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THESIS

Location and Estimate of Cost
of Electric Railway

Between M. A. C. and Haslett

H. D. SEVERANCE A. D. PETERS

1903

THESIS

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THESIS.

LOCATION AND ESTIMATE OF COST

of

ELECTRIC RAILWAY

between

M. A. C. and HASLETT

over the
H. D. Severance.

to the
A. D. Peters.

1903.

77-515

It is proposed to investigate the cost of construction of an electric railroad to connect H. A. C. and Haslett Park. The question of the proper location of such a line is essentially an economic one, not one as regards cost of construction, but also cost of operation and maintenance.

The question of location then, naturally divides itself into two heads: first, selection of a proper route. second, fitting of the line to the ground in such a manner as to give the best grades, the least initial cost and the least operating expenses.

RECOMMENDATION.

Upon looking over a map of the territory between H. A. C. and Haslett, we decided to run north through College Grove to the east and west road or section line between sections 7 and 10, thence due east following the road to the school house of district no. 8; continuing on this same line between sections 10 and 17

and 9 and 16 until we should approach to within about 500 ft. of the G. T. R. R.; at this point deflecting to the left and running parallel to the G. T. tracks until reaching Haslett Park.

Equipping ourselves with an Aneroid, a Pedometer, and a rough map of the territory, we walked over the line. This route, however, proved very unsatisfactory; first, because it would necessitate excessive grades, which would make operating and initial cost larger; second, because it crossed three swamps, one of which was about 100 rods across. (These swampy spots form a very unstable road-bed, since they are mere deposits of organic matter over glacial lakes. This crust has broken through in several places thereby causing considerable expense and trouble to the C. & G. T. R. R.) The advantages of this route were: directness, ^{and} ease with which the right of way could be obtained.

We then thought that by deflecting to the right from some point on the section line west of the school house of district no. 8, the hills and swamps could be

avoided. After passing around to the right of the "sink holes" and hills, we returned to the section line between sections 9 and 16, striking the line near the quarter post. Thence we ran along the section line to the North and South road which is between sections 15 and 16, thence straight across the country to Haslett Park. This route seemed much better than the first because the largest and lowest swamp was avoided and grades were much easier. The latter part, however, in which we crossed from the road to Haslett was not so favorable as the corresponding part of the first route; being intercepted by steep grades and swampy land.

By joining these two routes and shortening the distance by running east from the north end of College Grove instead of going to the section line, we had what we thought to be the most economical route.

PRELIMINARY LINE.

Since the line was definitely fixed as far as the intersection of Elizabeth St. and M. A. C. Ave. in College Grove, we took as a point of beginning of a pre-

liminary line the intersection of the centers of the above streets. (Assuming Elizabeth St. to be 4 rods wide.) From this point, we ran due east through the forest following the second plan of the route to Haslett, making corrections as the work progressed. (See preliminary map and profile).

As stated before, one of the principal difficulties was the unstable character of the soil. Although we avoided marshy peat beds as much as possible, it was impossible to avoid them entirely. The only places where the ground seemed uncertain were between Stas. 110 and 120, 140 and 150, and 180 to 200, but judging from the size of the trees and the soil clinging to the roots or overturned stumps, we concluded the crust to be amply thick to sustain an electric line.

The steepest grades were between stations 80 & 100 and 200 & 205. The former being caused by a range of hills running north and south for a considerable distance and hence unavoidable. The latter could have been reduced some by entering Haslett by a more westerly point. If this had

been done, it would have made the line considerably longer or it would have passed over several hills of nearly as steep grades as the one we wished to avoid.

TOPOGRAPHY.

Railroad topography consists in securing full data for mapping contour lines, property lines, roads, etc. The width of territory to be embraced varies with the character of the country and choice of the preliminary line.

The party consisted of two men, levelman and rodman. No peculiarities presented themselves in this work, except that we omitted the contour work where the ground adjacent to the line was practically level. (See preliminary map.)

PAPER LOCATION.

After having completed the mapping of the preliminary line and contours, we were ready to make the paper location. This problem of paper location is a complicated one. For the best road as regards construction may be a

failure because of excessive initial cost; while the cheapest construction may entail such heavy operating expenses that it may be equally unprofitable. The alignment must be as free from curves as possible, while heavy grades are at the same time excluded; these two requirements conflict, to a marked degree, in our problem. But we adjusted them as far as possible. The paper location was drawn in red ink, all angles measured, and curves best adapted to the conditions were drawn. (See map.)

LOCATION.

The point of beginning of the location line was in the center of the M. A. C. and Lansing St. R. R. referenced as per map. From this point, the line runs southeast on the Lansing and Howell road, (center of track to be 23 ft. to the right of the center of this road) until it reaches a point opposite the center of "Summit Place". From this point we deflected to the left, passing up the center of the above street, thence across lot no. 29, thence to the left again as we reach the center of M. A. C. Ave. running to the

point of beginning of the preliminary line. From this point, we followed as closely as possible the paper location. (See location line map).

CROSS SECTIONING.

On account of the fact that our stakes were pulled if left over night, it was found impossible to take cross section notes. But since there was little side hill work, the error in our estimate from this source is necessarily small.

ESTIMATE OF COST.

The final estimate included earthwork, clearing, track, fencing, overhead wire, etc. Earthwork: We figured on a 14 ft. base for fills, and an 18 ft. base for cuts, thus allowing for 2 ft. ditches. We assumed the ground to be level in direction transverse to the line, hence if h equals the height to be filled, or depth to be cut at any station, and A equal the area of cross section at that station, and b equal to the base, (18' for cuts and 14' for fills) then

$$A = h(h+b) .$$

The number of cubic yards to be excavated or filled between two stations, was taken from table XX, Nagle's Field Manual, using the mean area as argument. We assumed 500 ft. free haul, but for every cubic yard hauled over 500 ft., it would cost 1.5¢ for every 100 ft. or fraction thereof. Figuring cost of:

Excavation - - - - - @ \$0.20 per cu.yd.

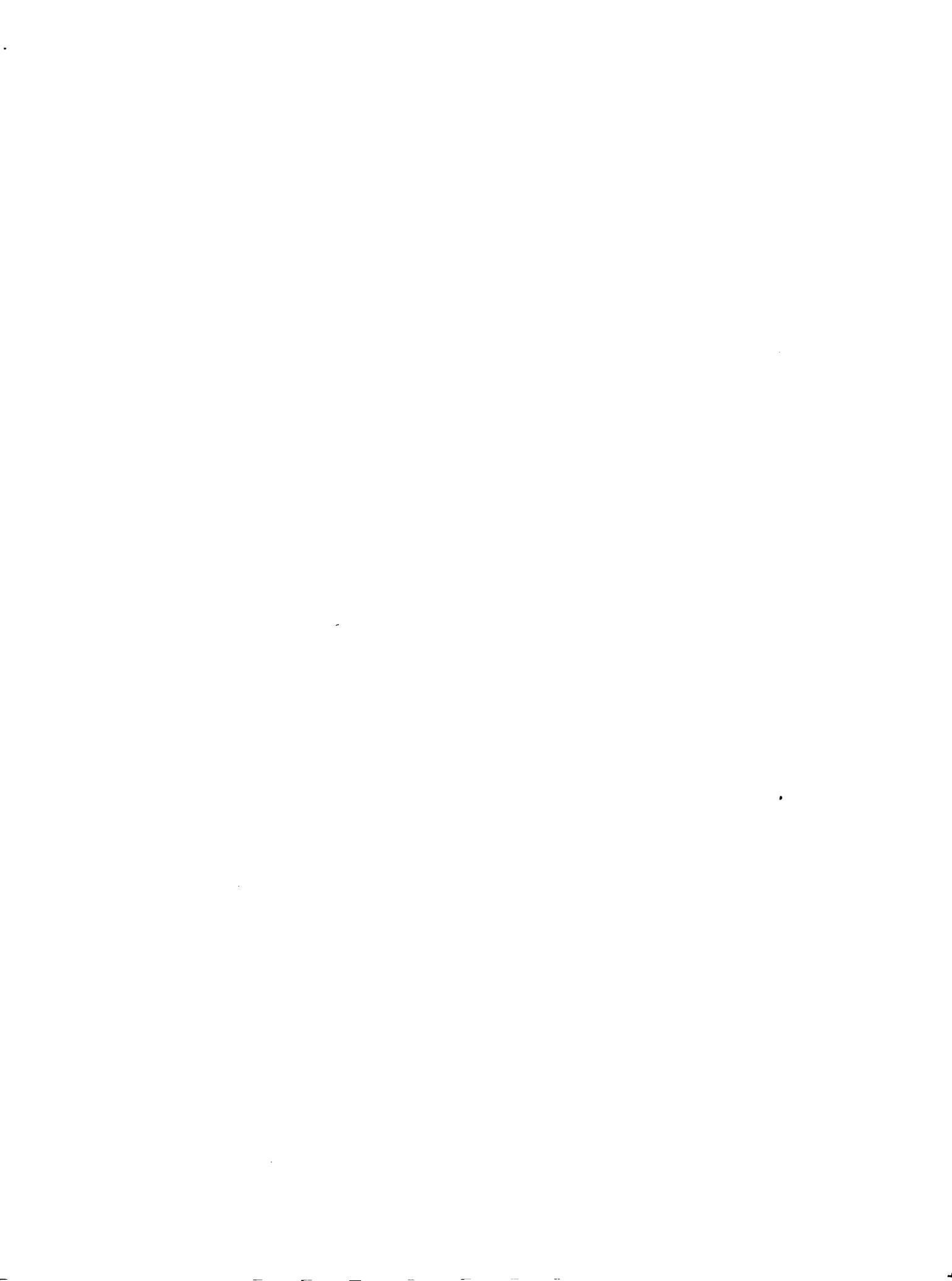
Borrowed embankment - - @ \$0.20 per cu.yd.

we found that it would be economical to overhaul 1400 ft.

M. A. C. & H. E. R. R.

Length of line = 24900 ft. = 4.79 mi.

Graduation	measure	price	quantity	Total amount.
1. Earth exc'tion	cu. yds.	\$0.20	9691.0	\$1938.20
2. Earth emb. borrowed	" "	.20	10701.3	2140.26
3. Earth overhauled	cu.yd.stas.	.03	210.4	6.31
" "	" "	.052	490.7	23.57
" "	" "	.045	1217.3	54.76



Graduation	measure	price	quantity	amount
Earth work overhauled	cu. yds. sta	\$0.015	757.2	\$11.36
" "	" " "	0.023	751.1	16.52
4. Clearing	acres	40.00	1.5	60.00
Bridges, culverts, etc.				
Cast iron for culverts	tons	30.00	19.7	591.00
Plank for road crossings	M ft.	25.00	1.3	32.50
Cattle guards	each	18.00	4.0	72.20
Track				
Ties	each	.50	12646.0	6323.00
Rails (60# per yd.)	tons	30.00	431.10	12933.00
Spikes	miles	150.00	4.79	718.50
Joints	"	300.00	4.79	1437.00
Track laying and surfacing	"	400.00	4.79	1716.00
Ballast	"	12.00	4.79	57.48

graduation	measure	price	quantity	amount
Miscellaneous				
Fencing	mile	\$450.00	3.75	\$1687.50
Right of way	acres	150.00	96.0	14420.00
Overhead wire (2, 00)	lbs.	0.20	15.323	3064.60
Trolley poles	each	2.50	1536.0	3840.00
				\$ 51123.50
Engineering	percent	5%		256.20
	Total	- - - - -		\$53679.50

Transit Notes For Location Line

Sta	Pts	Defl	Total Angle	Worm Inch	Apr 13 1948 Ved Bright L & Mc Transva.	Paper Stamps
53						
62						
61						
60						
59						
58						
57						
56 0						
55						
54						
53						
52						
51 0	PT 4° CR	8° 0'	16° 0'			
50		6° 0'				
49		4° 0'				
48		2° 0'				
47 0	PC 4° CR	0° 0'				
46						
43						
42						
41						

Paper
Stamps

Backsight on Sta 57

North Fence



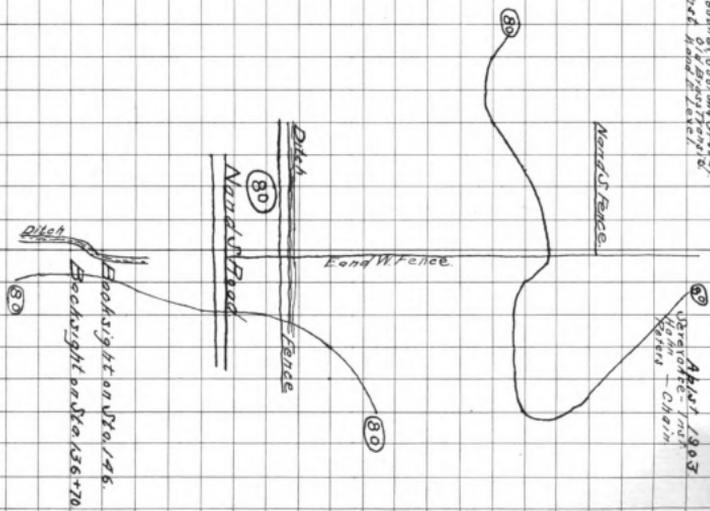


Transit Notes For Preliminary and Topographic

Woodstock, Va. and vicinity
Incl. Old Dominion Park
and Wood Lake

April 1903
W. H. Mendenhall
Surveyor - Charge

Sta.	Pts.	Defl.	Elev.
164			83.3
162	⊙	0° 45' L.	84.2
160			77.0
158			76.2
156			75.9
154			77.3
152			79.7
150			77.4
148			76.3
146+50	⊙	32° N.	75.9
146	⊙	32° L.	77.3





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