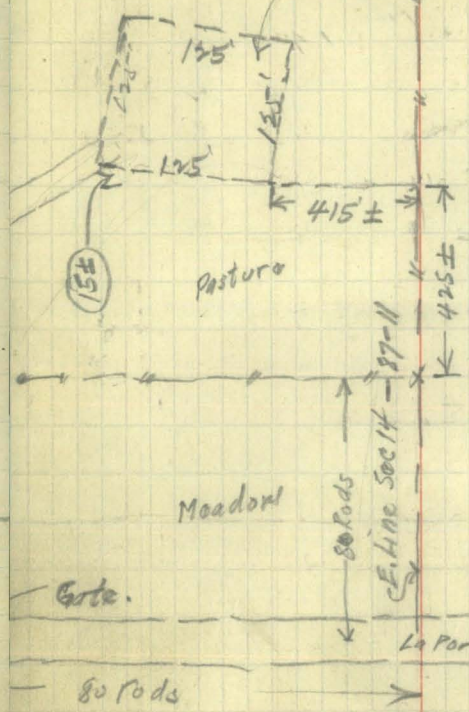
Tector
Bentley
Ahles -
Johnston

Consideration - \$250.00
area = 0.358 Acres.



148' from south

145' from road



GRAVEL PIT. - J.H. Fohl
Loc. SE 1/4 Sec 14 - 87-11.

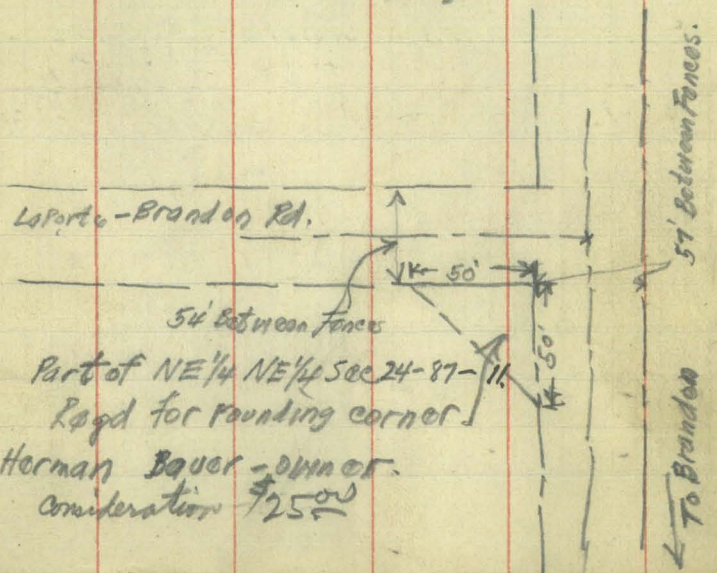
Drilled 6 test holes and found fairly good grade of gravel over the area as shown on opposite page.

Stripping appeared to be from 6" to 24" in depth. Holes approx 8 ft deep. Estimated gravel available.

$$\frac{120 \times 120 \times 6}{27} = 3200 \text{ cu yds.}$$

A.H. Fohl - La Porte, City - \$250.00
10 Year Lease. and Roadway strip and South - to Co. Rd.

Aug 4-1925.



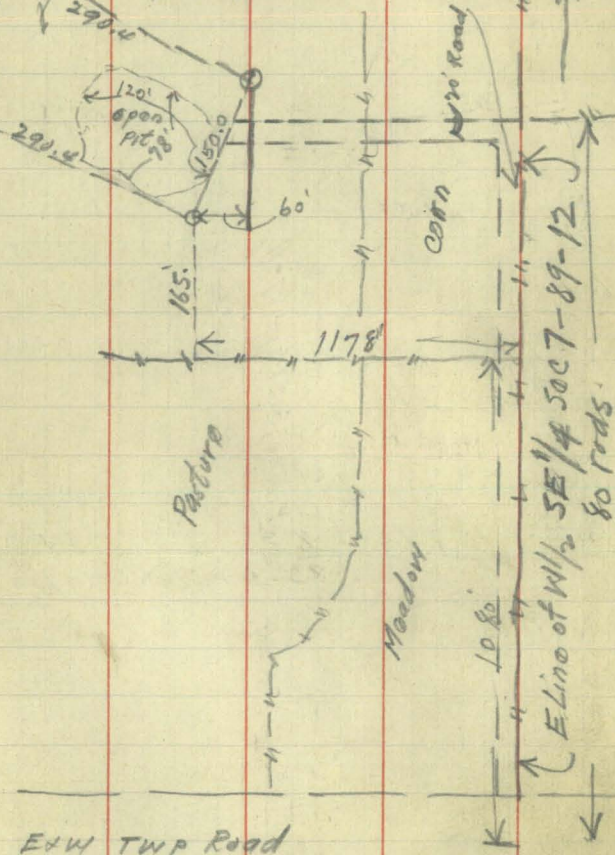
August 12-1925- consideration \$700.00 - 1 acre and Road
20' wide - east and South to Twp Rd. Term 10 years.
County to fence pit & Roadway. Owners to have
gravel for use on farm.

Dora Griffen Edwards Gravel Pit. Loc.
in W 1/4 SE 1/4 Sec 7-89-12

Aug 10/25
Johnston
Tarbell

Iron stakes set at corners

Gravel Pit
150 X 290.0 = 1 Acre.



Borrow Pit - Hudson - Cedar Falls Rd -
Maude Watters Brown - west side of road
Sta 14+28 to Sta 24+65

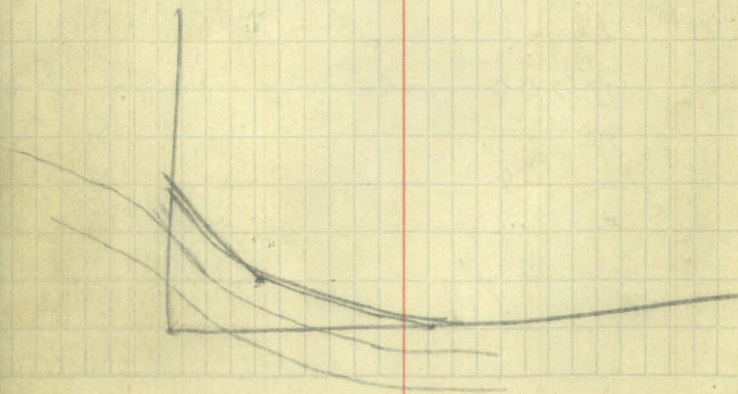
$$\frac{24+65}{1037 \times 40} = 0.95 \text{ acres}$$

~~James Holmes Jr. east side road.
Sta 14+28 to Sta 21+25~~

$$\frac{700 \times 20}{43560} = 144$$

Brandhaas -
Sta 36+00

$$\frac{24+65}{17+35 \times 40} = 1.04$$



$$\frac{27 \times 270 \times 3}{27} = 810 \text{ cu yd.}$$

$$\begin{array}{r} \text{Sta } 14+18- \\ 32+50 \\ \hline 18+32 \end{array}$$

$$\begin{array}{r} 1800 \overline{) 4000} \text{ cu yds} \\ \underline{3600} \\ 4000 \\ \underline{3600} \\ 400 \end{array}$$

$$274000$$

$$108,000 \text{ cu ft}$$

$$40' \text{ wide}$$

$$\begin{array}{r} 1.5 \times 1800 \\ \underline{1.5} \\ 9000 \end{array}$$

$$2700 \times$$

$$\begin{array}{r} 108000 \\ \underline{10800} \end{array}$$

$$\begin{array}{r} 1800 \\ 40 \\ \hline 72000 \\ 43560 \\ \hline 284400 \\ 261420 \\ \hline 229980 \end{array} \quad (1 \times 65 \text{ acres})$$

J. A. Messier Sta 221+32

$$\frac{245+50}{2418}$$

4500 cu yds
121,500 cu ft.

$$\begin{array}{r} \$1,000. \\ \underline{300} \\ 1300. \end{array}$$

$$308$$

$$\begin{array}{r} 2 \overline{) 43560} \\ \underline{44} \\ 156 \\ \underline{168} \end{array}$$

$$\begin{array}{r} 1000 \times \\ \hline 500. \\ \underline{205} \\ 30. \\ \underline{5} \\ 150 \\ \underline{5} \\ 650. \end{array}$$

$$\begin{array}{r} 2 \overline{) 43560} \\ \hline 218. \end{array}$$

W.C. Brandhorst Pitt

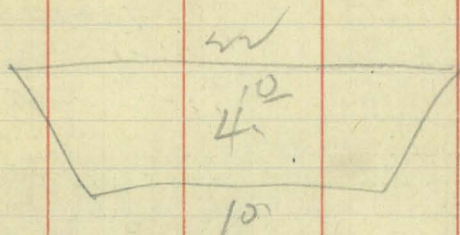
$$\begin{array}{r} 50 \\ 400 \\ 50 \\ \hline 150 \times 40 \times 10 = \frac{20000}{9} = 2200 \text{ cu yd.} \end{array}$$

$$\begin{array}{r} 61 \times 35 \times 3 \\ \hline 210 \text{ ft.} \end{array}$$

$$\begin{array}{r} 9 \times \frac{15}{15} \\ \hline 75 \\ \underline{15} \\ 225 \\ \underline{315} \\ 900 \\ \underline{225} \\ 675 \\ \hline 70650 \text{ ft} \end{array}$$

Bridges and Culverts repd 1924.

1. Holmhold conc. culv. located 4 miles north and $\frac{3}{4}$ mile west of Dewar - between sections -



$$\begin{array}{r} 640 \\ 200 \\ \hline 27 \overline{) 12800} \\ 10800 \\ \hline 2000 \end{array} \quad \begin{array}{l} 450 \\ \hline \end{array}$$



$$\frac{11}{4} \times 9 \times 15 = \frac{45}{4}$$

$$5 \times 27 \times 150 = 20250$$

$$\frac{4 \times 11 \times 11}{2} = 24.2$$

$$\begin{array}{r} 2 \\ 45 \overline{) 87120} \\ 9000 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Lot } 60 \times 140 \\ \hline 8400 \end{array}$$

$$\begin{array}{r} 43560 \\ 2 \\ \hline 3 \overline{) 87120} \\ 29040 \\ \hline \end{array}$$

$$\frac{7}{100}$$

$$\begin{array}{r} 2000 \\ .07 \\ \hline 2 \overline{) 87120} \\ 43560 \\ \hline 43560 \\ 300 \\ \hline 13516 \end{array} \quad \begin{array}{l} 450 \\ \hline \end{array}$$

$$\begin{array}{r} 1250 \\ 2.5 \\ \hline 6250 \\ 250 \\ \hline 3125 \text{ cy.} \end{array}$$

$$\begin{array}{r} .5 \\ .5 \\ .1 \\ \hline 2 \frac{1}{4} \text{ mile} \end{array} \quad \begin{array}{r} .38 \\ .17 \\ .55 \\ \hline .63 \end{array}$$

$$\begin{array}{r} 200 \\ 30 \\ \hline \$60000 \end{array}$$

$$\begin{array}{r} 1250 \\ .63 \\ \hline 3750 \\ 750 \\ \hline 78750 \end{array}$$

$$\begin{array}{r} 750 \times 2 \times 1.22 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 32 \\ .75 \\ \hline 160 \\ 24 \\ \hline 24.2 \end{array}$$

$$\begin{array}{r} 94300 \\ 92. \end{array}$$

$$\begin{array}{r} 350 \\ 12 \\ \hline 700 \\ 350 \\ \hline 27 \overline{) 4200} \\ 3700 \\ \hline 500 \end{array} \quad \begin{array}{l} \text{cy.} \\ 160 \end{array}$$

$$\begin{array}{r} 350 \\ 12 \\ \hline 700 \\ 350 \\ \hline 27 \overline{) 4200} \\ 3700 \\ \hline 500 \end{array}$$

$$\begin{array}{r} 3008 \\ 25 \\ \hline 591 \end{array}$$

40

Class A concrete.

1-2-3½ or 1 part cement / 2 1/2 parts fine agg.
1.95 part coarse agg.

Class B. concrete.

1: 1½ : 4 or 1 part cement ; 2.72 fine
to 2.45 part coarse agg.

Unscreened Gravel.

1/2 Sand 1/2 Gravel
1/2 in agg. wt. to 1/2 cu ft. G. 8 1/2 parts coarse

33 to 40	1 to 3.75	1.67
41 to 50	1 to 3.50	1.80
51 to 60	1 to 3.25	1.95
61 to 70	1 to 3.00	2.15

Proposed Channel Change

2000 ~~3x 23~~ = 400 cu yd
+ 28

KEITH'S RAILROAD CURVE TABLES.

Published by KEUFFEL & ESSER CO., New York.

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HOW TO USE KEITH'S TABLES.

EXAMPLE.

Wanted a Curve with an Ext. of about 12 ft. Angle
of Intersection or I. P. = 23° 20' to the R. at Station
542+72.

Ext. in Tab. IV opposite 23° 20' = 120.87
120.87 + 12 = 10.07. Say a 10° Curve.

Tan. in Tab. IV opp. 23° 20' = 1183.1
1183.1 + 10 = 118.31.

Tab. V. correction for A. 23° 20' for a 10° Cur. = 0.16
118.31 + 0.16 = 118.47 = corrected Tangent.

(If corrected Ext. is required find in same way)
Ang. 23° 20' = 23.33° + 10 = 2.3333 = L. C.

2° 19½' = def. for sta.	542	I. P. = sta.	542+72
4° 49½' = " " "	+50	Tan. =	118.47
7° 19½' = " " "	543	B. C. = sta.	541+53.53
9° 49½' = " " "	+50	L. C. =	2.33.33
11° 40' = " " "	543	E. C. = sta.	543+86.86
	86.86		

100 - 53.53 = 46.47 × 3' (def. for 1 ft. of 10° Cur.) = 139.41' =
2° 19½' = def. for sta. 542.

Def. for 50 ft. = 2° 30' for a 10° Curve.

Def. fc. 36.86 ft. = 1° 50½' for a 10° Curve

(These tables are published in Field Books of
KEUFFEL & ESSER CO., New York, N. Y.)

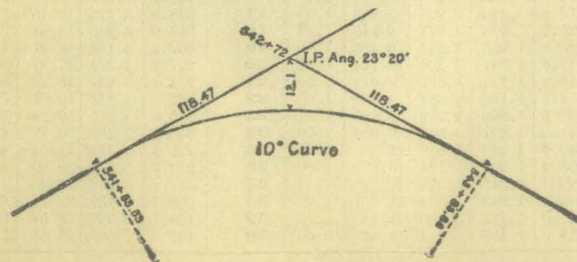


TABLE I. — Minutes in Decimals of a Degree.

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

TABLE III. — Radii, Ordinates and Deflections.

Deg.	Radius	Mid. Ord.	Tan. Def.	Chd. Def.	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Def.	Chd. Def.	Def. for 1 Foot
0° 10'	34377.	.036	.145	.291	0.05	7°	819.0	1.528	6.105	12.21	2.7
20	17189.	.073	.291	.582	0.10	20'	781.8	1.600	6.395	12.79	2.2
30	11459.	.109	.436	.873	0.15	30	764.5	1.637	6.540	13.03	2.2
40	8594.4	.145	.582	1.164	0.20	40	747.9	1.673	6.685	13.37	2.3
50	6875.5	.182	.727	1.454	0.25	50	716.8	1.746	6.976	13.95	2.4
1	5729.6	.218	.873	1.745	0.30	20	688.2	1.819	7.266	14.53	2.5
10	4911.2	.255	1.018	2.036	0.35	30	674.7	1.855	7.411	14.82	2.5
20	4297.3	.291	1.164	2.327	0.40	40	661.7	1.892	7.556	15.11	2.6
30	3819.8	.327	1.309	2.618	0.45	50	637.3	1.965	7.846	15.69	2.7
40	3437.9	.364	1.454	2.909	0.50	20	614.6	2.037	8.136	16.27	2.8
50	3125.4	.400	1.600	3.200	0.55	30	603.8	2.074	8.281	16.56	2.8
2	2864.9	.436	1.745	3.490	0.60	40	593.4	2.110	8.426	16.85	2.9
10	2644.6	.473	1.891	3.781	0.65	50	573.7	2.183	8.716	17.43	3.0
20	2455.7	.509	2.036	4.072	0.70	30	546.4	2.292	9.150	18.30	3.1
30	2292.0	.545	2.181	4.363	0.75	40	521.7	2.402	9.585	19.16	3.2
40	2148.8	.582	2.327	4.654	0.80	50	499.1	2.511	10.02	20.04	3.3
50	2022.4	.618	2.472	4.945	0.85	30	478.3	2.620	10.45	20.91	3.4
3	1910.1	.655	2.618	5.235	0.90	40	459.3	2.730	10.89	21.77	3.5
10	1809.6	.691	2.763	5.526	0.95	50	441.7	2.839	11.32	22.64	3.6
20	1719.1	.727	2.908	5.817	1.00	30	425.4	2.949	11.75	23.51	3.7
30	1637.3	.764	3.054	6.108	1.05	40	410.3	3.058	12.18	24.37	3.8
40	1562.9	.800	3.199	6.398	1.10	50	396.2	3.168	12.62	25.24	3.9
50	1495.0	.836	3.345	6.689	1.15	30	383.1	3.277	13.05	26.11	4.0
4	1432.7	.873	3.490	6.980	1.20	40	370.8	3.387	13.49	26.97	4.1
10	1375.4	.909	3.635	7.271	1.25	50	359.3	3.496	13.92	27.84	4.2
20	1322.5	.945	3.718	7.561	1.30	30	348.5	3.606	14.35	28.70	4.3
30	1273.6	.982	3.826	7.852	1.35	40	338.3	3.716	14.78	29.56	4.4
40	1228.1	1.018	4.071	8.143	1.40	50	319.6	3.935	15.64	31.29	4.5
50	1185.8	1.055	4.217	8.433	1.45	30	302.9	4.155	16.51	33.01	4.6
5	1146.3	1.091	4.362	8.724	1.50	40	287.9	4.374	17.37	34.73	4.7
10	1109.3	1.127	4.507	9.014	1.55	50	274.4	4.594	18.22	36.44	4.8
20	1074.7	1.164	4.653	9.305	1.60	30	262.0	4.814	19.08	38.16	4.9
30	1042.1	1.200	4.798	9.596	1.65	40	250.8	5.035	19.94	39.87	5.0
40	1011.5	1.237	4.943	9.886	1.70	50	240.5	5.255	20.79	41.58	5.1
50	982.6	1.273	5.088	10.18	1.75	30	231.0	5.476	21.64	43.28	5.2
6	955.4	1.309	5.234	10.47	1.80	40	222.3	5.697	22.50	44.99	5.3
10	929.6	1.346	5.379	10.76	1.85	50	214.2	5.918	23.35	46.69	5.4
20	905.1	1.382	5.524	11.05	1.90	30	206.7	6.139	24.19	48.38	5.5
30	881.9	1.418	5.669	11.34	1.95	40	199.7	6.360	25.04	50.07	5.6
40	859.9	1.455	5.814	11.63	2.00	50	193.2	6.583	25.88	51.76	5.7

TABLE IV. — Tangents and Externals to a 1° Curve.

Angle	Tangent	External	Angle	Tangent	External	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	52.83	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.05	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

TABLE IV. — Tangents and Externals to a 1° Curve.

Angle	Tangent	External	Angle	Tangent	External	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.

Angle	Tangent	External	Angle	Tangent	External	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.

Angle	Tangent	External	Angle	Tangent	External	Angle	Tangent	External
91°	5890.5	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	5804.6	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 use with table IV,

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

		For Externals Add													
ANGLE	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	.045	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°		.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°		.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°		.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°		.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°		.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.771	.845	.922	1.01
70°		.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°		.095	.182	.266	.353	.440	.528	.617	.707	.797	.887	.977	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	1.06	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

Table VI. Deflections for Sub Chords for Short Radius Curves.

Degree of Curve	Radius 50 sin. def. ang.	$\frac{1}{2}$ sub chord = sin of def. angle R				Length of arc for 100 ft.
		12.5 Ft.	15 Ft.	20 Ft.	25 Ft.	
30°	193.18	1° 51'	2° 17'	2° 58'	3° 43'	101.15
32°	181.39	1° 59'	2° 25'	3° 10'	3° 58'	101.33
34°	171.01	2° 06'	2° 33'	3° 21'	4° 12'	101.48
36°	161.80	2° 13'	2° 41'	3° 33'	4° 26'	101.66
38°	153.58	2° 20'	2° 49'	3° 44'	4° 40'	101.85
40°	146.19	2° 27'	2° 57'	3° 55'	4° 54'	102.06
42°	139.52	2° 34'	3° 05'	4° 07'	5° 08'	102.29
44°	133.47	2° 41'	3° 13'	4° 18'	5° 22'	102.53
46°	127.97	2° 48'	3° 21'	4° 29'	5° 36'	102.76
48°	122.92	2° 55'	3° 29'	4° 40'	5° 50'	103.00
50°	118.31	3° 02'	3° 38'	4° 51'	6° 04'	103.24
52°	114.06	3° 09'	3° 46'	5° 02'	6° 17'	103.54
54°	110.11	3° 16'	3° 54'	5° 13'	6° 31'	103.84
56°	106.50	3° 22'	4° 02'	5° 23'	6° 44'	104.14
58°	103.14	3° 29'	4° 10'	5° 34'	6° 57'	104.43
60°	100.00	3° 35'	4° 18'	5° 44'	7° 11'	104.72

CURVE FORMULAS.

$T = R \tan \frac{1}{2} I$	$R = T \cot. \frac{1}{2} I$	Chord def. = chord
$T = \frac{50 \tan. \frac{1}{2} I}{\sin. D}$	$R = \frac{50}{\sin. D}$	R
$\sin. D = \frac{50}{R}$	$E = R \text{ ex. sec. } \frac{1}{2} I$	No. chords = $\frac{1}{2} \frac{I}{D}$
$\sin. D = \frac{50 \tan. \frac{1}{2} I}{T}$	$E = T \tan \frac{1}{2} I$	Tan. def. = $\frac{1}{2}$ chord def.

The square of any distance, divided by twice the radius, will equal the distance from tangent to curve, very nearly.

Table IV. contains Tangents and External to a 1° curve. Tan. and Ex. to any other radius may be found, nearly enough, by dividing the Tan. or Ext. opposite the given Central Angle by the given degree of curve.

To find Deg. of Curve, having the Central Angle and Tangent: Divide Tan. opposite the given Central Angle by the given Tangent.

To find Deg. of Curve, having the Central Angle and Tangent: Divide Ext. opposite the given Central Angle by the given External.

To find Nat. Tan. and Nat. Ex. Sec. for any angle by Table IV.: Tan. or Ext. of twice the given angle divided by the radius of a 1° curve will be the Nat. Tan. or Nat. Ex. Sec.

To find angle for a given distance and deflection.

Rule 1. Multiply the given distance by .01745 (def. for 1° for 1 ft.), and divide given deflection by the product.

Rule 2. Multiply given deflection by 57.3, and divide the product by the given distance.

To find deflection for a given angle and distance: Multiply the angle by .01745, and the product by the distance.

RIGHT ANGLE TRIANGLES.—Square the altitude, divide by twice the base. Add quotient to base for hypotenuse.

Given Base 100, Alt 10. $10^2 \div 200 = .5$. $100 + .5 = 100.5$ hyp.

Given Hyp. 100, Alt. 25. $25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 = B$

Error in first example, .002; in last, .045.

To find Tons of Rail in one mile of track: multiply weight per yard by 11, and divide by 7.

Natural Sines

deg.	0'	10'	20'	30'	40'	50'	deg.	0'	10'	20'	30'	40'	50'	deg.	
0	0000	0029	0058	0087	0116	0145	89	140	6428	6450	6472	6494	6517	6539	49
1	0175	0204	0233	0262	0291	0320	88	41	6561	6583	6604	6626	6648	6670	48
2	0349	0378	0407	0436	0465	0494	87	42	6691	6713	6734	6756	6777	6799	47
3	0523	0552	0581	0610	0640	0669	86	43	6820	6841	6862	6884	6905	6926	46
4	0698	0727	0756	0785	0814	0843	85	44	6947	6967	6988	7009	7030	7050	45
5	0872	0901	0929	0958	0987	1016	84	45	7071	7092	7112	7133	7153	7173	44
6	1045	1074	1103	1132	1161	1190	83	46	7193	7214	7234	7254	7274	7294	43
7	1219	1248	1279	1305	1334	1363	82	47	7314	7333	7353	7373	7392	7412	42
8	1392	1421	1449	1478	1507	1536	81	48	7431	7451	7470	7490	7509	7528	41
9	1564	1593	1622	1650	1679	1708	80	49	7547	7566	7585	7604	7623	7642	40
10	1736	1765	1794	1822	1851	1880	79	50	7660	7679	7698	7716	7735	7753	39
11	1908	1937	1965	1994	2022	2051	78	51	7771	7790	7808	7826	7844	7862	38
12	2079	2108	2136	2164	2193	2221	77	52	7880	7898	7916	7934	7951	7969	37
13	2250	2278	2306	2334	2363	2391	76	53	7986	8004	8021	8039	8056	8073	36
14	2419	2447	2476	2504	2532	2560	75	54	8090	8107	8124	8141	8158	8175	35
15	2588	2616	2644	2672	2700	2728	74	55	8192	8208	8225	8241	8258	8274	34
16	2756	2784	2812	2840	2868	2896	73	56	8290	8307	8323	8339	8355	8371	33
17	2924	2952	2979	3007	3035	3062	72	57	8387	8403	8418	8434	8450	8465	32
18	3090	3118	3145	3173	3201	3228	71	58	8480	8496	8511	8526	8542	8557	31
19	3256	3283	3311	3338	3365	3393	70	59	8572	8587	8601	8616	8631	8646	30
20	3420	3448	3475	3502	3529	3557	69	60	8660	8675	8689	8704	8718	8732	29
21	3584	3611	3638	3665	3692	3719	68	61	8746	8760	8774	8788	8802	8816	28
22	3746	3773	3800	3827	3854	3881	67	62	8829	8843	8857	8870	8884	8897	27
23	3907	3934	3961	3987	4014	4041	66	63	8910	8923	8936	8949	8962	8975	26
24	4067	4094	4120	4147	4173	4200	65	64	8988	9001	9013	9026	9038	9051	25
25	4226	4253	4279	4305	4331	4358	64	65	9063	9075	9088	9100	9112	9124	24
26	4384	4410	4436	4462	4488	4514	63	66	9135	9147	9159	9171	9182	9194	23
27	4540	4566	4592	4617	4643	4669	62	67	9205	9216	9228	9239	9250	9261	22
28	4695	4720	4746	4772	4797	4823	61	68	9272	9283	9293	9304	9315	9325	21
29	4848	4874	4899	4924	4950	4975	60	69	9336	9346	9356	9367	9377	9387	20
30	5000	5025	5050	5075	5100	5125	59	70	9397	9407	9417	9426	9436	9446	19
31	5150	5175	5200	5225	5250	5275	58	71	9455	9465	9474	9483	9492	9502	18
32	5299	5324	5348	5373	5398	5422	57	72	9511	9520	9528	9537	9546	9555	17
33	5446	5471	5495	5519	5544	5568	56	73	9563	9572	9580	9588	9596	9605	16
34	5592	5616	5640	5664	5688	5712	55	74	9613	9621	9628	9636	9644	9652	15
35	5736	5760	5783	5807	5831	5854	54	75	9659	9667	9674	9681	9689	9696	14
36	5878	5901	5925	5948	5972	5995	53	76	9703	9710	9717	9724	9730	9737	13
37	6018	6041	6065	6088	6111	6134	52	77	9744	9750	9757	9763	9769	9775	12
38	6157	6180	6202	6225	6248	6271	51	78	9781	9787	9793	9799	9805	9811	11
39	6293	6316	6338	6361	6383	6406	50	79	9816	9822	9827	9833	9838	9843	10
deg.	60'	50'	40'	30'	20'	10'	deg.	deg.	60'	50'	40'	30'	20'	10'	deg.

deg.	60'	50'	40'	30'	20'	10'	deg.	60'	50'	40'	30'	20'	10'	deg.
80	9848	9853	9858	9863	9868	9872	9	9879	9884	9889	9894	9899	9904	8
81	9877	9881	9886	9890	9894	9898	8	9903	9907	9911	9914	9918	9922	7
82	9903	9907	9911	9914	9918	9922	7	9925	9929	9932	9936	9939	9942	6
83	9925	9929	9932	9936	9939	9942	6	9945	9948	9951	9954	9957	9959	5
84	9945	9948	9951	9954	9957	9959	5	9962	9964	9967	9969	9971	9974	4
85	9962	9964	9967	9969	9971	9974	4	9976	9978	9980	9981	9983	9985	3
86	9976	9978	9980	9981	9983	9985	3	9986	9988	9989	9990	9992	9993	2
87	9986	9988	9989	9990	9992	9993	2	9994	9995	9996	9997	9997	9998	1
88	9994	9995	9996	9997	9997	9998	1	9998	9999	9999	9999	1.0000	1.0000	0
89	9998	9999	9999	9999	9999	1.0000	0							

Natural Cosines

Natural Tangents

deg.	0'	10'	20'	30'	40'	50'	deg.	0'	10'	20'	30'	40'	50'	deg.
0	0000	0029	0058	0087	0116	0145	89	40	8391	8441	8491	8541	8591	8642
1	0175	0204	0233	0262	0291	0320	88	41	8693	8744	8796	8847	8899	8952
2	0349	0378	0407	0437	0466	0495	87	42	9004	9057	9110	9163	9217	9271
3	0524	0553	0582	0612	0641	0670	86	43	9325	9380	9435	9490	9545	9601
4	0699	0729	0758	0787	0816	0846	85	44	9657	9713	9770	9827	9884	9942
5	0875	0904	0934	0963	0992	1022	84	45	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295
6	1051	1080	1110	1139	1169	1198	83	46	1.0355	1.0410	1.0477	1.0533	1.0599	1.0661
7	1228	1257	1287	1317	1346	1376	82	47	1.0724	1.0786	1.0850	1.0913	1.0977	1.1041
8	1405	1435	1465	1495	1524	1554	81	48	1.1106	1.1171	1.1237	1.1303	1.1369	1.1436
9	1584	1614	1644	1673	1703	1733	80	49	1.1504	1.1571	1.1640	1.1708	1.1778	1.1847
10	1763	1793	1823	1853	1883	1914	79	50	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276
11	1944	1974	2004	2035	2065	2095	78	51	1.2349	1.2423	1.2497	1.2572	1.2647	1.2723
12	2126	2156	2186	2217	2247	2278	77	52	1.2799	1.2876	1.2954	1.3032	1.3111	1.3190
13	2309	2339	2370	2401	2432	2462	76	53	1.3270	1.3351	1.3432	1.3514	1.3597	1.3680
14	2493	2524	2555	2586	2617	2648	75	54	1.3764	1.3848	1.3934	1.4019	1.4106	1.4193
15	2679	2711	2742	2773	2805	2836	74	55	1.4281	1.4370	1.4460	1.4550	1.4641	1.4733
16	2867	2899	2931	2962	2994	3026	73	56	1.4826	1.4919	1.5013	1.5108	1.5204	1.5301
17	3057	3089	3121	3153	3185	3217	72	57	1.5399	1.5497	1.5597	1.5697	1.5798	1.5900
18	3249	3281	3314	3346	3378	3411	71	58	1.6003	1.6107	1.6212	1.6319	1.6426	1.6534
19	3443	3476	3508	3541	3574	3607	70	59	1.6643	1.6753	1.6864	1.6977	1.7090	1.7205
20	3640	3673	3706	3739	3772	3805	69	60	1.7321	1.7437	1.7556	1.7675	1.7797	1.7917
21	3830	3872	3906	3939	3973	4006	68	61	1.8040	1.8165	1.8291	1.8418	1.8546	1.8676
22	4040	4074	4108	4142	4176	4210	67	62	1.8807	1.8940	1.9074	1.9210	1.9347	1.9486
23	4245	4279	4314	4348	4383	4417	66	63	1.9626	1.9768	1.9912	2.0057	2.0204	2.0353
24	4452	4487	4522	4557	4592	4628	65	64	2.0503	2.0655	2.0809	2.0965	2.1123	2.1283
25	4663	4699	4734	4770	4806	4841	64	65	2.1445	2.1609	2.1775	2.1943	2.2113	2.2286
26	4877	4913	4950	4986	5022	5059	63	66	2.2460	2.2637	2.2817	2.2998	2.3183	2.3369
27	5095	5132	5169	5206	5243	5280	62	67	2.3559	2.3750	2.3945	2.4142	2.4342	2.4545
28	5317	5354	5392	5430	5467	5505	61	68	2.4751	2.4960	2.5172	2.5386	2.5605	2.5826
29	5543	5581	5619	5658	5696	5735	60	69	2.6051	2.6279	2.6511	2.6746	2.6985	2.7228
30	5774	5812	5851	5890	5930	5969	59	70	2.7475	2.7725	2.7980	2.8239	2.8502	2.8770
31	6009	6048	6088	6128	6168	6208	58	71	2.9042	2.9319	2.9600	2.9887	3.0178	3.0475
32	6249	6289	6330	6371	6412	6453	57	72	3.0777	3.1084	3.1397	3.1716	3.2041	3.2371
33	6494	6536	6577	6619	6661	6703	56	73	3.2700	3.3052	3.3402	3.3759	3.4124	3.4495
34	6745	6787	6830	6873	6916	6959	55	74	3.4874	3.5261	3.5656	3.6059	3.6470	3.6891
35	7002	7046	7089	7133	7177	7221	54	75	3.7321	3.7760	3.8208	3.8657	3.9136	3.9617
36	7265	7310	7355	7400	7445	7490	53	76	4.0108	4.0611	4.1126	4.1653	4.2193	4.2747
37	7536	7581	7627	7673	7720	7766	52	77	4.3315	4.3897	4.4494	4.5107	4.5736	4.6382
38	7813	7860	7907	7954	8002	8050	51	78	4.7046	4.7729	4.8430	4.9152	4.9894	5.0658
39	8098	8146	8195	8243	8292	8342	50	79	5.1446	5.2257	5.3093	5.3955	5.4845	5.5764

deg.	0'	10'	20'	30'	40'	50'	deg.	0'	10'	20'	30'	40'	50'	deg.
80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970	9							
81	6.3138	6.4348	6.5606	6.6912	6.8269	6.9682	8							
82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530	7							
83	8.1443	8.3450	8.5555	8.7769	9.0098	9.2553	6							
84	9.5144	9.7882	10.078	10.385	10.711	11.059	5							
85	11.430	11.826	12.250	12.706	13.197	13.727	4							
86	14.300	14.924	15.605	16.350	17.169	18.075	3							
87	19.081	20.206	21.470	22.003	24.542	26.432	2							
88	28.636	31.242	34.368	38.189	42.964	49.104	1							
89	57.290	68.750	85.940	114.588	171.865	343.770	0							

Natural Cotangents

$$\frac{2(43560)}{5221780}$$

$$160 \times 46 \times 8$$

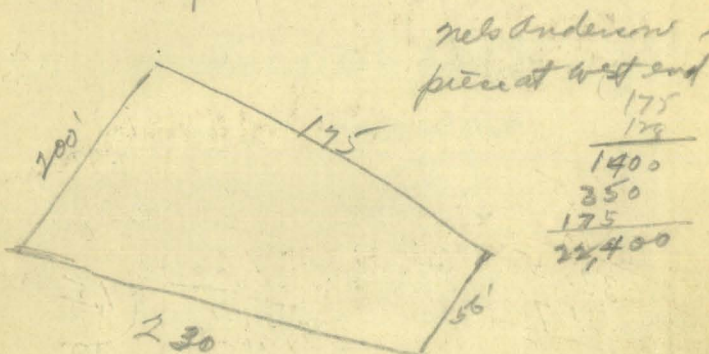
$$22$$

$$9$$

$$7.8 \times 35 \times 200$$

$$27$$

$$9$$



$$\frac{171}{350} \times 175 =$$

$$1300$$

$$27$$

$$9150$$

$$\frac{2435100}{1270} \times 15$$

$$1270$$

$$\frac{341.1}{1404350} \times 15$$

$$\frac{77}{200}$$

$$\frac{915000}{1800}$$

$$1800$$

$$\frac{91}{20}$$

mils Anderson
piece at west end

$$\frac{175}{175} = 1400$$

$$\frac{207450}{195}$$

$$1250$$

$$53$$

$$3750$$

$$\frac{625}{66250} \times 108000$$

$$423$$

$$14800$$

$$160$$

$$100$$

