

Mr. Gould. palate seems to crave, in such conditions, the simplest and crudest flavors.

Naturally, the principal interest centers upon the engineering rather than the culinary features of the paper. The desiderata in the present case, or the objects for which the survey was undertaken, are enumerated under five headings, the second one containing the kernel of the whole proposition, namely:

"To be sure that the line obtained was such that no other line could be built through the same country with the same or better ruling grades, with less expenditure, at the same unit prices."

This sentence very neatly expresses the object of all such surveys.

Perhaps the most important feature of the paper, and the one most likely to provoke discussion, is the insistence with which the author dwells upon the superiority of a paper location over a field location, that is to say, the taking of the ground into the office, and locating the line there, more or less mathematically, rather than doing it entirely by eye, upon the ground. If the speaker is not mistaken, this idea was carried to the limit in the case of the Lyons and Geneva Railroad, in France and Switzerland, by the construction of a plan in relief, reproducing in miniature the whole stretch of intervening country over which the road must pass, and locating the line upon it. The increasing effort to bring the field work into the office in all branches of engineering is a marked characteristic of the present trend of practice in America. While this may degenerate into "easy-chair engineering," when carried to excess, the speaker is inclined to believe that, in the case of the final location of a railroad, or other line, the getting of full details of the topography laid down upon a contour map is the true way to secure the best results. One point, however, has perhaps not been sufficiently dwelt upon in this paper, which is, that after the line has been thus located on paper and transferred to the ground, a final revision is absolutely necessary, by the best locating talent in the outfit, which will probably result in changes of greater or less importance. Indeed, it appears to the speaker that the whole process of scientific location, from the first examination of the territory as shown on the atlas map, down to setting the final slope stakes, is one of "trial and error," from field to office, and from office back again to the field. It also appears to him that, except in those cases where there is almost no choice to be exercised, the skill and experience of the locating engineer are best shown in the rapid comprehension of the broad features of the problem, rather than in elaboration of details. The qualities which enable an engineer to take this almost instinctive grasp of the possibilities of a wide and varied stretch of territory seem to be akin to those which characterize a great military commander in his selection of strategic points. The gift may be greatly

cultivated, but, for its fullest power, it must be inherent in the individual. It is also the opinion of the speaker that the value of this gift may be over-rated, and that when time allows—and if the surveys be promptly commenced instead of being relegated to the last moment, time generally will allow—no amount of "eye for the country" can supersede the patient and exhaustive instrumental examination of all the possibilities of the territory. At any rate, it is certainly safe to give to younger members the advice not to rely upon the fancied possession of this gift, but rather to cultivate the eye and judgment by painstaking study and observation.

In the present case, the necessity of exhaustive preliminary lines, previous to final location, was evidently realized, for Mr. Lavis says:

"Instructions were given the locating engineers to spend all the time necessary on investigations, to be sure they had the best line through the country traversed before putting in the location, on the ground."

It is certainly vain to cross-section a strip 800 ft. wide on both sides of a radically vicious line, when a 5-mile swing to the right or left would open up a practicable route through easy country. That is to say, it is useless to try to make the best of a bad line, when a good one is ready to the hand.

In regard to the instrumental work, the running out of all tangents to an intersection is sound practice, unless a curve is finally adopted which sweeps in several changes of direction, when the total deflection between the points of curvature becomes the true angle of intersection. In such case it might not be necessary to produce the tangents to an apex, but, in all cases, as the author states was done, the position of the P. C. and P. T. should be calculated and the hubs set from the apex, or by long chords or otherwise, before the curve is swung in, even at the cost of much additional labor. When the curve is run on final location, if a satisfactory connection is not made with the previously established P. T., the transit should be set up upon it and the curve run backward until the discrepancy is worked out, or the existence of an error is detected.

No mention of easement curves seems to have been made in the paper.

The speaker is free to confess that he does not like the form of transit notes used in this survey. His own invariable practice has been to have two columns for deflections, left and right, and to carry the balance over from page to page. In this way, by applying the balance to the first course of the survey, the calculated course can be checked at any given station. Distances should be added up and carried forward in a similar way, so as to check them with the numbering of the hubs. In reading angles, both verniers should be