THE CALCULATION OF OVERHAUL.

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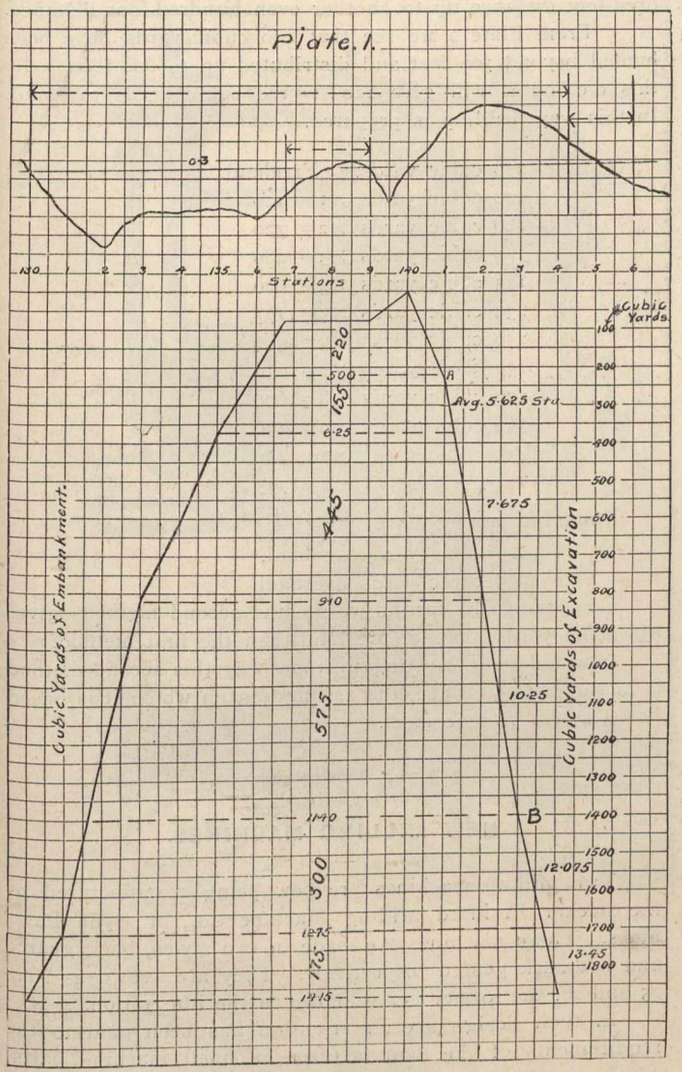
Specifications for railroad construction work usually stipulate that excavated material shall be hauled a certain number of feet, the schedule price per cubic yard covering this free haul, and all material hauled beyond the free haul limit to be paid for at a schedule price per cubic yard per 100 feet overhaul.

For years the standard method of calculation was the centre of gravity method, but of recent years graphic methods have come into favor. Unfortunately these graphic methods do not all bring the same results, and the purpose



of this paper is to describe two methods and compare the results, leaving to the reader the selection of the system best suited to his work.

That the description might be the more complete, I have selected an example, from actual work, to illustrate the methods. A rock cut, which was hauled through another cut, has been chosen as affording an example of the most general case. On the particular work where this cut occurred 500 feet was the free haul limit, the contractor receiving 2 cents per yard per 100 feet for all excavated material hauled beyond the free haul limit.

To prepare a diagram for the graphic calculation of overhaul take a role of standard profile paper, and near the top of the sheet plot the profile of the work, using preferably the scales usually adopted on railroad work, i. e.

Vert. 20 feet=1 in.

Hor. 400 feet=1 in.

With the aid of your progress profile indicate on the new profile the direction each cut or part of cut was hauled, also the limits of haul.

The selected cut, from sta. 140 to 144+25, was hauled so as to make the fill from sta. 149 to 130, with the exception of the small part made by cut 138+50.

Referring to the cross-section note book we find the number of cubic yards in excavation and embankment between each cross-section and from this we arrange columns one and two of Table 1, and in column three we place the summation of the cubic yards to each station, taking the grade point over which the cut was hauled as zero.

Table 1.

Station.	(1) Cubic Yd. of Emb.	(2) Cubic Yd. of Exc.	(3) Totals to each Sta.	(4· Fill Reduced.
130	...	...	3185	1873
...	321	...	....	....
131	...	...	2864	1700
...	770	...	....	....
132	...	...	2094	1232
701	...	...	....	....
133	...	...	1393	820
...	398	...	....	....
134	...	...	1047	615
...	346	...	....	....
135	...	...	649	372
...	398	...	....	....
136	...	...	353	208
...	227	...	....	....
+75	...	...	126	74
...	71	...	....	....
137	...	...	....	....
...	57	...	....	....
138	...	...	74	....
...	...	37	....	....
+50	...	...	37	....
...	...	...	....	....
139	...	...	126	74
...	63.0	...	....	....
+50	...	...	63	37
...	63.0	...	....	....
140	...	...	....	....
...	...	230	....	....
141	...	...	230	....
...	...	564	....	....
142	...	...	794	....
...	...	607	....	....
143	...	...	1401	....
...	...	435	....	....
144	...	...	1836	....
...	...	38	....	....
+25	...	...	1874	....
...	...	114	....	....
145	...	...	....	....
...	113	...	....	....
146	...	...	113	....
...	311	...	....	....
147	...	...	424	....

By studying column three we see that the quantity in the fill is almost 70 per cent. greater than the cut quantity. In actual construction we found that the cut from sta. 140 to 144+25 made the fill to sta. 130, so that in the breaking up and loose piling the rock has increased 70 per cent. in volume, not an unusual increase. Since all estimates were given according to cut quantities the fill quantities must be reduced proportionately until the total quantity in the fill equals the total cubic yards by the cross-section notes hauled to this fill from the cut. Thus ten-seventeenths of the fill quantities in Col. 3 give the quantities in Col. 4.

Just here it might be noticed that the quantities in cut 138+50, i.e., 74 cubic yards, made the fill from sta. 138 to sta. 136+75. This has been allowed for in the summation in Table 1, Col. 3.

Having selected suitable scales, say

Ver. 200 cubic yards=1 in.

Hor. 400 feet=1 in.