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It is not my intention to introduce any new methods for measuring or computing earthwork, nor attempt to put any one method forward as the best. No one method can be applied to all cases, and the engineer must adopt the one most suited to the work in hand. I wish briefly to refer to certain points, however, which apply to any method used.

The "minor details," as they are usually called, which taken together make up the greater part of the engineer's work, are not more than mentioned in a general way in works on engineering subjects, so that there are many things to be learned in practical work that are not thought of before. It is in these miner details that the greater part of the mistakes of practice will occur. A difficult curve will be located exactly, and important measurement, will be checked and rechecked, but an omission will be made in the note of a culvert, opening a road crossing, or some matter similarly small, which sometimes assumes large proportions later, when there is a question raised, and no notes are to be found.

In the question of earthwork of any kind, excavation or embankment, for railroad or other purposes, the principal points to be observed in the field work are:

1. Obtain notes that will give correct results when computed, that they shall correctly represent the ground measured.

2. The notes should be clear and not ambiguous, not only to the one who takes them, bnt to anyone else fa miliar with the subject. It does not require any more time or effort in the field to make a neat, compact page of notes than it does to cover one or two pages with what should be on one, and oftentimes an engineer's reputation will depend to a great extent on this one thing.

3. Make complete all notes in the field where any question could arise as to whether they might not be different, and note any omission of measurements that may be necessary.

The exact manner of keeping the notes, whether the distance out shall be above the line, and cut or fill below, or vice versa, or whether the notes shall be kept from the bottom of the page up, or from the top down are matters of personal convenience or habit and for uniformity are often regulated by the company for whom the work is being done.

Accuracy with the instrument and tape are important, this accuracy is often carried out to a greater degree than necessary. The idea that by giving the rod readings to hundredths in ordinary cross-section measurements, the exact amount of earth in the section is more nearly obtained, is erroneous. If the surrace of the ground were a perfect plane between the consecutive cross-sections this would do; but even in ordinary level country a slight elevation or depression in the ground or a change of a few feet in the location of the cross-sections will often change the rod reading a tenth or perhaps more, so that beyond a certain point we do not gain in accuracy of results by closer rod readings.

Correct results depend much more on the care and judgment exercised in making the cross-sections at the right places, especially in rough and broken country where a good deal of averaging is required.

It is always desirable to make as fast progress as possible in measuring up work and also to do it easily, for there is, comparatively speaking, a hard and an easy way of doing work. The engineer who will so plan the work that the most time and labor can be saved, other things being equal, is the best man. There are many ways in which the work in the field may be facilitated. For instance, it is unnecessary to find the elevation of each point takan, and then the difference of that point and grade and get the cut or fill. Take the difference between the height of instrument and grade and this gives the number to which the rod readings at the different points of a station are to be added or subtracted. This may seem too simple and apparent to need mentioning, but I have seen men of practical experience who still use the long way.

In setting slope stakes in a moderately level country, it is quite convenient to have a tape marked with the cut or fill at the proper distance out; this marking may be done on the back of a linen tape with common pen and ink and does not injure the tape for measuring. For instance, to mark a tape for a 16 ft. railroad embankment, slope 1½ to 1, beginning at the 8 ft. mark on the tape, for a fill of O. 1 make F. O. 1, at 8. 15, F. O. 2, at 8. 30, F. 1. 10, at 9. 5 and so on. This enables the tapeman to set the stakes at once as soon as cut or fill is given and prevents mistakes in getting the wrong distance out.

In rough country, where there is considerable difference in elevation between the centre and side, or on side hill work, the slope board and rod are indispensable. The slope board is usually ten feet in length, one edge straight, the other usually rounded widest in the middle, where a hand hole is cut and a small level bubble placed. The level rod is held vertically at a station, one end of the slope board is placed against this, the other on higher ground, the board is raised till level and the difference of elevation is read on the rod. There should be a line of levels at both top and bottom of slope to check on when possible, but a good degree of accuracy may be obtained with the slope board and much faster progress made on steep hill side than by any other method. There are so many methods used in the computation of earthwork, and so many formula, tables and diagrams prepared that I could hardly mention all of them, and no one formula can be selected that would apply to all cases. The nature of the work and the ground will usually determine to a great extent the method to be used.

The most simple and hence the easiest of application is the method of average and areas, that is, one half the sum of the areas of the end sections multiplied by the length of the section and divided by 27 for the number of cubic yards. Its simplicity and convenience of application makes it a very popular method. In the state of New York and perhaps other states, it is approved by statute to be used on public works, it is also used exclusively by many of the railroad companies for computing earthwork.

Probably the most exact method of computing earthwork is by the prismoidal formula, which is $S=\frac{2}{6x27}(A+4\ M+A)$ in which S equals cubic yards, L equals length of section, and A and A equal areas of the end sections, M equals area of a middle section. The area of the middle section is not a mean of the two end areas, but the dimensions of the middle section are means of the corresponding dimensions of the end sections. While accurate results may be obtained by this formula, it requires too much time, and is too tedious in its application for general use.

The Good Roads in Ontario County.

To fill in space a great many papers are writing editorials in favor of better country roads for the farmers to haul their grain upon, and to read the stuff one who knew no better might suppose each farmer grew forty or fifty thousand bushels of grain and had to hire draymen to haul it all to market. If our farmers could grow one-tenth as much as they could with the greatest ease haul on our concessions as kept at present they would all get rich in a very short time. The present plan of cutting a township up into road divisions and appointing a leading farmer in each division to oversee the performance of statute labor may not be the most economical method, but it is a guarantee that some person near at hand is responsible for the condition of roads tn his beat, whereas if ever iittle improvement had to be wire-pulled through the municipal councils or their commissioner, or engineer, half the roads would be neglected entirely and would be far better closed up. It is a great task for councillors and their commissioners to make such works and improvements as are too large to be covered by the present statute labor system, let alone to have to note every big stone which the frost heaves or the wash of showers lays bare.—[*Whitby Chronicle.*