

RAILROAD ELECTRIFICATION

RAILROAD electrification, perhaps, appeals to a larger part of the public than power for industrial use. For 20 years or more the electrification of railroads has been a subject of general interest. From time to time, as certain railroads have changed from steam to electrical operation for portions of their lines, the passing of the steam locomotive has been confidently predicted by experts who have been impressed with the superiority of electric traction, but the steam locomotive not only appears to be holding its own, but by notable improvements in design and appurtenances seems recently to have taken a new lease of life. Outside of the work on the Chicago, Milwaukee & St. Paul Railway there have been very few electrical installations in trunk lines in the past 4 or 5 years.

ADVANTAGES OF ELECTRIFICATION

The major advantages of electrification are well known. In general they include increased line capacity, because of increased train speed and heavier train loading; fuel economy, because of the more efficient conversion of heat units into power; lower maintenance costs, because electric locomotives require less repairs than steam locomotives of equal capacity; and increased serviceable locomotive hours, because the electric locomotives can be used more continuously and require less terminal attention between trips.

Besides these strictly operating features there are important social advantages. These appeal particularly to the general public. The elimination of smoke makes traveling more comfortable and adds to the value of nearby property. Electric traction has made possible the remarkable development of the property surrounding and the track approaches to the Grand Central Terminal. Electrification of the lines radiating from Boston, as a single example, would be of immense value to the community by abating the smoke nuisance, reducing noise, adding to terminal capacity, and increasing property values. Without electricity as motive power it would be impracticable to operate trains through tunnels such as those in New York City, Baltimore and Detroit, the Hoosac Tunnel of the Boston & Maine, the Cascade Tunnel of the Great Northern and others that might be named. The electrification of the mountain grades of the St. Paul and Norfolk & Western roads has made heavier trains possible, has, by regenerative braking, reduced the risk of handling heavy trains on descending grades and has increased road capacity.

PROBLEM ONE OF FINANCE

Practically all of the electrical installations on trunk lines have been designed to meet special operating conditions, such as tunnels or city terminals. No large railroad has been completely electrified. There is an absence of data that can be used in studies of complete electrification. Railroad executives therefore will be much interested in the Superpower Survey, hoping that it may contain information that can be applied to their local conditions. The typical railroad executive recognizes the advantages of electrical operation. He knows that it will eventually displace steam, at least on lines of heavy traffic and in congested terminals. For his own line under these conditions he would welcome the advent of electricity if a fairy godmother would provide the capital funds and make it possible to earn the additional carrying charges. The problem is not one of engineering. It is essentially one of finance.

If the estimates of the Superpower Survey engineers as to savings in expenses and return on capital investment could be accepted without reservation the financial problem would be easier of solution. Unfortunately, however, this is not the case. The figures are subject to material qualification. There is evidence of an inclination to go out of bounds in

making a case in favor of electricity and against steam. The zeal of the electrical engineer, who is firmly convinced as to the general soundness of his conclusions, is only natural but the report would carry much greater weight if it were less biased.

For example, in the item of fuel the electrical engineers have assumed that a steam locomotive requires $7\frac{1}{2}$ lb. of fuel for each kilowatt-hour of work at the rim of the drivers. Against this they set an estimate of 2 lb. under electrical operation. From these data it is assumed that electrification will save two-thirds of the fuel bill.

It should be noted, however, that the estimate for the steam locomotive is based on experiments made 11 years ago on the St. Paul, with a type of locomotive now considered as practically obsolete. It was not as powerful as the typical locomotive of today, nor was it equipped with other devices now common on modern locomotives. A comparative test with the heavier locomotive of today, equipped with modern appliances for economizing in fuel, would give far different results. The estimate for fuel consumption under electrical operation was based on the performance of a powerplant of modern design.

FUEL SAVING ABOUT ONE-THIRD

It is interesting to compare this theoretical saving of two-thirds of the fuel with the actual figures for the Norfolk & Western. In discussing the subject before a joint meeting of the societies of Electrical and Mechanical Engineers at New York City in October, 1920, the chief electrical engineer of that road stated that a comparison of fuel consumption on the electrified divisions with tests made with modernized Mallet type locomotives under similar conditions indicated that the saving in fuel by electrical operation was 29.3 per cent. This is less than one-third. If the Superpower Survey engineers had assumed a saving of one-third instead of two-thirds, the former is closer to the facts, the estimated fuel savings would be cut in two. A tendency to favor electrification is shown also in other items, such as in the allowance for steam locomotives released.

As has already been stated, the problem is essentially one of finance. In the case of a railroad that has an investment in road and equipment of, say, \$100,000 per mile, something more than a questionable return of 14 per cent is needed to induce recommendations for an investment, of, say, \$40,000 more per mile for electrification. On every hand there are needs for additional investments of other kinds that without question will yield more than 14 per cent.

CHANGE WILL COME PIECEMEAL

The Superpower Survey will probably stimulate further discussion of railroad electrification. Notwithstanding the defect that has been mentioned, the report is constructive and should be regarded as a valuable contribution to engineering and economic literature. When the railroads are again on their feet there will probably be further extensions of electrification where the conditions are most favorable.

It is improbable, however, that electrification on any such scale as is recommended by the report will be attempted. It will come piecemeal and gradually. The electrical engineers still have much to learn. The electric locomotive is still in the experimental stage. It is likely to undergo many changes in design and the experts have yet to agree on important fundamentals. While the electrical engineers are fighting among themselves the battle of alternating versus direct current and overhead construction versus third rail the mechanical engineers are unwilling to allow their electrical colleagues to stage the obsequies for the steam locomotive at the present time.—Prof. W. J. Cunningham in *New York Evening Post*.