The application of this formula is by no means so difficult as the formidable appearance of the above algebraic statement would indicate.

When making use of this formula, it may be advisable in figuring the first few sections, to draw rough sketches of the sections in order to ensure taking the points in correct order; a very little practice will enable an engineer to compute the areas directly from his cross-section notes.

The formula is not an approximation, as are the slope and other formulæ, but is mathematically exact and applicable to every kind of section.

The following directions should be followed:—

"Begin at any point on the section and proceed in either direction (clockwise or counter clockwise), multiplying each cut (or fill) in its order by its horizontal distance between the point just preceding and the point just succeeding. In cases where one passes to the right in measuring the horizontal distance from the preceding to the succeeding point, the product obtained by multiplying this distance by the cut (or fill) at the intermediate point is of one sign, and in cases where one passes to the left, it is of the opposite sign. Take one-half the difference between the sums of the products of opposite signs, and the result is the area of the section."

Thus, in a side-cut where only the slope stake reading and the intersection of the earth surface with the grade-line are taken, the area is a simple triangle, and the application of the formula to the computation of the area would seem to require three multiplications.

Two of the points, however, are on the grade-line and the cut (or fill) is zero, hence the product is zero; the formula, therefore, results in a single multiplication and taking one-half the product of the cut and width.

In the case of the so-called "three points" or "three level" section, which is a section actually containing five points, two multiplications are eliminated in a similar manner.

The outside slope points can be worked together by taking the sum of these cuts (or fills) and multiplying by one-half the width of the roadbed.

Many useful and interesting features of the application of the formula become apparent as its use is extended.

Letter to the Editor

TRADE UNIONISM AND ENGINEERS

Sir,—I have read, with much interest, the letter on "Tradé Unionism and Engineers," by Fred Christie, in your issue of December 18th, and I think he voices the sentiments of all engineers who do the work and are not the engineers who employ other engineers.

Mr. Christie is evidently not of that class of engineers who are afraid to speak of conditions as they exist. The engineers at present supposed to be in the control of the large engineering societies are mostly in the employ of corporations or are employers of engineers of their own. Many of the so-called leading engineers are "leading" because they control the living of other engineers, and the leaders could not hold their jobs unless they kept wages down.

If engineers are afraid of trade unionism, what about the methods that are used against them? These are the old methods used against the union men in former years, but which the employers no longer dare use. For instance, thirty of the leading engineers wanted to have a committee meet their employer and discuss pay. Would he receive the committee? Not so that you would notice it. He received the paid representative of the men who cleaned out his premises, but not the committee of his engineers.

The pay of the engineers has been raised less than 20%, while the scavenger has been raised 150% or more, and in some cases is getting nearly as much as the engineers. Force must be met with force, and the individual engineer negotiating with the employer is a joke. The engineer has no business education, is usually in debt for his schooling, and has a family, but in general has to assume the attitude of a supplicant instead of a freeman.

Some engineers are now in charge of $2,000,000 worth of various work in a year, and get less than $3,000. I paid an armature winder $66 for last week's work and hope to pay him more next week; the more he makes, the more I make. But the machine he wound was designed by me on a $23-a-week salary and an education that cost me $10,000 and seven years' time! That was some years ago, but the engineers in the same place are really getting less than that now, so far as the purchasing power of their money goes.

Dignity is all right, but when you have to hold off the grocery man, dignity is no good. How can a man with a college education be dignified with from $1,500 to $3,000 these days?

A salary of less than $5,000 a year is no good for dignity, and few engineers are getting that or ever will get it until they belong to some organization with "sand."

The sooner the engineers join a union, the better for all,—employers of engineers included. A man cannot work when he is only one jump ahead of the sheriff.

Another thing is this: The employer, while he will not pay the experienced engineer a decent salary, will pay a set of dubs three times as much to do the same work; that is, he gets six men at a low pay to do one man's work, and pays them in the aggregate three times as much as he would have to pay the one man. This has happened and is happening many times.

Some big companies have engineers by the dozen doing work that anyone with even less than a high-school education could do. Of course, it is a good idea to have a lot of technical men doing clerical work; they know what the words mean; but clerical work gets clerical pay, no matter who does it, and until engineers doing clerical work catch onto themselves, so long will they get clerks' pay.

The remedy for this is to exclude clerks from engineering societies; they are doing menial work, and not engineering work. The idea is that they are in line for promotion, but for 95 out of 100 there are no good jobs.

In the average large engineering establishment there are not over three good paying jobs and they are held for 40 years or so by the same men. What chance is there of promotion?

Many engineers now make a specialty of marrying rich girls or daughters of their employers, and in this connection I have never known of an engineer who married the daughter of his employer who failed to have the best job in the place. I suppose the business acumen he displayed in getting the girl is what got him the job, but I doubt it.

Never have I known an engineer, a hired one I mean, to get a good job without some influence other than his ability. The members outside of the influential circle can get into one by some kind of an organization doing its business with a paid representative, and by no other way. The ordinary engineer negotiating with his employer on the salary question is a joke.

N. C. MILLS,
Vice-President and Managing Director,
Montreal Armature Works, Ltd.

Montreal, Que., December 20th, 1919.

During the fiscal year 1918-1919, work was done in the province of Quebec on 904 miles of road, which included 282 miles of completed roads and 292 miles of winter roads. An aggregate of 16,580 ft. of bridges and culverts were also built by the highways department. The total amount expended during the year was $530,935.

In order to provide water and electric power for Palestine, Albert Hjorth, a Norwegian engineer, suggests a tunnel 37 miles long, from the Mediterranean to the Dead Sea, passing under Jerusalem, with power plant on the shores of the Dead Sea, and a pumping station on the Sea of Galilee. The initial cost would be $40,000,000. The surface of the Dead Sea is 1,300 ft. below sea level, and that of the Sea of Galilee, 650 ft.