

STATE OF MINNESOTA  
DEPARTMENT OF HIGHWAYS

COUNTY ROAD "C"

FIELD BOOK

8320

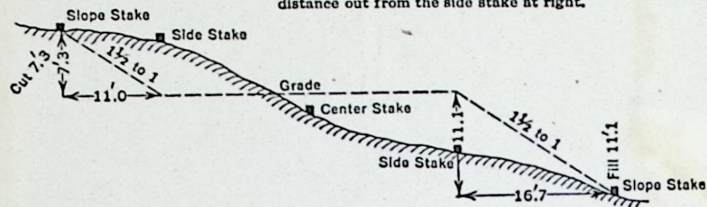
S.P. 27-515-01 & 62-511-01

10

### DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes  $1\frac{1}{2}$  to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.

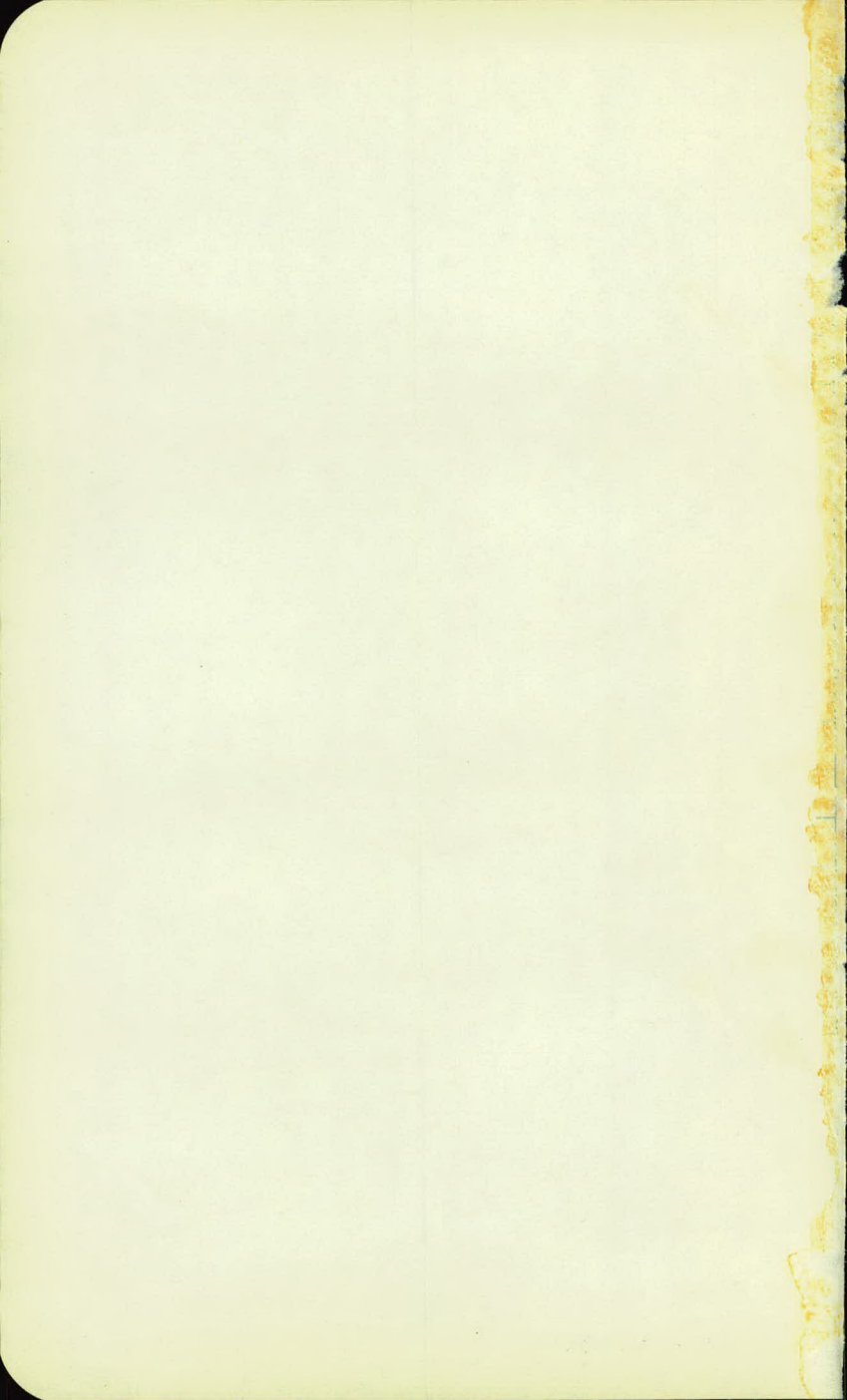


Cut or Fill	Distance out from Side or Shoulder Stake										Cut or Fill
	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

For Curve Tables see end of book.

H. F. White

1943





Tue April 6

Clear Fair

out on job with Mr Chard  
& Mr Wheeler today. met  
meibitt & Kerst at  
sta 120 at 9:30. our job  
and decided East end  
was dry enough to start  
work.

clerk Sulley called office  
in regard to test results  
on Williams & Delaney  
Pits. Informed Sulley  
that material in pit  
would not pass on tests  
submitted to lab. I also  
told him Mr Watkins said  
material <sup>frames</sup> could be added  
to build it up.

Mr Sulley said he would  
use a different pit but  
wanted to know why material  
was used on Thornton  
job last fall

Fri April 9  
Clear Fair

2 men 12 hrs filling &  
joint, that were to up due  
to slab settlement.

This work to be paid for  
on a former account  
basis.

Sat April 10  
Clear Cool

2 men & her work filling  
a joint that opened by  
dragline, clearing out  
edges of cuts that were  
wrt. between spelling  
and Cleveland ave.

Sun April 11  
no work.

Mon April 12  
Clear, Cool

Keeping Dragline Cleaning  
ditch stud. & ditches bet  
sta 53-65

Ditches are still wet,  
but are in better shape  
than they were last fall.

Tue, April 13  
Cloudy, Cold  
No Work

C. F. scully ready to haul  
gravel for surface shoulder  
but decided shoulder on  
swelling are were in  
a little better shape.  
shoulder on C are in fair  
shape bet 80-105 but have a  
few wet spots from 0-80

Wed April 14  
cloudy cool  
no work

Thu April 15  
Clear Fair  
no work

Friday April 16

Cloudy Cool

Power patrol blocking  
shoulders between New  
Brighton Road and  
Shelling Avenue

Sat April 17

Other Cloudy Cool

Power patrol blocking shoulders  
between New Brighton Road  
& Cleveland Avenue on south  
side of slab.

Scully hauling gravel for  
surface shoulders to this job.

Inst. Foreman McMahon to  
keep lights on beerwies over  
the weekend. Scully changing  
setup in Gravel Pit. Will reset  
screaming plant and use shovel  
to load with. Material is wet &  
hard to produce.

Mon April 18

Clear Cool

C.F. Sully, shovel, screening plant, 7 trucks & power pats, loading, hauling and spreading gravel for surface shoulder in zones 4, 5, 6 & 7.

Gen Contractor had a power patrol shaping shoulder ahead of hauling equipment

Free April 20 <sup>th</sup>

Clear Warm

C.F. Scully's shovel, securing  
plants, 8 trucks and power  
patrol loading hauling and  
spreading gravel for Surf  
shoulder in zones, 1-2-3  
10 & 11.

Gen Cont power patrol  
blading the shoulder for  
surfacing.

Traylor & scraper and tractor  
& dozer finishing slopes  
& ditcher sta 70-105

Wed April 21  
Clear Warm

C.F. Sullley shovel, dressing  
plants, 5 trucks and power  
patrol, loading hauling &  
spreading gravel for surf  
shoulder in zones 6, 7  
8, 9 & 10

Gen cont power patrol  
blading shoulder and  
finishing slopes.  
Grout & sweep & dozer  
finishing slopes 55-105

Thu April 22

cloudy AM - rain PM

Gene Cont worked about 1/2 day with power patrol & dozer finishing shoulders, slopes & ditches.

C. F. sculley shovel, screening plant, 1 truck & power patrol loading & hauling & spreading gravel for sub shoulder in zones 3, 4, 5 & 6. shut down at 2:30 P.M. due to rain

Fri April 23

clear fair

shoulders to wet to work on but were ok about 3 P.M. advised Meshette shoulders were ok to work on

Sat April 24<sup>th</sup>  
Clear Warm.

C. F. Sully's shovel, screening  
plant, 7 trips & power rated  
loading hauling and  
spreading gravel for surf  
shoulders in zones 1 & 2.  
started hauling about 7:45  
and completed about 2:30

Sun April 25  
no work.

Mon April 26  
cloudy cool

2 teams of teamsters & 2 laborers  
finishing slopes sta 80-105

no other work in progress

Free April 27  
cloudy cool

Two teams & teamsters and  
4 labour finishing slopes  
80-105

2 tractors & 2 dozers &  
1 tractor & scraper & Power  
patrol finishing 80-105

But is in fine slope  
but very sandy.

Sully hauled 5 loads  
of material to Cleveland  
Avenue to-day.

This completed material  
on County C for surf  
shoulders.

Wed April 28  
Clear Warm

Tractor & scraper, tractor &  
dozer, power patrol, two  
teams & teamsters and  
4 labors finishing 55-80  
Ditches in this section are  
wet

C. F. Scully, Patrol, Form  
Tractor & Pallet and Truck  
& Tank finishing shoulder  
between 80-105

spray bar on tank did not  
have holes drilled in  
elbows so requested  
driver to have it fixed  
at his earliest convenience

Thu April 29

Rain

No work to wit

Fri April 30

Partly cloudy cool windy

2 teams & teamsters & 2 lot  
finishing sta 80-105  
Patrol, tractor & dog  
finishing sta 55-80

C.F. Scully's Power Blade  
Tractor & roller worked  
 $\frac{1}{2}$  dog on shoulder  
 $\frac{1}{2}$  truck & tank worked  
1 hour.  
Shoulder plenty wit to  
roll & compact.

Sat May 1

Clear Barn

Two teams, tractors & 2  
labors finishing str 55-80  
2 tractors & dozers, 2 power  
pattles and tractor &  
scraper finishing str-  
20-55

C.A. scully Power patrol  
F tractor & roller and tank  
& tank compacting shoulder

Sun May 2

No work

Mon May 3  
Clear - Cool

C.4, scully power blades,  
water tank, and tractor &  
roller compacting shoulders  
sta 0 to 20.

Power patrol, tractor &  
dozer finishing slopes  
& ditches 0-15.

2 teams & transverse &  
2 labors finishing 0-50

Ditches on west end are  
wet, on the north side  
of the Kennepin co portion

Free May 4<sup>th</sup>  
cloudy cool

Tractor & dozer and power  
patrol finishing slopes &  
ditches sta 0-26. Two  
teams & teamsters & 2  
labors working in same  
section (0-26)

Sculley's equipment not  
working to-day.

Tractor on roller was down.  
Fan damaged radiator  
I guess.

Wed May 5  
Clear Warm

Traction & logs, tractor & scraper  
& power patrol, 2 teams  
& teamster & 2 laborers  
finishing west end  
of job to R.R. crossing  
Tate great lakes

Thurs May 6  
Partly Cloudy Cool  
No work

Fri May 17<sup>th</sup>

Partly cloudy cool

Tractor & dozer & tractor & scraper working bet sta 85-100. Major part of work is removing dirt that was covered with old oil mat. Bitum pill was mat removed until this spring.

2 labors building fence on bluek form sta 95  
2 teams & teamster &  
2 labors finishing on west end sta 0-40.

Inst Supt Nesbitt to complete & compacting gravel on shoulder on west end. This is Dunlop's sub contract over job with Nesbitt and pointed out several spots that would have to be fixed.

Mr Cloud called in regard to location of fence on bluek form

Sat May 8 deor Cool  
2 teams & tramster &  
2 labors finishing 0-26

Tractors & scraper & dozer  
finishing slopes 70-105  
2 men building fence  
on blue form  
3 labors & truck cleaning  
up brush & rock & debris  
Wt sta 55-105

Sun May 9

No Work

Mon May 10  
cloudy cool

Power patrol working on  
slopes & ditches. Sta 0-55

2 teams & tractors & 3 job  
& truck & driver picking  
up debris and dragging slope  
& ditches & general cleanup

Power patrol also blocking  
Cleveland ave approach  
closed 1 hour of day on  
south side of Cleveland ave  
Not enough binder in orig material  
scully called his roller  
off the job. Not completely  
so requested Swanson to  
have scully complete job  
over job with Swanson  
best & Mesbit.

Crew finished moving  
tel poles on west end in  
Winnepin to today.

Roberts building fence on  
Gluck farm, called Tom McCloud  
& asked him to go over job.

Thu May 11  
Pty cloudy Cool

C. F. Sully tractor & roller  
& truck & tank compacting  
shoulder between 0-1/5  
Part of the section was  
to wet to roll before

Sully worked in P.M.  
only

Wed May 12  
Pty Cloudy Cool

Power patrol, tractor roller  
compacting shoulders. West  
end of Gap. Worked about  
 $\frac{1}{2}$  day. (Ken's auto patrol)  
Completed - shoulders

Thu May 13  
clear fair

Cont swept overhead  
with hand brooms and  
primed with RT-2.

Instruct Hoffmann to use  
paper on slab so as  
to keep material off slab  
and to divert trouble on  
Cleveland until prime  
had penetrated.

Bob John on job in  
P.M. just before dust  
arrived and that base was  
ok.

Paper blew off slab &  
sheet off velvet got stuck  
& printer sprayed too on  
slab. Distributor operator  
was careless or inexperienced

Fri May 14  
Clear fair  
no work - waiting for  
prime to penetrate!

Sat May 15  
Rain  
no work

Sun May 16  
Light Rain  
No work

Mon May 17  
cloudy Cool

No work - to wet for  
bituminous

Tue May 18  
cloudy Cool

no work - to wet & to  
cool to work bit mix

Wed May 19  
Clear Warm

50 tons mineral oxy  
delivered to job today  
material is fairly wet  
and will require some  
drying before tar will  
mix right  
Power patrol mixing  
drying material

Thu May 20<sup>th</sup>  
Class Room

Power patrol # 69 missing  
& drying mineral egg. Mineral  
egg was not a whitening mix  
when delivered to job.

Load of tax delivered to job today  
but Trap Peston sent it back  
because temp was only 10.5 &  
dist was not equipped with  
burner. Pest did not get  
back until about noon  
shot window and mixed with  
2 blobs. Told Hoffman  
he might run into trouble  
if he had mix out today.  
Mix is a little rich,  
looked like ruin so Hoffman  
laid out & rolled.

Matt does not look to  
good and may have to  
be reworked unless  
white work out under traffic.

Fri May 20  
clear warm

Roller worked about 1 hr  
on bit mat.  
job does not look good.  
mat is not setting up  
the way it should.

Sat May 21  
clear warm

No work

Sun May 22

No work  
waiting for seed for  
slopes & ditches.

mon May 24<sup>th</sup>  
cloudy light rain

Tue May 25  
cloudy Rain

Wed May 26  
cloudy Rain

Thu May 27  
cloudy Cool

Friday May 28  
clear Warm

Sats May 29

Go with to seed all week.

Sun May 30

Mon May 31  
cloudy showers

Tue June 1  
cloudy warm

Wed June 2  
cloudy Rain

Mr Chard & Methuen  
over job this P.M.  
showed Meth. some  
panel at sta 100 and  
he said he would not  
pay for that kind of work  
said he would get  
swanson out and have  
him replace panel

Thu June 3rd  
Clear Warm

Over job with Methuen  
Chas Swanson, Gust  
and Nesbitt. Methuen  
accepted job with the  
exception of damaged  
panels of cone at sta  
160 and cleanup of  
ditch section at Cleveland  
avenue. Swanson agreed  
to replace cone at his  
earliest convenience.

Fri June 4  
cloudy cool

Sat June 5

Sun June 6

Mon June 7

showers AM.

Two teams & teamsters &  
2 laborers seeding.

Tue June 8

Cloudy Cool

Two teams & teamsters &  
2 laborers seeding.

Wed June 9

Cloudy

2 teams & teamsters &  
2 laborers seeding.

Thu  
Wed June 10  
Clear Warm

Two teams & teamster &  
2 laborers on slopes  
& ditches seeding.

Fri June 11  
Cloudy Warm

2 teams & teamster &  
2 laborers finished seeding  
with the exception of  
a few wet spots about  
noon. Spent balance  
of day picking rock that  
were exposed during  
seeding operations.

Sat June 12  
Hard Rain

No Work.

Sun June 13  
Rain

Mon June 14  
Light rain  
2 teams & teamster &  
2 lab picking rock

Tue June 15  
Rain  
2 team & teamster &  
2 labore

Wed June 16  
Light rain

2 teams of teamsters & 2  
labors worked about 6  
hrs.

Thurs June 17<sup>th</sup>  
Clear Warm

Cont removing cone on pod  
panels on County C. bet  
Sta 41+61.6 and 41+52.2  
air comp worked about  
 $\frac{1}{2}$  day.

Fri June 18  
Clear Warm

air Comp & crew worked  
in a.m. cleaning out  
balance of cone and trimming  
up edge of cone.

Cost panel in p.m.  
cone was hauled from  
miser str Snelling Ave  
Nesbitt requested

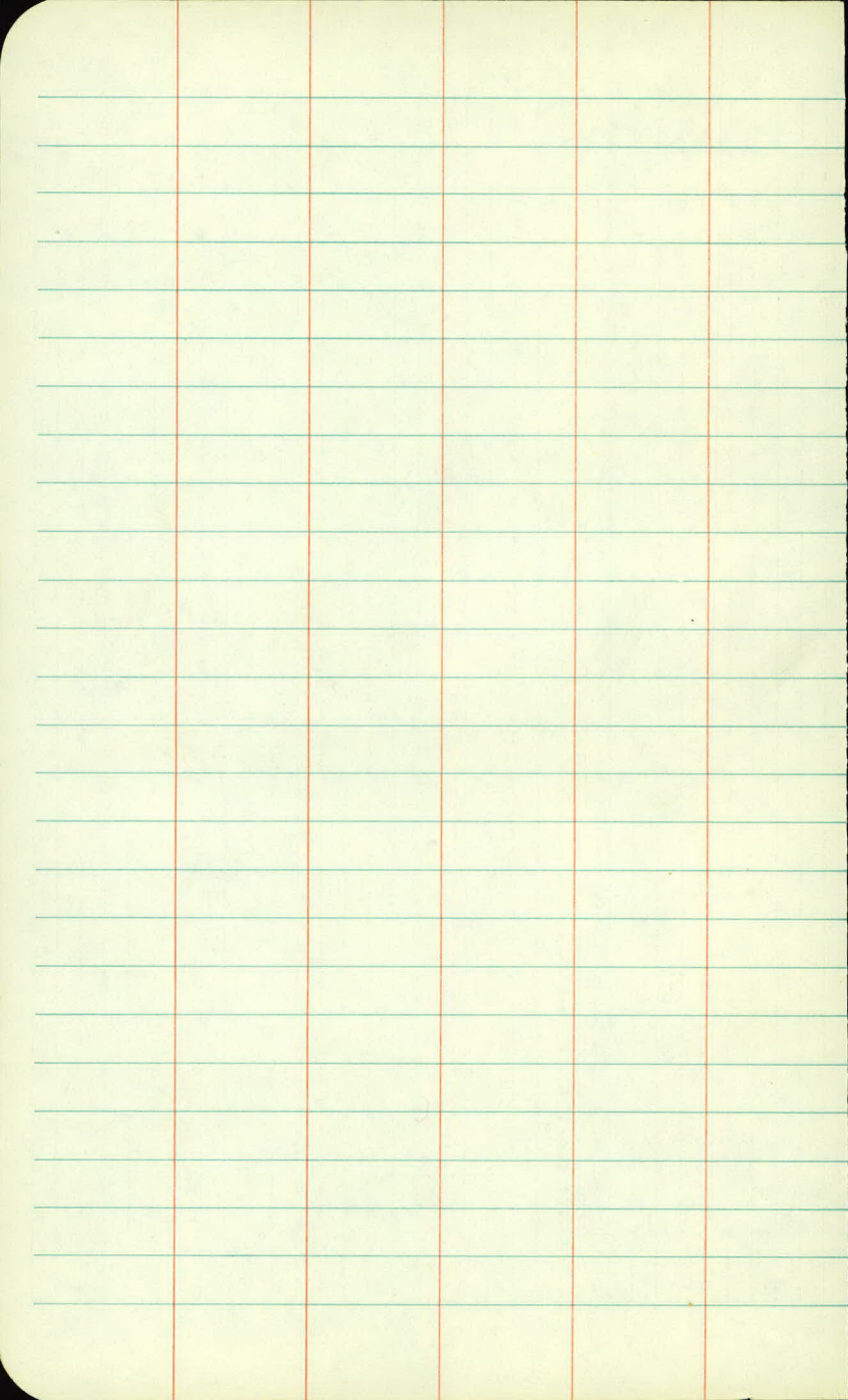
permissions to use 10%  
additional cement and  
4 lbs of  $\text{CaCl}_2$  per batch.

Nesbitt was given permission  
to use additional cement and  
calcium and ~~is~~ requested  
to protect panels from  
traffic for 5 days.

Nesbitt only used 1 truck  
so wet batch was a mess.

Mr White on job.

Lat no work.



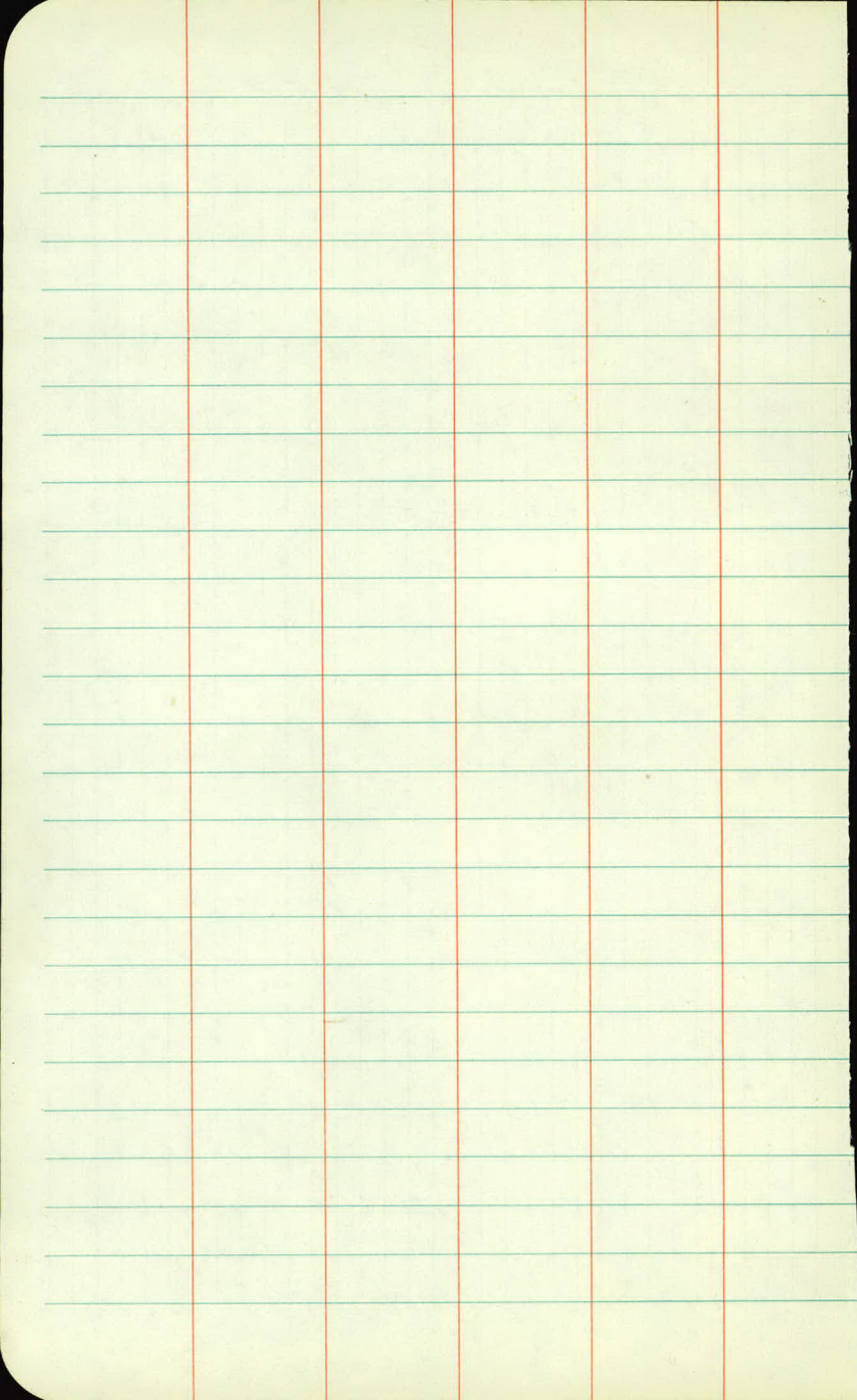
July 19.

2 men 3 hrs each  
raising manhole just  
East of New Brighton Road.  
Man hole was covered  
with sand & silt due  
to heavy wash from  
adjacent ditches.

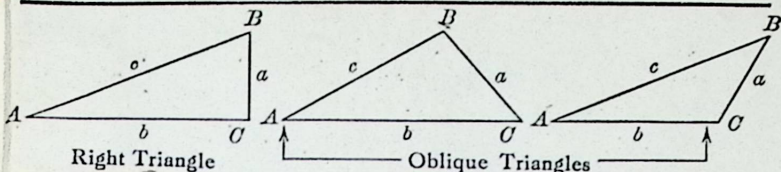
July 20

2 men worked 2 1/2 hrs  
each & completed manhole

This completes all  
work on County C.



# TRIGONOMETRIC FORMULÆ



## Solution of Right Triangles

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

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

## Solution of Oblique Triangles

$A, B, a$	Required $b, c, C$	$b = \frac{a \sin B}{\sin A}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
$A, a, b$	$B, c, C$	$\sin B = \frac{b \sin A}{a}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
$a, b, C$	$A, B, c$	$A + B = 180^\circ - C, \tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b}$ $c = \frac{a \sin C}{\sin A}$
$a, b, c$	$A, B, C$	$s = \frac{a + b + c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}}$ $\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}, C = 180^\circ - (A + B)$
$a, b, c$	Area	$s = \frac{a + b + c}{2}, \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$
$A, b, c$	Area	$\text{area} = \frac{bc \sin A}{2}$
$A, B, C, a$	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

## REDUCTION TO HORIZONTAL

Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle =  $5^\circ 10'$ . From Table, Page IX.  $\cos 5^\circ 10' = .9959$ . Horizontal distance =  $319.4 \times .9959 = 318.09$  ft.

Horizontal distance also = Slope distance minus slope distance times (1 - cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained.  $\cos 5^\circ 10' = .9959$ .  $1 - .9959 = .0041$ .  $319.4 \times .0041 = 1.31$ .  $319.4 - 1.31 = 318.09$  ft.

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