

STATE ROAD

SRH No 80

(10)

(10)

14000 INVERT HOLES

PULLAGE R.

LEIGH RIVER

FIELD BOOK

361

Notes on State Road
No 2 and SRH 80
Notes on bridges.

KEUFFEL & ESSER CO.

DRAWING MATERIALS
AND
SURVEYING INSTRUMENTS.
NEW YORK.

CHICAGO. ST. LOUIS. SAN FRANCISCO. MONTREAL.

TABLES FOR EXCAVATIONS AND EMBANKMENTS.

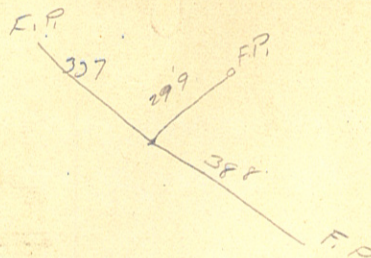
DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.
ROADWAY 18 FEET WIDE. SIDE SLOPES 1 TO 1.
FOR SINGLE TRACK EXCAVATION.

"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
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24	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	24
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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.



15"	18	20	24	30	36
4 028	260	142	34	30	
221032	38		144	418	74
41212	10		4	6	
81906			26		
61224					
46002	260	180	208	454	74

$$1514 - 12" @ .53 = 802.42$$

$$6002 \quad 15 \quad 78 = 4681.56$$

$$260 \quad 18 \quad 80 = 208.00$$

$$180 \quad 20" \quad 1.20 \quad 216.00$$

$$208 \quad 24 \quad 1.35 \quad 280.80$$

$$454 \quad 30 \quad 1.88 \quad 853.52$$

$$74 \quad 36 \quad 2.60 \quad 192.40$$

8692

7234.70

36.65 12 .53

7271.35 15 .78

34.75 18 .80

7236.60 20 1.20

6000.00 24 1.35

1236.60 30 1.88

36 2.60

Band 235

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Nov. 27.

Starting at 1100 we make
distance to Iron pipe
5+23.7

used sta 5+24.9 chained
S.E. and found sta 10+00

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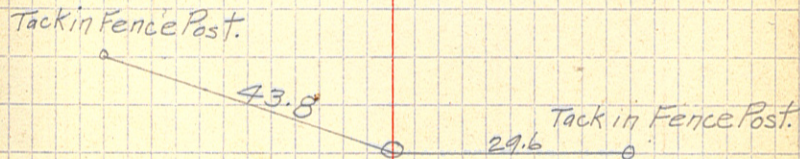
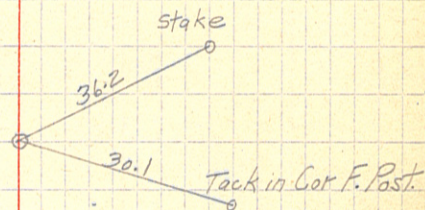
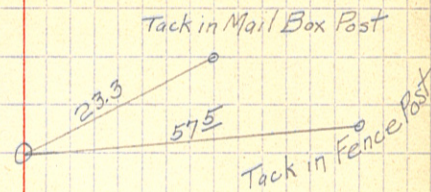
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Reference Points.

1123+59² Sec. Cor. (Stone)

1176+58 Sec. Cor. (Iron Pipe)

1202+70¹ $\frac{1}{4}$ Cor. (Iron Pipe)

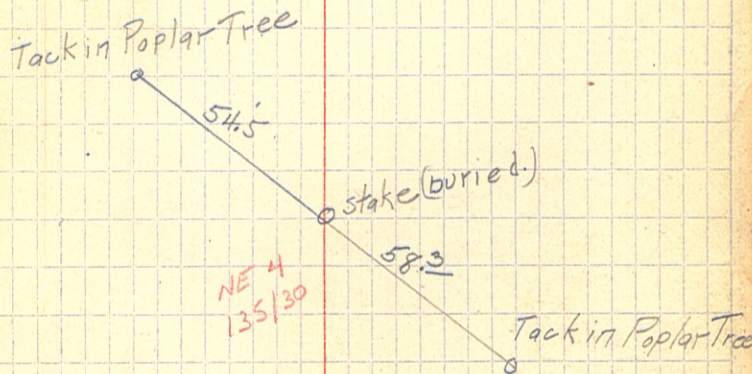
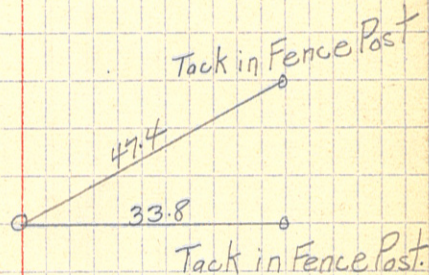
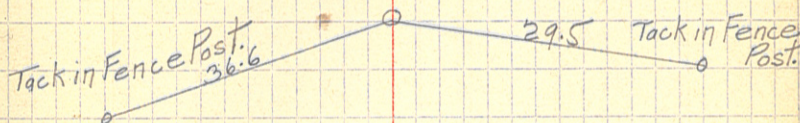


Reference Points.

1220+52.8 P.o.t. (Spike)

1282+01 Sec. Cor (Iron Pipe)

860+25 = Sec. Cor (Stake)



R. P. Points

700+819 Sec Cor (stake)

3

327

Fence Cor

on line with North edge
of Fence

Check of Culverts

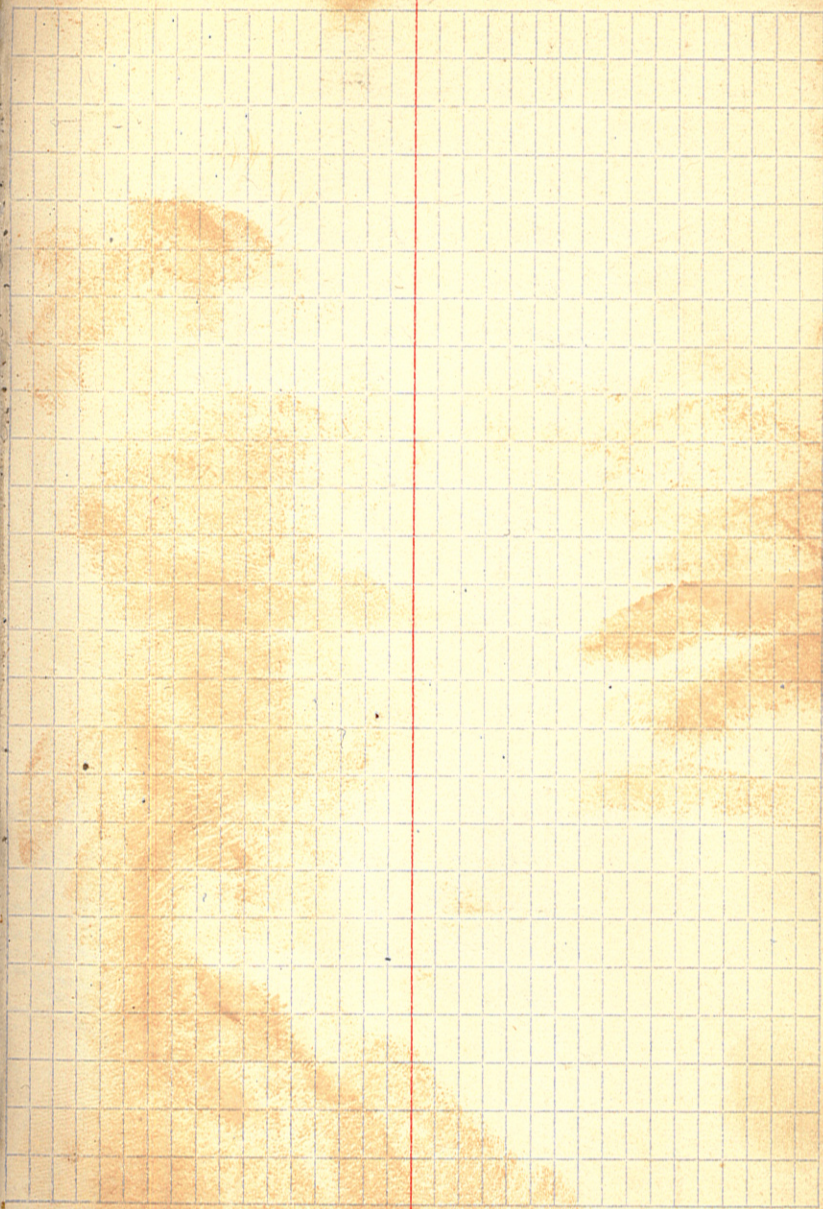
Sta. No.	Length	Diameter	REMARKS
3+50	24'	15"	Culvert at Sta 9+50.
42+50	24'	12"	CUT OUT.
49	24'	16"	Under King on L
57+25	24'	15"	In place
115+75	24'	15"	NOT IN ..
126+15	26'7"	20"	In place. ^{Get 2' more. To} 6 piece. _{SHORT on R. end}
132+80	20.8'	12"	" " R. on L (Even sta)
145	28'	20"	" "
157	26'	15"	Not in place
164	25'	12"	In place
182+70	24'	15"	" "
186	26'	15"	Not in place
194	46'	12"	In place. with expansion.
198	26'	12"	" "
207+65	26'	15"	" "
207+65	28'	15"	Not in place
230	8'	24"	Old Culvert ^{8' cut off}
239+50	24'	12"	In place
242	24'	12"	" "
254+75	26'	15"	" "
268	24'	15"	" "
279	24'	12"	In place. Under P.P. on L.
307	24'	15"	" "
323	26'	15"	" "

Check of Culverts

Sta.	Length	Diameter	Remarks
341	37'	12"	In place. 6' Extension
344	24'	24"	In place 6' Not in.
349+75	40'	15" 12"	" " With extension
359+30	26'	15"	" " 6' extension, not in.
364	24'	15"	" " 4' " - Collar "
368	14'	12"	Not in place
376	32'	15"	In place, Collar not in.
380	26'	15"	" "
384	24'	15"	" " with lower end
397	29'	12"	" " " Extension
405+50	24'	15"	" " 4' Not in.
413+50	24'	15"	" "
419+20	24'	12"	" "
428+70	24'	24"	" " 4' Extension not in.
438+50	22'	15"	" "
444+50	24'	15"	" "
453 ?	24'	12"	" "
458 ?	24'	15"	" "
650	26'	15"	" "
680	26'	30"	" "
698	24'	24"	" "
710	32'	30"	Not in place
	24'	30"	" " "
805	26'	15"	" " "
	26'	15"	" " "

Culvert is high on ends. Low in center. Extension on
 1' too high.

Sta.	Length	Diameter	Remarks
1167	24'	15"	Not in place
1179+50	22'	15"	In "
1202+75	16'	12"	" " P.D. on L.
1211	26'	15"	" "
1220 {	12'	12"	" " P.D. on L.
	16'	12"	" " P.D. on L.
1229+65	24'	12"	" " " " L
1237	24'	15"	" "
1241+25	24'	15"	" "
1245	22'	15"	Not in place
1258	12'	12"	" " P.D. on R.
1260	16'	12"	" " " L
1261	16'	12"	" " " R
1262+50	16'	12"	" " " L
1273 {	16'	12"	" " "
	16'	12"	" " "
1275	10'	12"	" " "
1282 {	24'	12"	" " L
	18'	12"	" " R



2-21-17

PILLAGEY BRIDGE

W. T. Warner and 2 go to bridge
1/2 South Pillagey - across
Crowwing Run.

Length Main bridge 260'
North span - 80' - 5-16's
Center " 100' - 5-20's
South " 80' - 5-16's

Approach at N end - 65' - (?)
4 spans - 16'

Main Bridge -

Dress - 10 x 10 - 3 x 10 one

X joists 12 x 16 x 18 " 10 " "

Dress approach 17 1/2 high

North pier being the first
pier under the main bridge -
is now and in poor condition.

9 feet wide at base about 12 feet
high. The middle and South
pier are pile in timber and
stone crib - timber work
is falling apart.

The north abutment,

9

being at head of approach - is
poor with plank forming -
not in very good condition.
The south abutment is piles
and plank forming - the cap
has slid off some of the pile -
due to the end pressure.

Bridge clear is about 12 1/2'
joists are 3 x 12 - fair condition
Dress pier has one rotten
pile. Two rotten pile in
approach.

Entire railing in very poor
condition 4 x 4 - 2 x 8 - 2 x 6 and 2 x 4.

Entire floor in poor condition
and need wheel guard.

Very cold and stormy

2-22-17

THE DAM, BRIDGE

10

Cross Bull Run in

Section 19 - Twp 133-79

Wooden structure - 6 yrs old

Length 198'

13 spans - lengths vary

Some being 15 to 16 feet

3 Piles in each bed

Timber joists - which
have been deformed later
with planks.

3" Hardwood flooring.

The piles, caps and joists
are Pine (joists all Pine) also

oak and white oak - were

put in the structure open and

with the bark on. Evidently

one set of piles on top of another.

The pile joists are in very

poor condition - some of

them being entirely punked

Caps and piles are more or

less rotted

Bridge in very poor
condition - and not safe

2-22-17

THE GULL RIVER BRIDGE
Across Gull River - Sec 17-133-29

Type - ^{Pile}Wooden Structure - 12 yrs old
Length 90 feet

The center span is 16 feet
other spans are (6-15'2)

3" x 10" joists - 2" hardwood floor

Due to neglect, this
bridge has been raised and
repaired.

By repairing the floor and
guard rail this bridge will do
for another season. As the
balance of the superstructure
is in fair condition.

An mail road - July 1917 to
Bramble

2-23-17

Red Bridge - 5 miles
North of Staples - across Crow
Wing River.

Length 280 feet

4 spans

3 timber & row arches - pile
unloaded

Saw some large wooden
structure. Piers and abutments are
in very poor condition. Several
timber piles recently got
washed. Wind stress rods
need repairing. Pile need tying
together. Floor and joists in
good condition.

Check in need repairing
before the spring break up.

In general this bridge is
in very poor condition.

Approx 15 yrs old. Age 10-12.

12

2-23-17

MOTLEY BRIDGE

Located across Crossway
Riv. - near Village of Motley.
Length 280 feet - 2 spans
Stone Masonry abutments -
Girder, concrete filled Ties
Steel superstructure - wood
joists and floor.

The floor and joists on
the north 1/2 (Cass Co) are not
in very good condition. The
floor and joists on South 1/2
have been replaced in the
last 3 years.

By replacing the floor and
joists on Cass Co the half the
bridge would be in good
condition.

Recommended suggest under
end of joists at center pier -
so they may rest on pier.

13

5-8-17

12	15	18	20	24	30
29	22	28	26	24	16
18	26	24	26	29	26
23	40	28	27	25	28
22	29	28	36	28	26
12	27	30	28	30	30
24	25	12		14	33
24	27	12			28
14	24	28			20
24	22				26
24	24				30
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18	16				
16	27				

5-8-17

No 80

14

Tues. May 8th -17

26 Hinch-Warner, Krake + A.W.M.

24 Beg. at Backus we measure

24 culverts on 1st 80. to P. Hager.

(Except 67 Pine River Bridge

which is 15+12, and 29 in 1st Swp S

which is 15+12. (163 Culs - 5-8-17)

go to Motley for night.

5-8-17

12	15	12	15	15
10	22	24	33	28
17	30	24	18	26
16	32	24	27	26
17	28		26	26
12	24		26	24
24	24		26	20
12	31		14	24
16	24		13	24
16	25		26	
16	24		24	
16	26		24	
16	12		25	
16	35		25	
16	14		28	
18	22		28	
16	23		26	
24	12		32	
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24	13		32	
24	28		40	
24	31		26	
26	26		24	
30	31		24	
24	27		24	
20	33		26	

TILE

5-8-17

No 80

(15)

166

No 80

5-9-17

12"	15"	18"	20"	24"	30"
29	28	17	26	42	26
24	27	28	16	38	26
30	22	48			10
31	26	4			36
27	30	30			32
27	22	12			27
24	30	6			30
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No 80

5-9-17

15"	15"	15"	15"	15"	(16)
32	32	24	24	16	
66	30	6	22		
37	29	2	22		
35	30	24	30		
38	27	32	24		
39	37	42	24		
23	4	24	22		
45	30	38	34		
36	26	28	32		
24	33	32	28		
12	4	28	26		
28	67	16	25		
26	46	33	30		
40	32	38	28		
25	26	16	30		
29	28	30	26		
30	34	27	32		
32	26	24	26		
36	30	15	26		
30	24	16	34		
40	30	40	28		
31	24	24	26		
56	24	16	32		
35	24	29	26		
38	16	18	28		

Krake Hinch Warner AWM.
Beg. at Backus - working north.

(163)

No 81			
NTILE	12"	15"	R-L
44	16		L
43	16		R
42		18"-16"	R
41		24	R
40	20		L
39	18		R
38	16		R
38	18		R
37	16		R
37	16		L
36	16		L
35	18		R
35	18		L
32	20		L
32	18		L
31	16		R
31	24		L
30	18		R
30	16		R
28	20		R
28	18		L
27	20		L
27	20		R
27	18		R
27	24		R
420	24	16"-18"	

No 81		5-9-17 (17)
Owner of Place	Beginning at Motley and going north 5-9-17	
C.H. Condit	Field	
Jos Kraker		
Ingal Goplen	Warner Hinck	
M.W. Hill	Krake AUM	
Frank H Parker		
Shandrew		
Geo. H. Beers		
Frank Jans		
Unknown		
Martin Hanson		
H.M. Hanson		
Kelly		
Denning		
A.S. Bjelde		
Bert Lamb		
F.W. Deline		
B.M. Underdahl		
Carl Granby		
John Henry		
C.D. LeFeret		
Jake Gillberg		
Stone		
Gett. Dewald		
Arthur DeWald		

MILE	12"	15"	20"	R-L
25			24-20	L
25			18-20	L
24	20			R
24	16			R
21	18			L
20	18			R
20	16			R
20	20			L
20	18			R
19	18			L
11	18			L
11	18			R
8	18			L
8	18			L
5	18			R
3	18			R
3	18			L
3	18			L
3	18			R
	314-		20'-24' -	
			20'-18' -	

TOTALS

Owner of Place

Mitchener	
Mathews	
A.A. Mowatt	
L.M. Boyer	
Farnum	
Unknown	
"	Opposite Gallagher
Gallagher	
Unknown	
Odgaard	
Unknown	
O.H. Peck	
U	
U	
Plegfool	
	At Town Line - Bull Head And River
	" " " "
	" " " "
Leri Morrow	

BRIDGE SURVEY

6		
5		
4		
+83 [±]	△	1349L
+53		
3		
+50		
2		
+54		
1	△	22021L 58830E Mag
00		

BR. No 2634 Sec 19. 133-29

(19)

Notes - Crow Wing River backed
water at this bridge - Current very
sluggish.

Sand Bank at East End of Bridge
Road to Power Dam.

W.L. 5/29/17 - 1177.38.

Max. W.L. Spring 1916 1180.00

Av. W.L. 1178.00

End of Survey

On General High Land

Sand Bank on R

E. End of BR.

500' →

W. End BR.

J. BC
AWM 5/29/17

W.L.	8.85	1186.23		1177.38
B.M.T				4.14 1182.09
00				5.0 81.2
+40				4.0 82.2
1				4.5 81.7
+54				5.6 80.6
2				4.9 81.3
3				4.3 81.9
+53				3.0 83.2
+83 [±]				0.8 85.4
T.P.	11.24	96.82	0.65	85.58
4				10.3 86.5
5				3.7 93.1
T.P.	7.28	1200.44	3.66	93.16
6				2.7 97.7

BR. 2634

5-29-17

(20)

On 10" I.P. 50' L sta. 1
EIV.

SOUNDINGS

1+54	S ₁	1' Water	9' Sand	Compact Sand	
2	S ₂	16' "	14' "	" "	
2+50	S ₃	20' "	12' "	" "	
3	S ₄	19' "	5' "	" "	+Gravel
3+25	S ₅	15' "	10' "+Mod	" "	+ "
3+50	S ₆	1' "	25' "+ "	" "	+ "

Soundings 20' upstream assumed the same
 " 20' down " " " "

BR. 2634

5-29-17

(21)

W. End Br.

E. End of Br. (3+53)

SURVEY FOR PILLAGER
BRIDGE

BRIDGE BUILT 12 YRS AGO

" WENT OUT APRIL 4 - 1917

6+50

6

5

+62⁵

+48

4

+81

3

+81

2

+96⁵

+89⁷

+35

1

00 South

June 11 - 1917

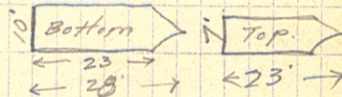
W.M. Starkweather
A.W. Moulster 22

Cribs are filled with Stone. Are 12' W
and approx. 20' Long. No Good.

Stone Pier at Sta 2 -

13' Above Water

In Good Condition
Not Recommended for Use



End of Survey

Gen. of old Abut.
Water Edge on S

4' Above Water Gen. old Cr. b

6.4' Above Water Gen. Old Crib Pier

App. Water's Edge on N Center Stone Pier

At Ft. of Stone Pier (N. Side)
Cor.

Edge of Fill

On Graded Str.

In Front Pr. Xing to R

PILLAGER BR. SURVEY

B.M.	3.70	103.70		100.00
W.L.			10.42	93.28
H.W.				104.10
1+37			3.30	100.4
1+89 ²			7.3	96.4
1+96 ⁵			9.7	94.0
T.P.	8.55	111.29	0.96	102.74
00			4.9	06.4
1			5.4	05.9
1+35			6.5	04.8
2			4.45	06.84
2			4.85	06.44
	10.41	110.41		100.00
4+62 ⁵			13.1	97.3
+63 ⁵			2.8	107.6
T.P.	12.60	121.37	1.64	108.77
5			10.6	10.8
6			4.4	17.0
6+50			1.7	20.7
1+48				93.28

W.M.S.
A.M.W.
6/11/17

23

On 24" Oak 60' NW of H. End Bridge

On Timber on
" Stone

On Cen. Pier - Bottom Joists

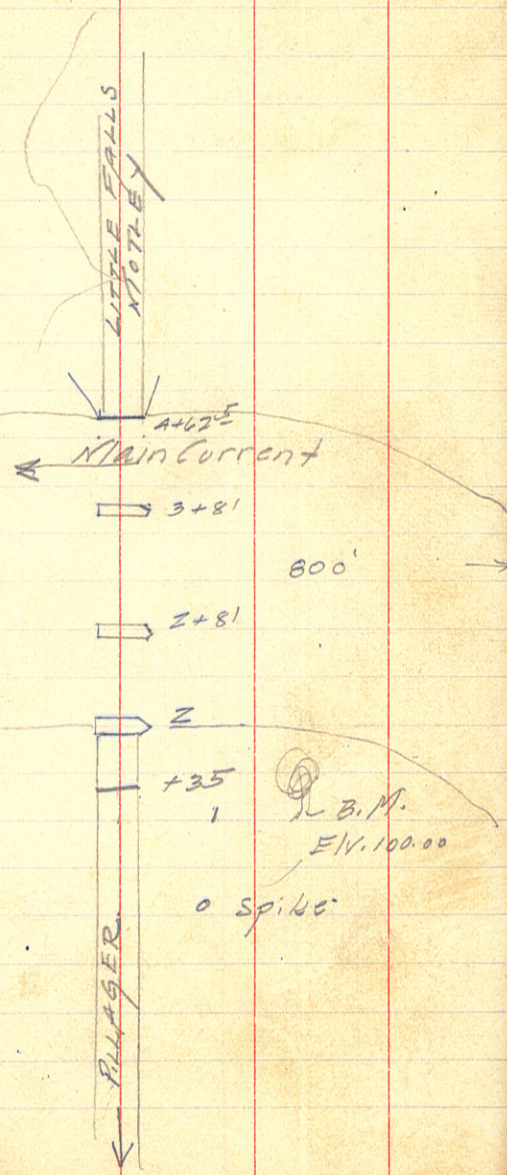
B.M.

End of Survey

Water Edge

PILLAGER BR. SURVEY

S
N



WMS
awm
6/11/17

CRIB STA 2+81

Sta 2+87

S₃

5.1' Water

2.0 Sand

Hard Gravel Bottom

Sta 2+75

8.0 W. 2' Sand Hard Gravel Bottom

4-5-0

Soundings at E+W Ends about the Same

CRIB STA 3+81

Sta 3+75 S₇

8' Water 20' Sand Hard Gravel Bottom

Sta 3+87 S₈

9.5' Water 2.5' Sand Hard Gravel Bot.

At West end of Pier 10' W - 2' Sand S₉

" East " " " 7' " 2.5' " (S₁₀)

4+48

C- 15' Sand Hard Gravel Bottom S₁₁

20' East 11' Sand " " S₁₂

20' W 10' " " " S₁₃

The Hotel Chase

L. H. CHASE, PROPRIETOR

Electric Lighted and Steam Heated

Rates \$2.00 Per Day

Walker, Minnesota, 191.....

$\begin{array}{r} 1514 \\ 53 \\ \hline 4542 \\ 570 \\ \hline 0242 \end{array}$	$\begin{array}{r} 6002 \\ 78 \\ \hline 48016 \\ 42014 \\ \hline 4681.56 \end{array}$	$\begin{array}{r} 260 \\ 80 \\ \hline 308.00 \end{array}$
	$\begin{array}{r} 208 \\ 1.35 \\ \hline 1040 \\ 624 \\ 208 \\ \hline 280.80 \end{array}$	$\begin{array}{r} 180 \\ 1.20 \\ \hline 3600 \\ 180 \\ \hline 2160.0 \end{array}$
$\begin{array}{r} 60 \\ 74 \\ \hline 040 \\ 20 \\ \hline 12.40 \end{array}$	$\begin{array}{r} 74 \\ 2.60 \\ \hline 4440 \\ 148 \\ \hline 192.40 \end{array}$	$\begin{array}{r} 454 \\ 1.88 \\ \hline 3632 \\ 3632 \\ 454 \\ \hline 853.52 \end{array}$

PILLAGER BR. SURVEY

STA 2

W End of Pier 3' Water 5'

7' Sand 3' compact gravel

E End of Pier 1' Water 5'

8' Sand

To Hard Gravel

6-11-17

WMS
AUM

25

LEECH RIVER BRIDGE SURVEY
Bet. Sec. 12, 144-26 & Sec. 7-144-25

General course of Miss. R is West
" " " Leech R. " S31°W Mag.

Elkhart Br. Co.
Mr. Lyons Foreman.

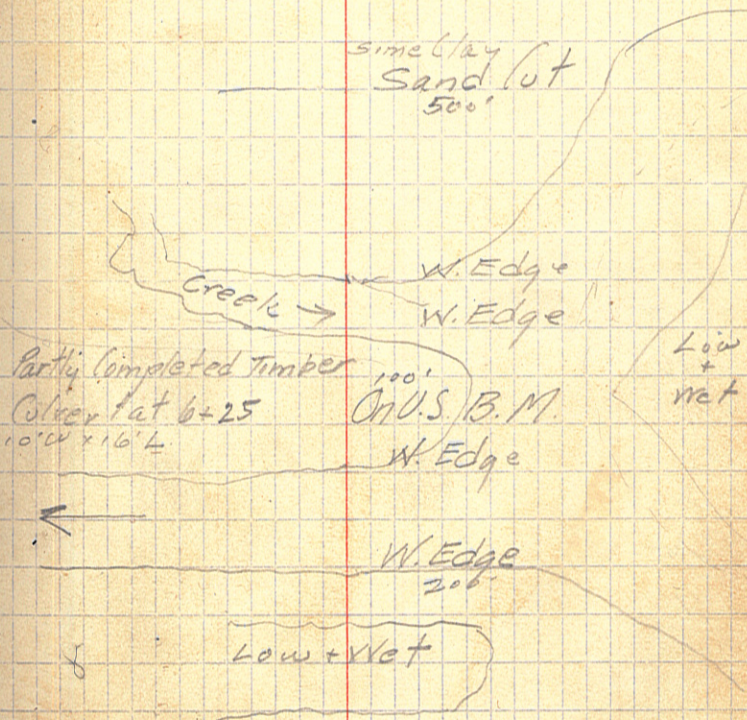
10	(20+01)	Hub	End of Survey
9	(19+01)		
8	(18+01)		
7	(17+01)		
+53			
6	(16+01)		
+60			
+24 ² / ₆	0	4" Pipe	44°54' R (S69°5'E Mag.)
5	(5+01)		
4			
+17			
+16			
3			
2			
+32			
1	0	Hub	
00			S51°E Mag.

M.S.
A.W.M.

JULY-19-17

26

River at present is about Normal H.W. - both dams are open - H.W. in Spring 1916 was 2.0' above present Elk. Ice in Spring during floods - Some logging - Evidence from Mrs. Wakefield who lives on N. bank of River at this bridge site.



LEECH RIVER BR.

B.M.	133	101.33		100.00
10			5.7	95.6
9			11.3	90.0
8			11.9	89.4
7			11.5	89.8
+53			12.0	89.3
W.L.			11.94	89.39
6			12.1	89.2
+60			9.8	91.5
+24 ⁸			2.5	98.8
5			11.98	89.3
W.L.			11.94	89.39
W.L.			12.00	89.33
3 +17			11.94	89.39
+16			11.3	90.0
3			12.7	88.6
W.L.			11.94	89.39
2			12.5	88.8
+32			9.7	91.6
1			1.8	99.5
00			2.8	98.5

CORRECTION
 At Sta 3 - we used a 200' Tape with
 shoulders - Sta 5 = Sta 5+01
 " 6 = " 6+01
 ETC

W.S.
 AWM

JULY 19-17

27

On U.S. B.M. 4" Pipe Sta 5+24.9
 In pipe

200' down Stream

200' up Stream

SOUNDINGS

	water	clay			
S ₁	5	0	5'	Mud-Sand to Compact Sand + Clay	
S ₂	5-20'	R	4"	" " " " " "	
S ₃	5	" L	8"	" " " " " "	Sand-Clay
S ₄	6+25	4' W	3'	Mud- " " Clay +	Gravel 2' Compact
S ₅	4	9' W	5'	Clay Mud " " do R+L.	3 " Clay
S ₆	3+16	7 1/2' of	"	" " " " " "	1 1/2 " Soil
S ₇	3+16	20' L	7"	" " " " " "	1 1/2 " "
S ₈	3+16	20' R	5"	" " " " " "	2 " Clay
S ₉	3	17' W	8	" " " " " "	1 " Sand Clay
S ₁₀	2		7 1/2"	" " " " " "	1 1/2 " " " " " " " " " " " "

Sta. 1 - 9' W - Approx. Main Channel

Penetration in Compact Soil

2'	Compact Clay
1'	" Soil
2'	" Sand Clay
Gravel	2' Compact
3'	" Clay
1 1/2'	" Soil
1 1/2'	" "
2'	" Clay
1'	" Sand Clay
1 1/2'	" " " " " " " " " " " "

List of Piling on ground Nov. 29 1918.

Length	amount	Length	amount
24	27	24	7
25	2	28	1
26	5	36	1
27	1	42	1
28	7	51	1
30	12		11
32	9		
33 1/2	1		
34	8		
36	7		
38	2		
40	6		
41	1		
42	4		
43	2		
44	3		
47	1		
48	1		
50	1		
51	1		
Total	101		

AUG. 24-17

J.F.P.
A.W.M.

GIRL RIVER BR. DATA

SEC. 2-140-28

OLD BRIDGE

143' Long

12' wide

Recommend - 120' Long

SOUNDINGS

Nest End of P. Br. 9' Mud to Gravel

C of Str. 22' water

" " " 12' to Gravel

All other soundings 9-11 ft. to Gravel.

29

ROAD SURVEY - South Line Sec 36-141-28

- 23
- 22
- 21
- 20
- 19
- 18
- 17
- 16
- 15
- 14
- 13
- 12
- 11
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 475
- 3
- 2
- 1
- 00

West on Town Line

W.M.S.
A.W.M.

30

SEPT 1-1917

8 Sec Cor. SE Sec. 36-141-28

End of Town Road from E Sec Cor. NE Cor. Sec 1-140-28

S LINE SEC 36-14-28

+80

79

28

27

26

25

24

31

9-1-17

End of Survey

Old "Foreo" road - SE + NW

8

LEVELS - S Line 36-171-28

B.M.	4.64	104.64		100.00
00				5.0 99.64
1				5.7 98.94
2				5.2 99.44
3				5.3 99.34
+75				5.1 99.54
+75				4.72 99.94
4				5.0 99.64
5				6.0 98.64
6				6.8 97.84
7				5.6 99.04
T.P.	4.78	104.80	4.62	100.02
8				6.5 98.30
9				5.5 99.30
10				5.5 99.30
11				5.4 99.40
12				5.5 99.30
13				5.5 99.30
14				5.0 99.80
15				2.8 102.00
T.P.	8.25	110.88	2.17	102.63
16				8.5 102.38
17				8.0 102.88
18				7.0 103.88
19				5.9 104.98

Spike in Tel. Pole

9-1-17
25' L of 00
Fill 1'

On Pipe - Sec for

8

LEVELS- SLINGE 36- 141-28

110.88

20				5.2	105.68
21				5.0	105.38
22				5.0	105.38
23				4.6	106.28
24				5.4	105.48
T.P.	3.89	110.25	4.52		06.36
25				5.4	104.85
26				5.4	104.85
27				5.2	105.05
B.M.			4.48		105.77
28				6.0	104.25
29				5.5	104.75
+80				5.1	105.15

9-14-17

33

On 6" Poplar 30' L 27+00

End of Survey

PILING AT BR. No 2159 1-27-18

22 W.P. - 28-29 ft. - not peeled
(1-27')

All fairly straight and 6" or
more at the small end
All are on small skids

34

SR No 2- 1-27-18

Sta 29- Angle for Valley

Approx. only

3x12-12 IIII ✓

3x10-12 I ✓

3x8-12 I ✓

2x6-16 I

3x12-14 IIIIII ✓

3x10-14 IIIIII ✓

Also a few 2x4's

Ed. Jewell - Totals -

(60)	48	pcs	4x12-16	3,072
	29	"	3x12-16	1,392
(42)	32	"	3x10-16	1,280
	26	"	3x8-16	836
	16	"	3x6-16	384
	12	"	3x10-20	600
	4	"	3x12-12	144
	1	"	3x10-12	30
	1	"	3x8-12	24
	11	"	3x12-14	462
	16	"	3x10-14	560
	Mis			200
	on Road -			1564
				<hr/> 70548

7-8-18

35

LUMBER - GULL R BRIDGES

Delivered - 1/2 m³ W of 2846

(PETE JEWELL)

12x12-20 III @ 210 = 2100

12x12-18 II @ 216 = 432

3x10-20 31 @ 50 = 1550

3010

Note - 3 inch is about 2 1/2"

Ed JEWELL

4x12-16 IIIIII IIIIII IIIIII IIIIII ✓

3x12-16 IIIIII IIIIII IIIIII ✓

3x10-16 IIIIII IIIIII IIIIII ✓

3x8-16 IIIIII IIIIII ✓

3x6-16 IIIIII ✓

3x10-20 - IIIIII ✓

On Road -

4x12-16-12 = 768

3x10-16-10 = 400

3x10-20-6 = 300

3x12-16-2 = 76

1564

LUMBER 8-26-18

BRS 2846-50

At Jewells Mill - Aug. 26-18

39 pcs	4x12-16	2496	B.F.
4 "	3x10-16 @ 40	160	
64 "	3x 8-16 @ 32	2048	
52 "	3x 6-16 @ 24	1248	
			<hr/>
			5,952

JEWELLS BILL FOR LUMBER
11-15-18 - sent to Auditor

60 pcs	4x6x16	1920
66 "	4x4x12	1056
108 "	2x6x16	1824
60	2x4-16	640
84	2x4-12	672
75	4x12-16	4800
		<hr/>
		22,912
		\$ 801.92

LUMBER Needed - 5/3/19
FEM
AWM
GULL L. BRIDGES

36

2846 (west) -
4 - Lin. ft 16' flooring

East abut - 4 1/2' or
5 Wings 5' x 1 1/2'
N " 5 x 1 1/2'

2850

E { Floor 1 1/2 lin ft
E Abut 4' high
Wings - 4' "

W { Floor 1 1/2 "
Abut 12'
Wings 12'

Order from Mathews 5/5/19

40 pcs	3x12-16	1920
42 "	3x12-12	1512
		<hr/>
		3432

BRIDGE SURVEY - KILPATRICK LAKE

00
 1 Δ Hub 12°37R H81°W Mag (11730)
 +30
 +66
 2
 3
 +26
 +70
 1922 o Hub

B.M	12.24	112.24		100.00
00			1.2	11.0
T.P.	0.15	100.15		100.00
+55			6.5	93.7
+80			8.6	91.6
1			7.6	92.6
+30			9.3	90.9
+66			11.67	88.48
T.P.	9.95	98.43	11.671	88.48
2			10.20	88.20
3			10.13	88.30
+26			9.1	89.3
+70			5.0	93.4

W.M.S. 12-31-17 38.
 A.W.M.

Loc. M.F. Sec. 17-135-29

On hill

East Edge of ice

W. Edge of ice

On Ridge - End of Survey

On 6' Pap. 15' R. Sta. 00+40

B.M

On ice

KILPATRICK BR. SURVEY

98.43

3+92² 0.10 97.3
 BM 1.59 96.84

Current - NE.
 General Course - N 26° E. Mag.
 Narrows approx. 50' wider N. and
 S. of Br. Site

SOON DINGS 1-2-18

	Water	Mud	Gravel	Total
S ₁ 1+65	0.0	10.0	1.0	11.0
S ₂ 2	4.0	7.0	1.0	12.0
S ₃ +50	6.0	8.0	2.0	16.0
S ₄ 3	1.5	1.5	1.0	4.0
		(7.5) Use for piling.	(1.0)	

H.W. = 3.6 Higher than present
 taken from marks on piling

12/31/17 139

On 8" H.P. 10" R Sta. 3+80

1-2-18
 OLD PILING - GULL LAKE

110 Long Ones
 52 Short " (Cut off at water)
 60 " " (South bunch)

GRAVEL

88.5

84.5

82.5

87.0

BR. SURVEY - GULL LAKE -

+32.5	Hub			
+07				
3				
+65				
2				
+50				
1				
+60				
+30				
+15				
00	Hub	S 64° W Mag.	(572° W)	
B.M.	0.04	100.04		100.00
00			2.2	97.8
+15			4.0	96.0
+30			11.6	88.4
T.P.	2.43	91.06	11.41	81.63
+60			5.0	86.1
1			5.13	85.93
+50			5.25	85.81
2			5.20	85.86
+65			5.0	86.1
3			3.8	87.3
+07			2.9	88.2
B.M.			2.26	88.80

Located - NW 1/4
Sec 16 - 135 - 29

W.M.S
AUM 1-2-18 140

End of Survey

Iron Spike on High bank

50'

W. Edge Water
Current ←

East Edge of water
Foot of bank

Iron Spike in Hub

On High bank - E. Side of Narrows

On 4" Oak 30" R

Sta 0+15

ICE = 85.85

3.60

89.45 = H.W

On Ice

On 8" Oak Sta 50 R Sta 3

Near Water Edge

GULL LAKE BR. SURVEY

T.P. 9.93 98.73 88.80
 3+32[±] 1.8 46.9

SOUNDINGS

	Water	Mud	Gravel	Sand	Total
2+50	2.0	26	2.0		32.0
2	10.0	20		5.0	35.0
1+50	10.0	22		5.0	37.0
1-	6.0	17		4.0	27.0
00+60	1.0	Frozen	Assume d same as	5.0	5.0

NW 1/4 Sec. 16-135-29

1-2-18 | 41

Gr. EIV.

83.8 S₅
 75.8 S₄
 75.8 S₃
 80.0 S₂
 84.8 S₁ (70 EIV = Hard bottom)

KILPATRICK L

24	26	30	35	36
###	###	###		###
###	###			###
###				###
				###
				1

19	13	8	4	21
----	----	---	---	----

GULL L

26	28	30	35	40	42
1	###	###	###	###	1
	1	U	###	###	

1	6	7	12	10	1
---	---	---	----	----	---

31
27

42

45	50
###	###
	###
	###
	###
	###
	###
	###
7	34

CASS LAKE MARROWS BRIDGE

15+98.4

13+20

4

+30

+20

3

+85

+70

+57 oHub

2

+60 oHub

+34.25

+10 oHub

1

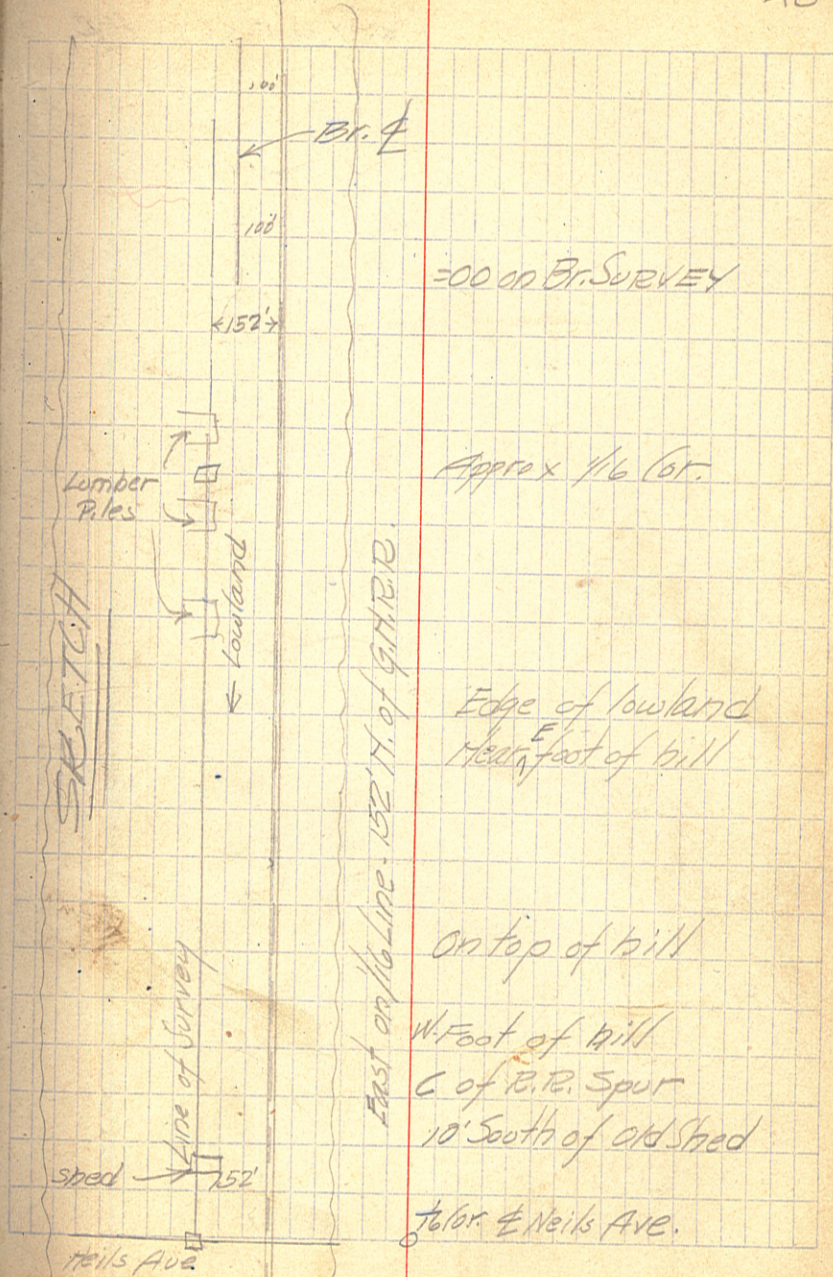
00

EAST

Note - Foresights
taken from the East
using fine GN tracks

A.W.M.
J.F.P. 4-22-18

43



Sta	T.S.	HI	Rod	F.S	Elev
	10.85	11329			10294
BM		2.52		7.19	10610
T.P.	4.97	11581	2.45	11059	
T.P.	1.90	11610	1.41	119.26	
BM			2.65		11395

grade

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

April 23, cold

AA

B.M. on Water gate G.N. Spill. Elev 10294
equals water Elev 4/23/18

B.M. spike in 1st gate Sta 175

BM spike in the gate 120 R Sta
on Road survey being east
of Hall's Ayc.

Recrossed of Hill #1169
For estimate June 1, 1915

2.4 R
00.13

142 13.7 11.2 10.9
18 6.5 8.0

16.9 12.9 12.8 12.3 110.3
55.50 115 125

105 10.5 10.3 0.7 0.8 10.6 10.3 11.3
50 0 7 11 20 23 86 97 117

5.7 0.9 0.9 0.5 1.0 1.0
0.9 6.2 52 0 63 7.20 125

0.9 0.7 0.8 0.7 1.0
75 0 60 1.15 125

0.9 0.4 0.8 0.7 0.9 1.0 0.6
80 28 26 55 75 85 120 125

to top of Hill 0.8 0.7 0.8 0.9 0.8
20 30 78 100 125

Note: A settlement
from Sta 175 to Sta 55
on south side.

sta

4

+30

+20

3

+85

+70

+57

2

+60

+36 Top East rail Spur

+10

Cross-section of Hill

HILL

1279 1042

1314

1207

1045

0

1123	119	083	079	089	064	071	069	072	077	103	079
125	105	95	70	50	25	0	25	50	50	100	125

1127	141	154	150	162	165	153	158	153	156	148	142
130	105	90	62	72	75	0	12	30	75	70	100

1166	208	225	227	227	222	225	217	209	215	190	135
125	77	64	37	21	0	20	33	50	77	90	100

1165	219	239	258	269	271	266	263	250	230	177	107
130	100	75	75	20	0	21	70	60	72	100	103

1147	214	219	246	245	279	279	278	261	253	232	223	157
110	105	100	65	90	15	0	16	70	60	80	86	105

139	206	217	217	225	178	161	147	133	127
60	35	33	0	20	50	80	100	120	125

141	140	160	147	125	100
15	8	0	30	50	100

674 115.02

1133
0

May 8 1918
Sta 1+00 of West approach of bridge
Gross section
Sta 8+00

Sta 0+0 to 1 on left fill 2' to outside
L. & R. 15' RB

Sta 2	108.0	-5.5	-0.3	-0.9
		22.2	0	18

+65	108	-0.8
-----	-----	------

3	108.4	-1.7
---	-------	------

R.R. siding outside rail elev = 107.10 grade 1080

2+00 108.00 10%
Vert curve = 108.8

2+65 108.00 15% shrinkage = 109.2

2+90 108.09 15% = 109.3

3 108.12 15% = 109.3

+15 108.25 15% = 109.8

+40 108.56 15% = 109.9

+65 109.00 15% = 110.4

+90 109.56 15% = 111.0

+100 109.82 15% =

+115 110.25 15% = 111.8

+140 111.06 15% = 112.8

+165 112.00 15% = 113.8

5+00 113.4 15% = 115.4

+25 114.4 15% = 116.6

West end Bridge

L & R

-1.4	-0.9	-0.9	Fill
111	0	105	6' to outside on R.

Set stake on dirt on east end of bridge
Fill 2' to outside

May 13 1918

L	&	R
2.3	0.7	-11.5
9		9

-1.0	-0.1	-0.6
9		9
1.4	-0.4	-0.5
9		9

-1.6	-0.6	-0.9
9		9
-2.3	-0.7	-0.1
9		9

-3.1	-1.0	-1.3
9		9
-2.1	-1.5	-2.0
9		9

-1.9	-2.1	-2.7
9		9
-2.4	-3.4	-3.7
9		9

-2.1	-1.5	-1.7
9		9
-8.5	-6.5	9.3
9		9

9.6	-7.7	7.9
-----	------	-----

31-10-1918

from 4/24/188' to
Edge of 2' in ground
6700 Loads @ 11/1/18

State Road N2B

26+55 = N.W. Cor sec 4
26-750 End of E8W Road turn south
For Levels South
see page 57

22

21

20

19

18

17

16

15

14

13+00 ○

Gross N2S Wagon road

12

11

10

9

8

7

6

5+50 Hub

4

3

2

1

00 = North $\frac{1}{4}$ Cor sec 4 -137-30

Survey of N Line Sec 4-137-30 A7

April 24 1918

For levels see page 48

POST

Line run to N.W. Cor sec 4

Levels from N/4 cor 50' 137-30 to NW Corner sec 4-137-30 A8

(Windy day for levels)

Sta	BS	HI	FS	Rod	Elev
BM	6.27	106.27			100.00
				11.85	94.42
TP	5.22	^{2.71} 108.98	2.51		103.74
TP	12.70	^{11.95} 120.96	0.72		108.26
00				7.9	116.1
1				5.5	115.5
2		^{121.97}		6.8	117.2
3		¹¹¹		9.9	117.1
+15				9.8	111.2
4				7.0	117.0
5				7.2	116.8
+50				7.1	116.9
6				7.6	116.7
+10				5.0	116.9
7				8.2	112.5
+25				9.7	111.3
+30				11.7	09.3
TP	0.60	^{12.31} 108.65	12.91		108.05
BM			4.40		116.36
8				2.0	06.7
+50				4.1	09.6
9				7.9	00.8
10				6.9	01.5
11				6.4	02.3

BM spike in tele pole Westside road N side of old bridge across Pine River

Water elev Pine River April 24-1918

L	E	R
Level	10.9	Level
12.7	13.7	13.9
25	15	5
Level	11.3	11.8
4 for 20 ft	6	17
0.70	08.6	09.3
20	70	20
		20
		22
		30
		14.0
		16.0
		14.9
		31
		11.9
		14.6
		11.9
		39
		11.6
		12.9

B.M. spike in tele pole 30' R 6+30

04.4 05.4 05.7 06.9

20 05.0 25

Level Edge Road

10.41

April 29 1918

Sta	BS	HI	FS	Rod	Elev	
		10865				
12				5.5	93.2	B.M. 130' L. Sta 12+00 on tele pole Elev 107.51
13				2.7	96.0	Cross old road
14				10.0	98.7	" "
15				11.2	97.5	" "
16				11.1	97.6	" "
TP	3.60	⁵⁶⁷ 102.98	92.7		99.38	
17				5.8	97.2	" "
18				6.2	96.8	" "
+50				6.3	96.7	" small draw
+70				5.3	97.7	" "
19				5.5	97.5	" "
20				5.1	97.9	
21				4.8	98.2	
+05				4.8	98.2	
+08				6.3	96.7	Dry cr bed
+18				5.7	97.3	
+23				4.4	98.4	
+80				4.2	98.8	Dry cr bed
+82				5.5	97.5	
22				3.6	97.9	
+25				4.8	98.2	
+75				4.4	98.6	
+77				6.0	97.0	Dry cr bed
+90				6.3	96.7	

Sta	BS	HI	FS	Pod	Elev
		10298			
23				5.2	97.8
+05				4.3	98.7
+30				5.6	97.4
+90				4.0	99.0
+95				5.6	97.4
24				5.3	97.7
+25				4.5	98.5
+30				5.5	97.5
25				5.0	98.0
+90				4.0	99.0
26				6.3	96.7
+13				6.2	96.8
+30				4.3	98.7
+50				4.1	98.9
+55				3.2	99.8
				6.33	96.45
26 +55	Sec Cor			3.18	99.80

SIR H02

10298
6.33
98.45

10298 50
7.35
98.73

Dry Cr

Dry Cr

Dry Cr

Water Elev at sec corner in County ditch

on Hub

Water elev to left of sta 21 = 95.43

	Cross section		State		3	
Grade	Area EXCA	Area Emb	cu yds EXCA	cu yds Emb		
11+00	103.33	00	23.2	00	23.0	
				3.0	33.1	
+50	103.17	3.2	12.5			
				30.3	10.1	
+91	103.03	36.76	6.8			
				14.7	02	
12+00	103.0	51.34	4			
				7.8	0.1	
+04	103.0	54.17	00		00	
				8.3		
+080	102.92	57.96	59		0.4	
+12			00	41.2	4.4	
+22	102.78	100.88			67.3	
				24.2		
+28	102.72	117.00				
				116.0		
+51	102.49	155.36				
				185.5		
+80	102.2	190.01				
				139.4		
13	102.0	186.48				
				94.2		
+15	101.85	152.62				
				16.9		
+12	101.58	94.92	00			
				60.2		
				continued		

Road No 2

Fill 20' RB/stol 51
cut 50 RB/stol

	L	Φ	R	May 6/18
	00	-1.0	-1.1	
	28	11.5	11.6	
chub	+09 00	-06	-1.2	
	264 10		11.8	
	+2.9 00	00	+02 00 -0.4	
	30.9 3.	5 4	10.6	
				Hub.
	+3.7	+0.2	00 -0.2	
	31.4		6 10.3	
	+3.5	+0.3	00 -0.0	
	31.5		3 10	
	+3.5	+0.4	00 -0.8 00	
	31.5		133 24.5 28	
			00	
			2.4	
	+4.5	+1.0	+0.4 +1.2	
	32.9		10 29.2	
	+4.5	+1.5	+0.8 00	
	32.5		21 28	
	+4.5	+2.9	00	
	32.5		28	
	+3.5	+4.3	+3.8 +1.1	
	31.5 18		0 29.1	
	+4.4	+3.5	+7.0 +3.5 +1.9	
	29.9 10.0		13 29.9	
	00	+3.5	+3.9 +2.8 +1.5	
	28	0	7 25 22.5	
	00	+1.2	+3.8 +3.8	
	10		14 31.8	

Project Level
Applied
Judson Road

	Grade	Area Exca	Area Emb	cu yds Exca	cu yds Emb
13+62.5	101.37	49.00	1.0	22.1	0.4
13+87	101.13	00	32.5	0.2	20.3
14+00	101.00	0.54	51.2	.1	21.0
+10	101.00	00	62.1	794.1	256.1
15	101.00		91.5		193.3
+6.5	101.00		69.0		103.4
16	101.00		90.6		377.8
17	101.00		113.4		438.9
18	101.00		123.6		215.1
+50	101.00		108.7		72.9
+70			88.2		102.9
19			96.8		1776.5

Fill 20 R.B. 1/2 to 1
Cut 56 R.B. 1:1.5

R. May 5 52
1918

-12.00 +35
193 31.5

-25 -1.7 00
137 10

-27 -243.00 +03
17 0.126 214 28.3

-30 -27 -20 00
14.5 0 13 28

-41 -36 -31
162 147

-24 -26 -37
144 0 156

-39 -30 -34
158 151

-59 -38 -38
18.8 154

17175 - 410000

-61 -41 -41
142 162

-35 -44 -43
153 0 164

-34 -32 -42
141 0 163

-33 -38 -44
150 162

153
164
21.9

	Grade	Ered. Emb.	cu yds Exca	cu yds Emb
20	101.00	88.9		34.80
				289.1
21	101.0	47.7		12.9
+05	101.	71.4		
BM	30' L. 5 to 21 to 0	Elev 98.46		36.9
+15	101.	127.9		39.4
+25		81.9		141.2
+80		53.7		10.8
+84		91.6		57.5
22 v		102.6		118.8
+40		57.8		68.9
+70		65.5		53.3
+85		126.3		56.0
23 v		74.9		1227.8

20' R.B. 1/2 to 1 slope
 May 6 1918
 L & R

	5.3	-3.4	-3.9
	150	0	15.8
	2.7	2.5	-2.8
	145	0	14.2
	-2.8	-2.5	-3.3
	14.2	0	15.0
	-4.6	5.1	-4.7
	16.9		17.0
	-3.1	-3.3	-3.9
	14.7	0	15.9
	-2.4	-2.3	-2.4
	13.6	0	13.6
	-3.3	-3.6	-3.9
	15.0	0	15.9
	-3.5	-4.0	-4.3
	15.3	0	16.5
	-2.8	-2.1	-2.8
	14.2	0	14.2
	-2.4	-2.5	-3.0
	13.6	0	10
			16.0
	-4.3	-4.7	-4.4
	14.5	0	14.6
	-3.0	-3.2	-2.8
	14.5		14.2

May 7, 1918

	Grade	Area Emb.	cu yds Emb.
23+46	101.00	85.3	136.5
+82	101.00	56.0	94.2
24	101.00	85.3	47.1
+10	101.05	70.8	28.9
25	101.55	86.7	262.5
+86	101.93	48.7	215.6
+91	101.96	97.9	13.6
26	102.0	153.5	41.9
+32	102.0	92.3	145.7
+50	102.00	76.3	56.2
+55	102.00	53.9	12.1
BM. on Hub	26+55	99.80	10.3
+61		38.9	
+			9.2
+65	cross	85.34	9.1
+70.1	to c/s slope	13.6	

State Road No 2

20' R B 1/2 to 1 slope May 7, 1915 5A

L	E	R
-34 151	-37	-34 151
-20 130	-26	-23 133
-36 154	-31	-32 148
-29 144	-29	-29 144
-35 153	-35	-34 151
21 132	-21	-21 132
-39 159	-38	-37 156
-54 175	-56	-56 179
-32 148	-38	-37 154
-31 147	-31	-31 147
-22 133	-24	-22 133
-16 124	-17	-19 128
-34 151	-34	-34 151

Curve to left
13 1/2
9



Figure slope

		Area Exca	Area Emb	cuyds Exca	cuyds Emb
5	110.60	341.29		740.0	
				678.9	
+50	110.0	389.82		731.8	
6	109.40	398.37		561.2	
+34	108.75	441.22		566.0	
+70	108.14	455.58		439.4	
7	107.60	333.60		437.8	
+52	106.66	121.00		89.4	
+79	106.18	57.75	00	34.3	00
8	105.8	30.58	27	17.4	2.6
+25	105.35	00	30	159.5	0.9
+31	105.21	00	20		7.3
+50	104.90		18.63		15.7
+82	104.32		58.5		57.2

50' R.B. 1+01 S

L & R

$$\frac{+60}{31} \quad \frac{+62}{9} \quad +60 \quad \frac{+63}{12} \quad \frac{+59}{30.9}$$

$$\frac{+71}{32.1} \quad \frac{77}{20} \quad \frac{-66}{15} \quad +70 \quad \frac{+67}{12} \quad \frac{-6.1}{31.1}$$

$$\frac{+84}{33.6} \quad \frac{+83}{19} \quad \frac{+71}{15} \quad \frac{+67}{7} \quad \frac{+71}{7} \quad \frac{+57}{30.7}$$

$$\frac{+87}{33.7} \quad \frac{+87}{19} \quad \frac{+81}{3} \quad +7.0 \quad \frac{+62}{28} \quad \frac{+68}{31.8}$$

$$\frac{+70}{32} \quad \frac{+79}{3} \quad +64 \quad \frac{+5.9}{18} \quad \frac{+8.4}{25} \quad \frac{+7.9}{32.9}$$

$$\frac{+44}{29.4} \quad \frac{+66}{10} \quad \frac{+64}{3} \quad +52 \quad \frac{+50}{15} \quad \frac{+8.4}{28} \quad \frac{+8.4}{33.4}$$

$$\frac{00}{25} \quad +2.4 \quad \frac{+28}{15} \quad \frac{+52}{23} \quad \frac{+55}{30.5}$$

$$\frac{00}{10} \quad +1.5 \quad \frac{+15}{17.6} \quad \frac{+32}{25} \quad \frac{+33}{28.3}$$

Fill 20' R.B. 1/2 total slope

$$\frac{-10}{11.5} \quad \frac{00}{4.4} \quad \frac{+0.8}{3} \quad +0.8 \quad \frac{+1.7}{26.4}$$

$$\frac{-06}{10.9} \quad 00 \quad \frac{00}{10}$$

$$\frac{-04}{10.6} \quad 00 \quad \frac{00}{10.25}$$

$$\frac{-13}{120} \quad \frac{-08}{11} \quad -0.6 \quad \frac{-1.5}{12.3}$$

$$\frac{10}{11.5} \quad \frac{-0.9}{10} \quad \frac{+2.3}{6} \quad -2.8 \quad \frac{-3.1}{14.7}$$

May 7 1915			Area Emb	Cu yds Emb
9400	10400		73.0	738
10	10300		42.9	2146
+84	10339		45.9	1369
				<u>3893</u>

For Cross section from sta 11 to

Continued on page 51

Levels to south continued
from page 47.

Sta	BS	HI	Roof	F.S	Elev
BM	320	11500			111.80
TP	452	⁷³⁹ 10862		11.90	10310
26+75			9.7		979
27			7.7		999
+05			4.7		009
+22			11.5		961
+22			5.07		10259
+51 ⁸			3.03		6263
159 ⁸			8.9		98.7
28			9.6		78.0
+50			10.1		99.5
29			2.2		99.1
+05			7.9		99.8
BM	361	11591			11180

Continued on next page

$$\begin{array}{r} -1.9 \quad -2.9 \quad -3.2 \quad -3.2 \\ \hline 12.4 \quad 9 \quad 14.8 \end{array}$$

$$\begin{array}{r} -1.8 \quad -1.8 \quad -2.1 \\ \hline 12.7 \quad 13.3 \end{array}$$

$$\begin{array}{r} 1.8 \quad -2.2 \quad -1.8 \\ \hline 12.7 \quad 12.7 \end{array}$$

26+55 see pages 51 52 53 & 54

(summary)

Emb 45847

$$\begin{array}{r} 6.87.7 \quad 15\% \\ \hline 5272.4 \end{array}$$

Exca 5388.6
Emb 5272.4

Excess
EXCA 1162

For further notes
on SR #2 see
BOOK Marked
SR.H. #80 Lateral
No 1

Ben R
Top Br. Head
in H. S. rail
Ben R

For final cross section
see Book SR.H. #80
Lateral No 1 page 21

May 10 1918

West approach 2.5% for 80 ft

East " " 2.5% for 80

cont from page 5-7

sta	BS	HI	Rod	FS	ERM
		115.91			
29+18			7.5		07.9
+29			3.0		10.7
+87					
30			3.0		10.9
31			4.8		10.6
32			4.9		10.5

Curve Note 2. Cross section

From sta 26+00 to 26+52 Length

of curve 52'

Sta	Grade
26+00	102.0
+13	101.9
+26	101.7
+39	102.1
+52	102.5

Hemlock Bay River Bridge 58
F.W. Moulster

50
39
11

May 10 1918

Piling cutoff 5' above present water
elev (making a 6' clearance)

Flat
Flat
E-W Road
Flat NBS Road
Flat " " "
Flat " " "

Area of Hill
102 104
12

Station	L	R
10' of 2	-1.0	-3.5
10' of 2	1.0	1.0
10' of 2	-3.5	-2.7
10' of 2	1.5	1.0
10' of 2	3.5	2.0
10' of 2	1.4	1.3
10' of 2	-3.5	-1.1
	2.4	1.6

May 22, 1906
 Survey of N Line Sec 28-139-30

BM	BS	HI	FS	IKV
	8.86	10886		
00			11.4	97.5 ✓
1			6.2	102.7 ✓
+72			0.8	108.1 ✓
2			1.2	07.7 ✓
3			8.8	00.1 ✓
4			12.0	96.9 ✓
5			8.9	100.0 ✓
6			9.2	99.7 ✓
TP	523	^{24.2} 10629	7.85	101.01 ✓
+75			8.5	97.7 ✓
7			10.7	95.5 ✓
8			11.6	99.6 ✓
9			8.9	97.8 ✓
10			8.2	98.0 ✓ Leave Road
+25			8.1	98.1 ✓
+50			7.6	01.6 ✓
11			7.9	98.8 ✓
+25			9.9	96.3 ✓
+40			15.0	91.2 ✓
+85			14.8	89.9 ✓
+90			19.8	86.4 ✓
12			15.6	90.4 ✓
+75			14.6	89.6 ✓

continued on page 40

Pomasec transit
 Starkweather Rodman

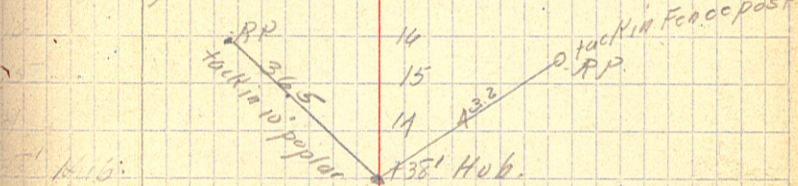
59

30' R sta 2+90

L L R

130 077077 077 120 Level
 17 10 5 8

17 in fill



14 13 12 11 10 9 8 7 6 5 4 3 2 1 00

13 12 11 10 9 8 7 6 5 4 3 2 1 00

12 11 10 9 8 7 6 5 4 3 2 1 00

11 10 9 8 7 6 5 4 3 2 1 00

10 9 8 7 6 5 4 3 2 1 00

9 8 7 6 5 4 3 2 1 00

8 7 6 5 4 3 2 1 00

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Level 99.8 98.5 Level

Transit Notes

160.1 N.W. cor sec 28 N 55 to South

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 00

14 13 12 11 10 9 8 7 6 5 4 3 2 1 00

13 12 11 10 9 8 7 6 5 4 3 2 1 00

12 11 10 9 8 7 6 5 4 3 2 1 00

11 10 9 8 7 6 5 4 3 2 1 00

10 9 8 7 6 5 4 3 2 1 00

9 8 7 6 5 4 3 2 1 00

8 7 6 5 4 3 2 1 00

7 6 5 4 3 2 1 00

6 5 4 3 2 1 00

5 4 3 2 1 00

4 3 2 1 00

3 2 1 00

2 1 00

1 00

00 stationing to E

#80

12' x 15" Cul. req. at Parkers Farm

12" x 12" with collar along ~~along~~ road
N.E. corner 7-136-30

sta	BS	HI			
			106.24		
12+50			5.5	100.7	Level
T.P.	11.40	112.99	7.85		101.39
13			1.8	11.2	level
T.P.	10.35	122.32	10.2	111.97	
+40			8.5	13.8	
+50					Road
14			6.8	15.5	
15			5.6	16.7	L
16			8.3	14.0	
17			7.8	17.5	
18			5.1	17.2	18.5 16.2 16.7 17.8 15.8 16.2 18.2
19			9.0	13.3	16.7 10 10 15 18
B.M.			3.24	119.06	spike in Tele pole 25' R 14+25

Checked by W. H. S.

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. = $23^{\circ} 20'$ to the R. at Station
542+72.

Ext. in Tab. IV opposite $23^{\circ} 20' = 120.87$
 $120.87 + 12 = 10.07$. Say a 10° Curve.

Tan. in Tab. IV opp. $23^{\circ} 20' = 1183.1$
 $1183.1 + 10 = 118.31$.

Tab. V. correction for A. $23^{\circ} 20'$ for a 10° Cur. = 0.16
 $118.31 + 0.16 = 118.47 = \text{corrected Tangent}$.

(If corrected Ext. is required find in same way)
Ang. $23^{\circ} 20' = 23.33^{\circ} + 10 = 2.3333 = \text{L. C.}$

$2^{\circ} 19\frac{1}{2}' = \text{def. for sta. 542}$	I. P. = sta.	542+72
$4^{\circ} 49\frac{1}{2}' = \text{" " " +50}$	Tan. =	1.18.47
$7^{\circ} 19\frac{1}{2}' = \text{" " " 543}$	B. C. = sta.	541+53.53
$9^{\circ} 49\frac{1}{2}' = \text{" " " +50}$	L. C. =	2.33.33
$11^{\circ} 40' = \text{" " " 543+}$	E. C. = sta.	543+86.86

$100 - 53.53 = 46.47 \times 3' (\text{def. for 1 ft. of } 10^{\circ} \text{ Cur.}) = 139.41' =$
 $2^{\circ} 19\frac{1}{2}' = \text{def. for sta. 542.}$

Def. for 50 ft. = $2^{\circ} 30'$ for a 10° Curve.

Def. for 36.86 ft. = $1^{\circ} 50\frac{1}{2}'$ for a 10° Curve

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

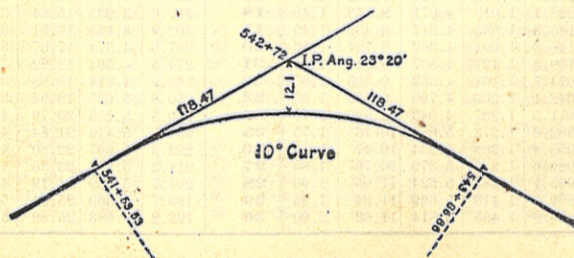


Table VI. Deflections for Sub Chords for Short Radius Curves.

Degree of Curve	Radius 50 sin. def. ang.	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°	103.18	1° 51'	2° 17'	
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. = $\frac{\text{chord}^2}{R}$
$T = \frac{50 \tan. \frac{1}{2} I}{\text{Sin. } D}$	$R = \frac{50}{\text{Sin. } D}$	No. chords = $\frac{1}{2} \frac{I}{D}$
$\text{Sin. } D = \frac{50}{R}$	$E = R \text{ ex. sec. } \frac{1}{2} I$	Tan. def. = $\frac{1}{2} \text{ chord def.}$
$\text{Sin. } D = \frac{50 \tan. \frac{1}{2} I}{T}$	$E = T \tan \frac{1}{2} I$	

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 Ext. 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. $25^2 \div 200 = 3.125$. $100 - 3.125 = 96.875 =$ Base.
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.

*McK Thompson
Walden town*

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	40	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	1277	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	2475	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	9828	9833	9838	9843	10

deg.	0'	10'	20'	30'	40'	50'	deg.
80	9818	9853	9858	9863	9868	9872	9
81	9877	9881	9886	9890	9894	9899	8
82	9903	9907	9911	9914	9918	9922	7
83	9925	9929	9932	9936	9939	9942	6
84	9945	9948	9951	9954	9957	9959	5
85	9962	9964	9967	9969	9971	9974	4
86	9976	9978	9980	9981	9983	9985	3
87	9986	9988	9989	9990	9992	9993	2
88	9994	9995	9996	9997	9997	9998	1
89	9998	9999	9999	9999	1.0000	1.0000	0

Natural Cosines

V

Natural Tangents

deg.	0'	10'	20'	30'	40'	50'	sec.	deg.	0'	10'	20'	30'	40'	50'	sec.
0	0000	0029	0058	0087	0116	0145	89140	8391	8441	8491	8541	8591	8642	49	
1	0175	0204	0233	0262	0291	0320	8841	8693	8744	8796	8847	8899	8952	48	
2	0349	0378	0407	0437	0466	0495	8742	9004	9057	9110	9163	9217	9271	47	
3	0524	0553	0582	0612	0641	0670	8643	9325	9380	9435	9490	9545	9601	46	
4	0699	0729	0758	0787	0816	0846	8544	9657	9713	9770	9827	9884	9942	45	
5	0875	0904	0934	0963	0992	1022	8445	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295	44	
6	1051	1080	1110	1139	1169	1198	8346	1.0355	1.0416	1.0477	1.0533	1.0599	1.0661	43	
7	1228	1257	1287	1317	1346	1376	8247	1.0724	1.0786	1.0850	1.0913	1.0977	1.1041	42	
8	1405	1435	1465	1495	1524	1554	8148	1.1106	1.1171	1.1237	1.1303	1.1369	1.1436	41	
9	1584	1614	1644	1673	1703	1733	8049	1.1504	1.1571	1.1640	1.1708	1.1778	1.1847	40	
10	1763	1793	1823	1853	1883	1914	7950	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276	39	
11	1944	1974	2004	2035	2065	2095	7851	1.2349	1.2423	1.2497	1.2572	1.2647	1.2723	38	
12	2126	2156	2186	2217	2247	2278	7752	1.2799	1.2876	1.2954	1.3032	1.3111	1.3190	37	
13	2309	2339	2370	2401	2432	2462	7653	1.3270	1.3351	1.3432	1.3514	1.3597	1.3680	36	
14	2493	2524	2555	2586	2617	2648	7554	1.3704	1.3848	1.3934	1.4019	1.4106	1.4193	35	
15	2679	2711	2742	2773	2805	2836	7455	1.4281	1.4370	1.4460	1.4550	1.4641	1.4733	34	
16	2867	2899	2931	2962	2994	3026	7356	1.4826	1.4919	1.5013	1.5108	1.5204	1.5301	33	
17	3057	3089	3121	3153	3185	3217	7257	1.5399	1.5497	1.5597	1.5697	1.5798	1.5900	32	
18	3249	3281	3314	3346	3378	3411	7158	1.6003	1.6107	1.6212	1.6319	1.6426	1.6534	31	
19	3443	3476	3508	3541	3574	3607	7059	1.6643	1.6753	1.6864	1.6977	1.7090	1.7205	30	
20	3640	3673	3706	3739	3772	3805	6960	1.7321	1.7437	1.7556	1.7675	1.7797	1.7917	29	
21	3839	3872	3906	3939	3973	4006	6861	1.8040	1.8165	1.8291	1.8418	1.8546	1.8676	28	
22	4040	4074	4108	4142	4176	4210	6762	1.8807	1.8940	1.9074	1.9210	1.9347	1.9486	27	
23	4245	4279	4314	4348	4383	4417	6663	1.9626	1.9768	1.9912	2.0057	2.0204	2.0353	26	
24	4452	4487	4522	4557	4592	4628	6564	2.0503	2.0655	2.0809	2.0965	2.1123	2.1283	25	
25	4663	4699	4734	4770	4806	4841	6465	2.1445	2.1609	2.1775	2.1943	2.2113	2.2286	24	
26	4877	4913	4950	4986	5022	5059	6366	2.2400	2.2637	2.2817	2.2998	2.3183	2.3369	23	
27	5095	5132	5169	5206	5243	5280	6267	2.3559	2.3750	2.3945	2.4142	2.4342	2.4545	22	
28	5317	5354	5392	5430	5467	5505	6168	2.4751	2.4960	2.5172	2.5386	2.5605	2.5826	21	
29	5543	5581	5619	5658	5696	5735	6069	2.6051	2.6279	2.6511	2.6746	2.6985	2.7228	20	
30	5774	5812	5851	5890	5930	5969	5970	2.7475	2.7725	2.7980	2.8239	2.8502	2.8770	19	
31	6009	6048	6088	6128	6168	6208	5871	2.9042	2.9319	2.9600	2.9887	3.0178	3.0475	18	
32	6249	6289	6330	6371	6412	6453	5772	3.0777	3.1084	3.1397	3.1716	3.2041	3.2371	17	
33	6494	6536	6577	6619	6661	6703	5673	3.2709	3.3052	3.3402	3.3759	3.4124	3.4495	16	
34	6745	6787	6830	6873	6916	6959	5574	3.4874	3.5261	3.5656	3.6059	3.6470	3.6891	15	
35	7002	7046	7089	7133	7177	7221	5475	3.7321	3.7760	3.8208	3.8657	3.9136	3.9617	14	
36	7265	7310	7355	7400	7445	7490	5376	4.0108	4.0611	4.1126	4.1653	4.2193	4.2747	13	
37	7536	7581	7627	7673	7720	7766	5277	4.3315	4.3897	4.4494	4.5107	4.5736	4.6382	12	
38	7813	7860	7907	7954	8002	8050	5178	4.7046	4.7729	4.8430	4.9152	4.9894	5.0658	11	
39	8098	8146	8195	8243	8292	8342	5079	5.1446	5.2257	5.3093	5.3955	5.4845	5.5764	10	

deg.	60'	50'	40'	30'	20'	10'	sec.	deg.	60'	50'	40'	30'	20'	10'	sec.
80	5.6713	5.7694	5.8708	5.9758	6.0844	6.1970	9	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	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	82	7.1154	7.2687	7.4287	7.5958	7.7704	7.9530	7
83	8.1443	8.3450	8.5555	8.7760	9.0098	9.2553	6	83	8.1443	8.3450	8.5555	8.7760	9.0098	9.2553	6
84	9.5144	9.7882	10.078	10.385	10.711	11.059	5	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	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	86	14.300	14.924	15.605	16.350	17.169	18.075	3
87	19.081	20.206	21.470	22.903	24.542	26.432	2	87	19.081	20.206	21.470	22.903	24.542	26.432	2
88	28.636	31.242	34.368	38.189	42.964	49.104	1	88	28.636	31.242	34.368	38.189	42.964	49.104	1
89	57.290	68.750	85.940	114.588	171.885	343.770	0	89	57.290	68.750	85.940	114.588	171.885	343.770	0

Natural Cotangents

1.2
3.7

1317
323
96

65.00 to 24 = 10/100
34 to 24 +.5 = 102.
2.0 - +53 = 00102

8578
 686.1
 732.9
 666.5



Grade on SPH No 2

Sta 00 to 2 Grade
 116.00 114.2 9-
 Sta 2
 114.2 109.4 - 4.2.0%
 6 9
 1299 1040 - 1.8
 9 12
 104.0 103.0 - .333
 12 14
 103.0 101.6 4.00%
 14 24
 101.0 101.0 00
 26 +.5%
 102.0
 26.55 00

27422
 26453
 67
 70
 59
 293
 883

DISTANCES FROM CENTER OF ROADWAY FOR CROSS-SECTIONING.
 ROADWAY 14 FEET WIDE. SIDE SLOPES 1 1/2 TO 1.
 FOR SINGLE TRACK EMBANKMENT.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	7.0	7.2	7.3	7.5	7.6	7.8	7.9	8.1	8.2	8.4	0
1	8.5	8.7	8.8	9.0	9.1	9.3	9.4	9.6	9.7	9.9	1
2	10.0	10.2	10.3	10.5	10.6	10.8	10.9	11.1	11.2	11.4	2
3	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	3
4	13.0	13.2	13.3	13.5	13.6	13.8	13.9	14.1	14.2	14.4	4
5	14.5	14.7	14.8	15.0	15.1	15.3	15.4	15.6	15.7	15.9	5
6	16.0	16.2	16.3	16.5	16.6	16.8	16.9	17.1	17.2	17.4	6
7	17.5	17.7	17.8	18.0	18.1	18.3	18.4	18.6	18.7	18.9	7
8	19.0	19.2	19.3	19.5	19.6	19.8	19.9	20.1	20.2	20.4	8
9	20.5	20.7	20.8	21.0	21.1	21.3	21.4	21.6	21.7	21.9	9
10	22.0	22.2	22.3	22.5	22.6	22.8	22.9	23.1	23.2	23.4	10
11	23.5	23.7	23.8	24.0	24.1	24.3	24.4	24.6	24.7	24.9	11
12	25.0	25.2	25.3	25.5	25.6	25.8	25.9	26.1	26.2	26.4	12
13	26.5	26.7	26.8	27.0	27.1	27.3	27.4	27.6	27.7	27.9	13
14	28.0	28.2	28.3	28.5	28.6	28.8	28.9	29.1	29.2	29.4	14
15	29.5	29.7	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.9	15
16	31.0	31.2	31.3	31.5	31.6	31.8	31.9	32.1	32.2	32.4	16
17	32.5	32.7	32.8	33.0	33.1	33.3	33.4	33.6	33.7	33.9	17
18	34.0	34.2	34.3	34.5	34.6	34.8	34.9	35.1	35.2	35.4	18
19	35.5	35.7	35.8	36.0	36.1	36.3	36.4	36.6	36.7	36.9	19
20	37.0	37.2	37.3	37.5	37.6	37.8	37.9	38.1	38.2	38.4	20
21	38.5	38.7	38.8	39.0	39.1	39.3	39.4	39.6	39.7	39.9	21
22	40.0	40.2	40.3	40.5	40.6	40.8	40.9	41.1	41.2	41.4	22
23	41.5	41.7	41.8	42.0	42.1	42.3	42.4	42.6	42.7	42.9	23
24	43.0	43.2	43.3	43.5	43.6	43.8	43.9	44.1	44.2	44.4	24
25	44.5	44.7	44.8	45.0	45.1	45.3	45.4	45.6	45.7	45.9	25
26	46.0	46.2	46.3	46.5	46.6	46.8	46.9	47.1	47.2	47.4	26
27	47.5	47.7	47.8	48.0	48.1	48.3	48.4	48.6	48.7	48.9	27
28	49.0	49.2	49.3	49.5	49.6	49.8	49.9	50.1	50.2	50.4	28
29	50.5	50.7	50.8	51.0	51.1	51.3	51.4	51.6	51.7	51.9	29
30	52.0	52.2	52.3	52.5	52.6	52.8	52.9	53.1	53.2	53.4	30
31	53.5	53.7	53.8	54.0	54.1	54.3	54.4	54.6	54.7	54.9	31
32	55.0	55.2	55.3	55.5	55.6	55.8	55.9	56.1	56.2	56.4	32
33	56.5	56.7	56.8	57.0	57.1	57.3	57.4	57.6	57.7	57.9	33
34	58.0	58.2	58.3	58.5	58.6	58.8	58.9	59.1	59.2	59.4	34
35	59.5	59.7	59.8	60.0	60.1	60.3	60.4	60.6	60.7	60.9	35
36	61.0	61.2	61.3	61.5	61.6	61.8	61.9	62.1	62.2	62.4	36

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

MADE IN GERMANY.