

solution of this problem, as in most all of our cities, franchise conditions require the railway company at its expense to build and maintain a large proportion of the pavement in streets upon which the tracks are built, and surely there is but little encouragement for the street railway, willing to meet the conditions with a heavily ballasted track of the latest design, when it is confronted with the proposition that upon all heavy traffic streets, concrete ballast shall be used regardless of all other conditions.

**Objections to Concrete.**—"The objections of street railway officials to a concrete ballasted track are correctly stated in the main by Mr. Compton, though he has failed to state that the work of reconstruction will be materially slowed down and delayed by the use of concrete, except his penetration method of making concrete be adopted. It would certainly be unwise at the present time, after a little over one year's experience upon 10½ miles of track in Baltimore to recognize this penetration method as good practice, in the face of the generally recognized principle that concrete must be allowed to set before being subjected to stress and particularly shock and jar, and particularly also where the cement is floated in by means of grout.

"Grout has its proper uses, but it is not generally regarded as good practice to use grout as the only means of injecting cement into the aggregate. The street railway objections to concrete ballast are real and ever present, and should not be so lightly waived aside. It is a fact that the concrete does in time disintegrate, crack and pulverize under the ties and rails, making a very difficult proposition to handle in making repairs.

"There is much poorly paved track in this country to-day. Such track is either worn-out or has been too lightly constructed, but in many cases the worn-out track has admirably served its purpose and we do not believe that these conditions would have been but temporarily improved had concrete ballast been used; certainly the difficulty and expense of making repairs would have been immeasurably increased and conditions existing in and around track which is manifestly too light and temporary in its nature to meet present-day traffic and pavement requirements should not be a factor in determining conditions governing a relatively permanent track.

**Differs with Mr. Compton.**—"We cannot agree in the correctness of Mr. Compton's conclusion, after a little over one year's experience in Baltimore, that the concrete-ballasted track is the solution of the pavement troubles in and around street railway tracks. Any properly constructed track, whether ballasted with stone or concrete, should last perfectly for at least ten years without any attention other than that which is due to the vehicular wear on the top surface of the pavement and in connection with this question of life, it would have been interesting and of value if Mr. Compton had included in his paper a list of cities which have used and are using in whole or in part, concrete as a foundation for track. Some information as to the conditions under which it is being used and also a list of cities which have used it and discontinued its use with the whys and wherefores would be interesting. I am not entirely familiar from personal knowledge with conditions at all of the points mentioned, but have made some investigations in the past few years, and it might be proper to call attention to some of these local conditions as follows:—

**Experience of Municipalities.**—"New Orleans—I have always understood that this city and its streets are literally floating upon soft muck, and that the only way

they can get a distribution of the load is by the use of concrete.

"Buffalo—The street railway here was a pioneer in the use of concrete ballast. I visited this city in 1911 and with their roadmaster walked over some of their worn-out track. The ties and rails had completely cut their way down through the concrete and the trackmen were helpless to remedy the difficulty and make repairs. The two types were concrete-beam and solid concrete, similar to the type now being built in Baltimore. These types were both abandoned and since 1912 they have constructed about 40 miles of track, using a concrete slab upon which the track is being laid and surfaced, using, I presume, a little sand for the purpose.

"St. Louis—Has since 1905 and is still using solid concrete track.

"Boston—The street railway has one and one-half miles of solid concrete and 144 miles of concrete-slab tracks and has abandoned these types and is now favoring rock ballast, though the city's requirements still call for concrete slab.

"Brooklyn—Has only ten miles of concrete track, laid in 1907. This type has been abandoned.

"Chicago—The mileage here is about evenly divided between rock ballast and solid concrete ballast. The street railway people say that the rock ballast has proven more satisfactory and that the pavement has held up better. Their tracks in the heavy business portions of the city are largely built upon rock ballast, the concrete is used when the subsoil consists of prairie muck. Some concrete track built upon a good foundation only after three or four years of service developed a crack through the concrete parallel with the rails along the ends of the ties.

"The street railways in the following cities have abandoned the use of solid concrete track after having used the same for a considerable period and having an extensive mileage: Milwaukee, Rochester, Syracuse.

"Philadelphia—With its more than 600 miles of surface tracks has only about 17 miles of concrete construction, the rest is laid generally upon the natural soil. The writer found in visiting this city in 1911 that most of the concrete had been installed upon the heavy-traffic downtown streets, but not upon Market or Chestnut streets, probably the heaviest, where their standard rail weighing 141 pounds per yard has been laid upon the natural soil, the rail having been equipped with a very good joint. This track at that time had been practically worn out in the service and was still in good line and surface and but few if any pavement repairs were needed. During the same visit the writer found at night a large gang at work upon a recently built concrete track, where the cars had been turned off, the pavement removed to permit of shimming up the rails and filling in with grout under them the trough which had been cut in the cement by the rails."

**Mr. Campbell's Remarks.**—Gordon Campbell, who was the delegate of the American Electric Railway Association to the convention, discussed Mr. Compton's paper extemporaneously, saying:—

"The American Electric Railway Association includes the American Electric Railway Engineering Association, of which the gentleman who has just spoken, Mr. Larned, is a member. This association has a permanent Maintenance of Way Committee, devoting its attention to the study of track questions coming before them and, of course, paving is one of the vital questions. That com-