Rail Failures: A Class of Trouble Which Seems to Have Overlooked the Electric Railways

IN THESE times of many troubles the electric railways have cause to congratulate themselves upon their comparative immunity from serious accidents due to rail failures. Unlike the steam railroads, we have seldom heard of this trouble upon electric railways although the tracks, upon private right-of-way at least, are built very much in the same manner, with similar rails, ties, ballast and other construction features. Meanwhile the steam railroads have been burdened with an increasing number of accidents from this source and several fatalities have occurred, which investigation proved were due to rail failures. These in turn were mostly of the type ascribed to transverse fissures. This sort of rail failure is very peculiar in that it usually comes suddenly, with no previous warning. It is a progressive fracture which starts from a hidden interior defect. The most careful inspection on the part of maintenance-of-way forces will fail to reveal the presence of transverse fissures which may cause a break within a few hours after an inspection has been made.

The committee on rail of the American Railway Engineering Association has been investigating the subject for several years. Although it has secured many valuable data, it has, as yet, discovered no definite preventative. However, it is believed that the change from bessemer to open-hearth steel for rails, which has been incorporated into the practice of most railroads, has helped considerably in reducing the number of broken rails. Constant study has been given to improvement in mill practice and many types of alloy steel have been tested in service as well as greatly increased rail sections, but the trouble persists much as the corrugation trouble which still bothers the electric railway in street track.

Perhaps the immunity of the electric railways from rail failures may be ascribed to the lighter axle loads and to the lesser impact which prevails even with electric locomotives, since it has been found that the impact upon bridges of more than 20-ft. span, produced by electric locomotives of the Chicago, Milwaukee & St. Paul or Norfolk & Western types, is not more than one-third that produced by steam locomotives. There can be no question but that severe impact will finally search out undisclosed transverse fissures.

A renewal of interest attaches to the subject because of the prominence again given it through the recent report of the chief of the bureau of safety of the Interstate Commerce Commission, covering the investigation of the accident which occurred in April last on the Long Island Railroad at Central Islip, N. Y. The body of the report is made up from the exhaustive study of the subject of transverse fissures prepared by J. E. Howard, engineer-physicist, and the discussion therein of the conditions in the so-called critical zone of the rail-head metal (which zone is at the surface and extends downward perhaps half an inch below the surface) serves to call attention again to the question as to how the action of the steel in the rail head in this zone may affect the tendency of rails in street service to corrugate. It is pointed out in the report that in this zone the elastic limit of the steel is exceeded, the relations of the elastic limits in tension and compression are disturbed, internal strains are introduced and the value of the modulus of elasticity is at least temporarily lowered and sometimes destroyed. The latter has been proved by laboratory tests.

Can it be possible that in the last item we have a substantiation of the argument advanced by several engineers to the effect that overstraining of surface metal is the prime cause of corrugation? Would transverse fissures develop, instead of corrugations, in street railway rails if the axle loads were as heavy as those on steam roads? It would indeed be interesting if tests upon corrugated rails could be made to disclose whether or not the modulus of elasticity has been destroyed in the critical zone of these rails. We understand that the structural changes above noted do not extend much, if any, below the critical zone, and it is rather interesting to note also that as a rule corrugations once removed from the surface (critical zone) seldom return. This would indicate that whatever the structural changes which occur in rail heads which become corrugated, these do not extend below a certain critical zone. Surely there is room here for important tests which may throw light on a vexing subject.