

required for present stresses; the advisability of tie renewals in continuous stretches as compared to single-tie renewals; and experience with metal, composite and concrete ties. A large amount of information has been collected on each of these subjects and is included in the report.

Replies to a circular asking opinions as to the size of ties were received from roads representing about one-third of the total mileage in the association. From extensive tabulations of this material in the report it is found that there has been an increase in the number of

mittee presents a large amount of additional information in the form of brief reports from various roads using special forms of ties. From a study of this data the committee observes that the concrete tie, the combination concrete and metal tie and the combination asphalt and metal tie have not yet proved a success because of fracture caused by vibration, excessive weight and deterioration of asphalt filling. A combination tie of steel and wood is stated to give promise of developing an economic substitute, while the all-steel tie is believed to have proved satisfactory under heavy,

mental track maintained on that basis and that it was expected the ties could all be renewed when the rail was renewed.

The recommendation of the practice of single-tie renewals in preference to renewals in continuous stretches was adopted.

The association endorsed the conclusions of the committee in reference to its study of the size of ties and its study of metal, composite and concrete ties as presented in the review mentioned above.

Committee on Rail

This committee has prepared a study of rail failures and presents in its report a large amount of tabulated and analytical data on rail failures for the year ended Oct. 31, 1910. It was found that the responses to enquiries were more complete than before and showed that most of the railways are now keeping a record of their rail failures. Eighty-three companies furnished statistics relating to about 11,750,000 tons of rail. The report included summaries by sections, weights and kinds of steel; classification according to position in the ingot and a comparison of the wear of special rail.

As a result of its study of this information the committee makes the observation that accurate and specific information is not furnished for the determination of the value of different sections of rail because of the variations in traffic and roadbed conditions and in the conditions surrounding manufacture. It is believed that the difference in quality of material may eliminate differences in rail sections, but it is pointed out that the matter of desirable features of rail sections should be kept in mind at the same time that the present efforts toward improvement of material are made so that when a good quality of metal is attained there will also be a desirable rail section. It is observed that a study of these statistics furnishes information relative to the difference between Bessemer open-hearth and alloy steels and shows a relation between broken rails and failure of head, web

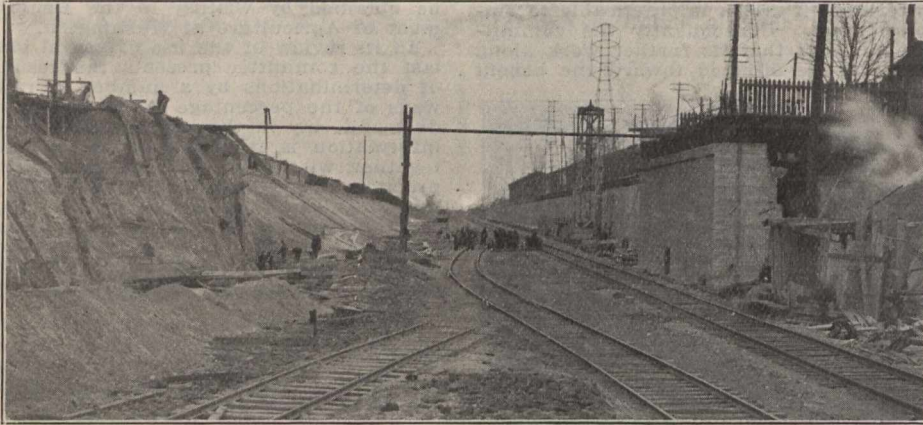


Fig. 6. G.T.R. Grade Separation. Shoring Wall at Exhibition Grounds, Dec. 1, 1911.

ties used per 30 ft. rail since 1905, the rail-bearing area now being about 40%, as against 35½% in the former year. It also appears that about 59% of the mileage reporting in the circular is of the belief that a 6 x 8 in. x 8 ft tie is too small and 96% of that mileage considers a larger tie desirable. It is found that 22 sizes of cross-ties are now in current use, with 47% of the mileage reporting using the 6 x 8 in. x 8 ft. size. It is pointed out that the sentiment is evidently in favor of a larger tie, but evidently the length has not been considered as much as the width and depth. Of the mileage reporting 18% uses a tie 8½ ft. in length and over 10% favors a tie 7 x 9 in. x 8½ ft., none favoring 6 x 8 in. x 8½ ft.

In connection with this discussion a table is presented which shows the superior strength of air-dried timber for ties as compared to that of green ties. A list of articles is appended relating to the size of cross-ties and the stresses to which they are subjected.

The committee draws the conclusion that it is not feasible to make a fixed rule for the size and spacing of ties based on the A, B and C classification of density of traffic due to the variation in the character of the subgrade, ballast, axle loads, tie timber and other considerations. In general, however, it is considered good practice for class A and perhaps class B roads to space ties 10 to 12 in. face to face, the width of tie being considered not so important with this spacing, provided that the minimum width of face of the ties is limited to 7 in.

The investigation relative to the advisability of renewals of ties in continuous stretches against single-tie renewals showed almost universal endorsement of single-tie renewals. Continuous renewals at station platforms, street crossings and similar places are favored by some. It is recognized that there would be advantages in continuous renewals in giving a uniform lift to the track and in reducing labor costs of renewals, but these are outweighed by the fact that single renewals keep the track as a whole in more uniform and safe condition and obtain the maximum life out of each tie.

As a result of its investigation of ties of other materials than wood, the com-

medium-speed traffic. It is believed that the fastenings for these ties will be further improved.

The discussion of this report brought up the question of computation of actual stresses in ties under given wheel loads. The opinion was expressed and sustained that enough information is now becoming available to permit approximate assumptions and exact methods of design somewhat similar to those for bridges and abutments. The President explained that progress had already been made along this line in Europe and

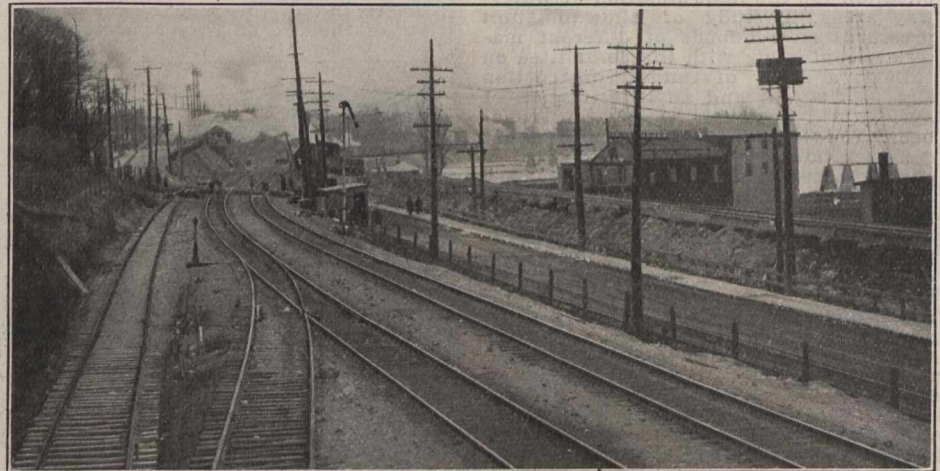


Fig. 7. G.T.R. Grade Separation. Looking East at Sunnyside, Dec. 1, 1911.

that it is proposed that the committee shall take up the subject.

Referring to the recommendation favoring single-tie renewals, Hunter McDonald gave some figures on an experimental mile of track laid in 1903, where he has applied the practice of renewals in continuous stretches, with the result that the maintenance account is so far about \$200 a mile cheaper than for single-tie renewals. He believes that the continuous system has its merits, but that railway officials have become accustomed to single-tie renewals and are not willing to go to the expense of trying the other plan. C. A. Morse stated that the Santa Fe had 22½ miles of experi-

and base. It also shows a difference between rails of different mills when the sections and chemical composition are practically the same.

M. H. Wickhorst, engineer of tests of the committee, has made an investigation to throw light on the relationship of the size of ingots of Bessemer rail steel to the segregation of the metalloids, locations of pipes and blow holes, and the properties of the rails. It was found that under the conditions of the tests, the carbon, phosphorus and sulphur collected or segregated toward the interior and upper part of the ingot and that, in a general way, such segregation increased with the size of the ingot. The