RELATION OF HIGHWAYS TO MOTOR TRUCK OPERATING COST*

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HIGHWAYS are merely the means to an end. That end is economic and efficient transportation of passengers and commodities. If this fundamental principle had been the universal basis for the improvement of highways during the past twenty years, the problem of determining the relation of highways to motor truck operating cost would have been materially simplified.

The highway transport engineer or manager cannot assume, for every transportation route, that what has been done is what should have been done. In fact, in the case of any one of thousands of proposed routes, he cannot assume that the highway is 100% improved, even based on the crudest ideas of what constitutes an improved highway. It is well to bear in mind that the construction of highways outside of municipalities is to-day in its infancy. Furthermore, it should be recognized that of the 2,500,000 miles of highways outside of municipalities in the United States, only 12% can be classified as improved, and that not over one-fourth of 1 per cent. are suitable to carry intensive motor truck traffic.

Survey Under Three Classifications

No thorough consideration appears to have been given to the effect of highways on operating cost by many legislators and commissions when establishing schedules of legal rates for transportation of commodities. For example, the Nebraska uniform rate of one and one-half cents per 100 lbs. per mile, recognizes the fact that the roads of Nebraska will not permit a 300-day-a-year business with 5-ton trucks, by entirely failing to recognize the fundamental fact that a 30-mile haul on one route may easily cost twice as much as on another route, particularly as only about 2% of Nebraska's rural routes are classified as improved.

It is evident that a thorough field investigation of every proposed highway transport route should be made, and that the results of this survey should be an improved factor in the final decision pertaining to the establishment of a highway transport business. The result of this survey, from the standpoint of highways, may be roughly classified under the following three heads: First, relation of unimproved highways to operating cost; second, relation of proposed new construction and the reconstruction of improved sections to operating cost; and third, relation of sections of improved highways which will not be reconstructed for a period of less than five years to operating cost.

Unimproved Portions of Highways

The first class of sections of a proposed route—namely, the unimproved portions of highways, may present conditions of narrow widths of roadways, steep grades, sharp turns or rocky, sandy or clayey surfaces, such that a glance will be sufficient to condemn the route for efficient highway transport. Generally speaking, unimproved highways constitute a positive economic barrier to the development of a highway transportation business. Take for example, George H. Pride's 1919 average daily cost of $28.56, covering the operation of a 5-ton truck for an average of 50 miles per day for 300 days per year. These figures are based on New York City conditions, including the average type of improved highways outside of cities over which his trucks operate. Let us diagnose Mr. Pride's cost sheet and determine what would be the effect of substituting a system of poor roads for the system of improved roads in the near vicinity of New York City. It is self-evident that poor roads would materially raise the cost of at least the following items on the cost sheet: Tires; oil, grease, etc.; gasoline; depreciation; maintenance; and lost time. A combination of a rough roadway on steep grades for a mile section of a 25-mile route, might easily double or treble the operating cost, if not actually rendering continuous operation of a truck over such a route impracticable.

The following interesting deduction pertaining to saving in gasoline which will result when the system of 5,000 miles of highways in Illinois are improved has been made by A. N. Johnson. He assumes that these highways will develop a traffic of 500 motor vehicles per day for 300 days in the year. He estimates that the saving of gasoline by the above traffic on improved roads, as compared with earth roads would be 66,000,000 gallons per year, or approximately $15,000,000.

Saving in Gasoline

The results of tests carried out by the White Co., of Cleveland, with a 2-ton motor truck, are of interest as an indication of the saving of gasoline due to operation of motor trucks on some of the types of pavements suitable for trunk highways, as compared with operation over earth roads. The investigations showed that on concrete and brick pavements it was practicable to operate a loaded 2-ton motor truck for an average of 11.5 miles on one gallon of gasoline, whereas on the average earth road only 5.8 miles to the gallon was obtainable. In round figures, the conclusion drawn from the test was that it was possible to operate the 2-ton truck on high-class pavements for twice the distance which was practicable on earth roads.

The second classification of highway sections cover those parts of routes which are liable to be constructed or reconstructed within a comparatively short period after the establishment of a transportation business. This phase of highway improvement demands serious consideration, as construction and reconstruction generally implies that vehicular traffic will be shunted on to detours, most of which are far from satisfactory, considered from the standpoint of economic highway transport. The growth of motor transport will force highway engineers to give serious attention to providing serviceable roadways for traffic during highway improvement. In some cases, roadways are provided alongside the highway under improvement, in others one-half of the highway is improved at a time and in others the traffic uses detours. Highway transportation interests will soon emphatically demand that the same consideration be given to the facilitation of highway transport as is usually provided for railway transport when a railroad line is under reconstruction.

In connection with the third general class of highway sections of a given route—that is, improved sections which will not be reconstructed in the near future—it is necessary to consider the influence of each fundamental element of a highway upon economic highway transport. The elements which will be considered are drainage, foundations, grades, widths of roadway, shoulders, curves, roadway wearing courses and bridges.

Drainage and Foundations

American highway literature contains an enormous amount of advice pertaining to drainage and foundations. Although it is generally conceded that the importance of this subject has not been over emphasized, nevertheless, American practice is far from satisfactory. The writer believes that the increasing use of highways by motor transport will cause so many failures of insufficiently drained highways and others which have weak foundations, that there will be a general improvement in the near future. As loads are transmitted from the wearing course to the foundations and from there distributed to the subgrade, the bearing power of the soil composing the subgrade is an important factor in the design of the highway. It is well known that the bearing power of soils, in many instances, is materially increased by efficient drainage. The roadway, therefore, should be so drained that the maximum bearing power of the subgrade is developed. While a poorly drained

*Presented at the annual convention of the National Highway Traffic Association, January 29th, 1920, in Chicago.