VALLEY OR RIDGE LOCATION FOR RAILROAD LINES?

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The first serious engineering question the writer was ever called upon to decide on his own responsibility was in 1886, and was to make a choice between two feasible railroad routes between two points, one of the routes lying on a ridge and the other in the parallel valley. The two points were about 30 miles apart and the ridge and the valley were generally about 5 miles apart. No compromise was feasible; the line had to go along the top of the ridge or close to the stream in the bottom of the valley. Grades, curvature and first cost with temporary structures slightly favored the valley line; while a shorter road with permanent roadbed could be secured at much less cost on the ridge. The traffic immediately tributary to the two routes differed even more than the engineering features. The ridge was covered with good pine timber for which there was a market waiting. The valley had a good deal of hardwood timber for which there was no immediate market, and large bodies of fine but somewhat undeveloped arable land suitable for corn and cotton.

The traffic conditions and the item of first cost decided the writer in favor of the valley location, though at the time he could not have cited a single precedent for his decision. The prospects for immediate traffic seemed best on the ridge, but the prospects for the most durable and the largest ultimate traffic seemed to lie in the valley. The cotton and corn, hogs and cattle of the valley would not readily go to the ridge top, while more or less of the pine lumber would come down from the ridge to the road in the valley.

The road had good traffic from the beginning, and the valley now contains several thriving villages.

In his recent work* Mr. Beahan says on this subject:

> A ridge route is often preferred in the middle West, as there the ridges are more frequently low and practicable than those nearer the seaboard. Among the reasons for preferring a ridge to a valley are: (1) There is little or no bridging; (2) there is no overflow, and (3) the grade lines can be kept low and quantities reduced. The disadvantages are: (1) There is more "classification" in the grading, as rock is more apt to be met on a ridge; (2) there is more curvature, because a ridge is seldom as straight as a river bottom, and (3) towns are not usually found there, for towns will never incline to locate on a ridge as against a valley site. Too little weight is given to this fact last mentioned. The road first located in a region will often choose a ridge rather than a valley route. A second road will locate and build a line some years later through the same country and in the same direction, but follow the valley, no great distance from the older ridge line. The last line gets the most business. The towns were there originally and the produce comes down to the valley line rather than up to the ridge line.
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> While the laws of traffic are always worthy of scrutiny, and while traffic men are the safer persons to interpret them for their localities, it may be perhaps safely said that a railroad should be located like a sewer. A preliminary should be run on ground such that the traffic can flow toward the preliminary on a down grade and with no other railroad, ridge or unabridged stream intervening between the traffic and the preliminary line. Sewers are placed on lowest ground, with the idea that gravity calls all fluids to it. Railroads are like placed and for reasons which seem to the writer quite similar. Commerce seeks the lines of least resistance. Traffic is lazy and will move to the road that can be reached with least energy.
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> The St. Louis & San Francisco Railroad is a ridge location to Springfield, Mo., and was located, the writer was always informed, by General Fremont. There is not a town of any consequence along the line. Traffic is very meager and could only be hauled to it up a hill at quite prohibitory cost. Nevertheless, ridge roads have always had their advocates, owing to low first cost through avoidance of bridges. These lines usually have large total curvature, choppy grades and considerable classification of grading materials.
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> The Fort Worth & Denver City Railway, for the first 50 miles out of Fort Worth, was located and built by the writer on a ridge. It now appears that the Chicago Rock Island & Pacific Railway parallels that line in the valley to the northwest, at less first cost, and that the Rock Island gets about all the business.

The locations occupied by the Northwestern and St. Paul roads in the state of Wisconsin, coupled with the records of their cost and earnings in that state, make up an interesting study in this connection. The Northwestern generally, though not always, occupies ridge locations, either along or across them, in Wisconsin, while the St. Paul generally, though not always, occupies valley locations. This fact is probably not due, however, to any settled policy of the two systems, since many of the Wisconsin lines of each company were brought into the system by purchase. Each system has between 1,700 and 1,800 miles of road in the state. The main line to the Twin Cities of both systems runs through Wisconsin. Both systems occupy the eastern and southern portion of the state and neither of them occupies the northwestern quarter of the state.† There are 18 cities in Wisconsin of 10,000 or more people and the St. Paul and the Northwestern reach jointly 12 of them. Thus the two lines are quite similarly placed in Wisconsin and compete pretty well throughout the state. The St. Paul has better terminals in Milwaukee, the metropolis of the state, but the Northwestern probably has better traffic connections at Chicago, which materially affect the main line traffic between Chicago, Milwaukee and the Twin Cities.

According to the careful appraisal recently made, the cost of reproducing the physical properties of the two roads in the state, supposing all property new, is about the same for the two systems—$35,300 per mile for the St. Paul, and $34,900 per mile for the Northwestern. According to the sworn statement made by the presidents of the two companies, the per mile gross earnings in 1904 of the Wisconsin mileage of the Northwestern exceed the per mile earnings of that system by 19 per cent; while the per mile gross earnings of the Wisconsin mileage of the St. Paul exceed the per mile earnings of that system by 23 per cent. The gross earnings per mile of the two companies are about the same in the state, having been in 1904 $8,701 on the St. Paul and $8,560 on the Northwestern. But the net earnings in the state seem to be very much in favor of the road with the preponderance of valley location. The net earnings of the St. Paul in 1904 were $3,698 per mile in Wisconsin, while the Northwestern's were $2,860.‡

However, there are too many other features affecting the traffic of the two systems in Wisconsin to take these facts as conclusive, but it does seem more than probable that the preponderance of valley location held by the St. Paul in the state operates in favor of that road.

Still, it is true that in the location or purchase of a railroad line traffic considerations should always outweigh any and all topographic conditions. Given a good mine, factory, or agricultural district, and a market for the output, and, generaly speaking, a railroad connecting either of them with its market will pay without regard to the topographic features of the intervening country.

The New York Central and the Chesapeake & Ohio are the trunk lines that occupy distinctive valley routes from the great interior of the country to the eastern seaboard. But neither of these has nearly so large or remunerative a traffic as the Pennsylvania, which crosses the Alleghanies at a most inconvenient point from the standpoint of railway construction and operation. But the Pennsylvania crosses these mountains with such grades and curves as it may and at whatever cost is necessary to serve traffic centers upon whose output the prosperity of the country depends.

*"The Field Practice of Railway Location." Engineering News, 1904, page 47.

†The lines of the Omaha System are not included in this comparison.

‡However, these figures for the Northwestern are not entirely conclusive, since that road in its report to the state authorities does not give the operating expenses in Wisconsin, though it does give the Wisconsin gross earnings. The net earnings shown for the Northwestern are arrived at by taking from the Wisconsin gross earnings the same proportion of operating expenses as obtained on the entire system.