

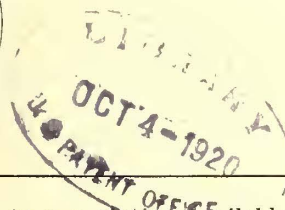
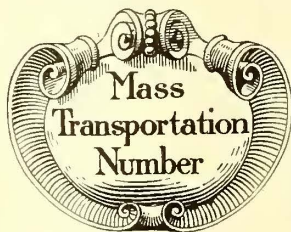
New York, Saturday, October 2, 1920

Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

Volume 56

Number 14



Transporting People in Large Numbers

THIS issue is devoted primarily to the discussion of a number of important city traffic problems. For this reason the name "Mass Transportation" has been selected. The topics treated are rapid transit lines, schedules, speeds, safety car, interurban, bus and commuter traffic on electrified steam railroads. The best way of hauling passengers in large numbers is one of the biggest problems in the transportation world today. We hope that this issue will help in its solution.

The Status of the Motor Bus

SO MUCH has been said and written about the motor bus as an auxiliary it is well to review the general situation. Undoubtedly the experience of the last few years has shown that the motor bus has a place in mass transportation and that its development has only been started. We believe also, however, it has been shown that the street railway companies are the proper agencies to develop the bus. The bus business is 90 per cent transportation, and logic and economics indicate that its development should be entrusted to competent transportation management.

If bus service is to be given in a city in which there is an electric railway system, it should be rendered by the electric railway because the latter already has a transportation organization that is acquainted with the needs of the community; because it can use the motor bus in its proper field and extend its use if developments warrant such extensions, and because thereby it can preserve its investment in street railways against pirate attacks by stock-jobbing motor bus companies.

At the present time motor buses cannot supplant the trolleys for the same length of haul, fare and operating conditions because the cost per passenger-mile is greater for the bus; because streets are not wide enough to accommodate the number of buses required for rush-hour traffic; because, inherently, large crowds cannot be handled with the same speed and comfort in small trackless vehicles, and finally because power is constantly becoming relatively cheaper for the railway due to the increasing cost of gasoline.

Motor buses have a certain field at the present time that should be recognized and developed. The motor

bus makes transportation available in thin territory at a minimum capital cost. The motor bus can give a de luxe service on certain streets on which the trolleys cannot operate. The motor bus can give service on lines that operate only part of the year, such as lines to shore or summer resorts. The motor bus can be used on streets on which trolleys do not operate, to give added direct routes to passengers and to relieve surface traffic congestion. In every case the initial capital cost is lower but the operating cost will usually be higher than in the case of a trolley line, so that the rates of fare should be separate and distinct from that of the trolley line. We also question the advisability of free transfers as this would tend to maintain the old practice which companies had of extending lines without increasing fares.

The bus business is growing rapidly, but there remains room for great improvement in methods and vehicles. The motor bus is neither a street car nor an automobile and requires specialization in design and operation. Given the proper vehicle, the use of the bus then involves the fundamental problems of any system of transportation, and the street railway is the existing transportation authority to use the bus.

Strike Demonstrates Need for Rerouting

ONE of the interesting sidelights of the Brooklyn Rapid Transit strike was the discovery by the public of new routing possibilities. The improvised automotive passenger carriers and jitney buses sought out the short cuts immediately, being limited only by paving conditions. A large portion of the Brooklyn public also became acquainted with the just-opened extensions of the Interborough much more rapidly than if they had been solicited only by advertising, for people are astonishingly slow to try new though faster routes. However, the most striking change was that many people learned perforce that there was no sense in traveling along two sides of a triangle when they could reach their destination by the third side. Strange as it sounds, many learned for the first time that they were living directly opposite their work in the Thirties and Forties of Manhattan and that there was no reason why they should ride to downtown New York before going to uptown New York.

It is only fair to point out, however, that the public is not wholly to blame for failing to take the theoret-

ically shortest route indicated on the map of the railway system. The trouble in almost all of our large cities is that they developed from competitive systems, some of which have too much and others too little trackage for the inevitable shiftings and growth of population. As each constituent company has its own franchises, most logical treatment of the system as a unit in the light of existing conditions is attended with great difficulties, both within and without the organization. The legal staff is always concerned about any changes that may impair franchise interests, the owners of the underlying companies tend to oppose anything that diminishes the physical and operating value of their particular property, while a distrustful administration, like Mr. Milton's Cerberus, may have well-toothed jaws agapé for any action that looks like "putting something over on the peepul." To all this there is but one solution that will go to the root of the matter and not hack around the twigs. That solution is to determine, first, the most satisfactory and economical routing and then work toward that.

Take Advantage of the Speed Fiends

WHEN we read of Ralph de Palma going 400 miles at the rate of 80 miles per hour we inevitably compare this with some speed experienced by ourselves in an automobile or train and then there wells up in our minds an envious desire to emulate de Palma and experience his sensations as we conceive them.

The American, thank heavens, likes speed. Why not capitalize more on this? Speed is a panacea for many railway ills. Earnings depend on the car-miles, but expenses, on the other hand, depend on the car-hours. If each car-hour can produce more car-miles than now expenses are relatively reduced. High schedule speed possibilities are at the base of the street railway structure. To increase schedule speeds involves such factors as rerouting, better track and rolling stock maintenance, double berthing, improved loading methods, use of skip-stops, signals, traffic regulation at street intersections, etc. It is not idle to predict that the transportation agency that offers the highest speed service will predominate in the future, and we believe that the possibilities of higher schedule speeds are not fully realized in the street railway industry.

Inherently the street car is capable of a schedule speed comparable to that of a private automobile due to its quick acceleration and the ease with which it is controlled, and it ought to be possible for the street car to attain the same average speed in city traffic. It is up to the traffic experts to give the vehicle opportunity to realize its speed possibilities. There is no fundamental reason opposing the speed increase, and we venture to say the present rate of speed is due only to the fact that transportation, like Topsy, "just grewed" without any determined or intelligent effort to shape its growth as a co-ordinated unit that involves city planning, pedestrians, automobiles, street cars and everything that makes for congestion of traffic on the surface of streets. We heard a railway manager say the other day, "With just a reasonable degree of effort and at but little expense we increased our schedule speed in the congested districts from 2 to 6 m.p.h." The point is, higher speed is possible. Furthermore, it is a practical means of meeting jitney competition. Finally, it pays.

Certain Criticisms of the Federal Report Considered

COMMENTS on the report of the Federal Electric Railways Commission in the daily press, on the whole, have been very favorable. There has been a general recognition of the existence of an electric railway problem and a disposition to believe that the unanimous decision reached by the commission after its long and painstaking inquiry must be justified by the facts. The report is recognized not as an answer to the electric railway problem, but as an analysis with recommendations, which will prove a valuable aid in the various local situations.

But there has been some criticism of the report in the public press, and, from this, some criticism of the railways which cannot be minimized simply by neglecting it. What criticism there has been is usually based on the argument that the railways are saying their 5-cent franchise contracts should not hold, now that 5 cents is not profitable, whereas they fought for the inviolability of the contract when the 5-cent fare was supposed to be a money maker. There is also the statement that the present plight of the railroads was largely brought about by themselves because of overcapitalization, neglect to provide for depreciation, payment of excessive dividends in the past and the commitment of other financial errors.

Those who take the first position and claim that a franchise, which was accepted perhaps under conditions of four or five decades ago, is an inviolable contract which the company must carry out to the letter, and presumably forever if it is a "perpetual" franchise, should bear in mind certain things. One of these is that the railways also at one time believed that there was such a contract or bargain relation between themselves and the communities which they served, but this idea was largely dispelled when the states generally appointed public service commissions to regulate utility service and establish fair and reasonable rates therefor. At first and naturally the companies were opposed to such a radical change in their status, but the commissions were established, and the railways thereby changed from enterprises largely private in their nature to real public utilities. The change was undoubtedly desirable from all points of view, and the power of the state, acting through a commission to increase fares, in spite of limits mentioned in the original franchises and against the protests of the municipalities concerned, has been generally upheld by the courts.

But let us assume for the sake of argument that there is a franchise contract not rendered inoperative as to fare provisions by the creation of a utilities commission or by some other turn of events. Let us assume also, as is the case at present in practically all cities where the fare has not been raised, that owing to the increased costs of operation the company can supply transportation only at a loss. The railway becomes in consequence an unprofitable enterprise without credit, possibly in the hands of a receiver and utterly unable, of course, to make extensions or other improvements which the community really needs. In these circumstances, the only logical policy to follow for any city which wishes to grow and prosper is one which will put the utility on a real business basis. Thus it is obviously in the interest of every community to replace any "contract" to supply electric railway service at an unremunerative rate, if such a contract exists, with one

which will enable the city to get what it wants upon payment of a reasonable fare.

As for overcapitalization and payment in the past of excessive dividends, they hardly affect a settlement which is based not on capitalization but on the value of the property used and useful in the public service. Recognition of this fact ought to do away with any misunderstandings on the relation of capitalization to income.

In its working out, some holders of stock may find that they have paid more than their holdings are now or ever were worth, and some will have to suffer therefrom. The sooner that railway companies, who need to do so, can effect such financial reorganizations as are necessary to convince the public that they are not paying excessive returns on some old investments, the better for both railways and public. But the prime factors the public is interested in, service and rates, are not affected by the nominal capitalization.

Finally, there is no doubt that past neglect of the companies to provide for depreciation and obsolescence has undoubtedly been a costly error, but it, too, is one from which the present stockholders rather than the public will suffer in connection with any fare based on the present value of the property.

Henry Ford's Price Bomb

HENRY FORD'S mid-September announcement of a return to pre-war prices is of almost as great significance to the majority of electric railways as it is to the majority of automobile manufacturers. We can let the latter do their own worrying, but what does it mean to us? Obviously, that electric railways in all but a few large cities will have to run their undertakings on strictly business principles. The idea that the sky's the limit as regards fare increases must give way to the cruel fact that a great many people don't have to ride and that they and many of their friends and acquaintances can walk or else ride in their own vehicles. No matter how widely railway operators may differ as to the results of fare increases, it hardly needs to be argued that there is an economic limit. That limit is not far away when less than \$500 will buy a touring car which is sickeningly cheap to run and maintain. Of what value are service-at-cost or sliding scale fares if the patron may take such easy recourse to something else?

But, of course, if we are willing to run the electric railway on business principles we will see in this reduction of automobile prices only another incentive to give the community what it must have in any case, *i.e.*, co-ordinated, rain or shine transportation. It may be a novelty to us to see the individual manufacturing his own transportation, as it were. It's no novelty to the great baking companies which have succeeded in proving to millions of housewives that it is preferable to be able to buy their bread and cake at any time in any quantity than to go to the trouble of home baking, even if Madame Housewife does make fancy pastry now and then. Have we no parallel arguments to offer as to the difference between using an automobile every day and using it only where the electric railway is unavailable or inconvenient? If we have not, then we deserve to be condemned for expecting prosperity to come of itself.

Making Short Walking Distances Seem Long

ONE of the most unfortunate results of the American unit-fare practice was that operators had no way of learning whether any noteworthy percentage of their public was riding easy walking lengths. However, as we have pointed out from time to time, higher schedule speed and frequency of service are also major factors in the development of short riding, although only a costly traffic survey would "legally" prove that statement on a unit-fare system. It seems fanciful to believe that a person traveling part of a mile would be influenced by a difference in schedule speed amounting only to the saving of 2 or 3 minutes, yet that is human nature, else why do thousands of people brave apoplexy or heart failure to catch one car when there is another right behind? The temptation to save time first and then dissipate it afterward appears simply irresistible. That frequency of service also builds up short riding will hardly be disputed, even by the most conservative, for the records of safety car operation on shorter headways can lead to no other conclusion.

Perhaps, if a philosopher or psychologist were asked to analyze the reasons that lead walkers to become riders, he might tell us that all distance is purely relative; that if a man were walking a mile against a procession of horse-drawn trucks he would not feel that he was going either a great distance or that he was moving much slower than the other traffic. Contrariwise, if a man is walking the same distance against a flight of fast cars or automobiles shooting by him at the rate of one a minute he will get the idea subconsciously that he is in the same class with the snail and the tortoise. What is more natural than that he should think the distance longer than it really is and that he should desire to board one of the vehicles whose speed is offending his ego? The capitalization of this principle is worth the careful consideration of every transportation purveyor.

Advantage to One Side Is Disadvantage to the Other

ONE strong point made by the proponents of the motor bus as an advantage which it possesses over the trolley car as a transportation agent is that there is no investment in property not easily removable, in case conditions should prove unfavorable. This is undoubtedly an important benefit for the operating company, as is shown by the ease with which certain municipal buses were taken off in New York City when the court ruled that they were operating illegally, and also when the city's Staten Island line was discontinued.

But how is this freedom of action so far as regards the community served? With an electric railway on the streets a community is pretty sure of continued service, as otherwise the company would have to abandon a large proportion of its investment. There is consequently much greater assurance to property owners that they may develop their property with the expectation of continued transportation service than if, owing to changed business conditions or other circumstances, the company could remove its entire investment in a day. These facts should be borne in mind by every city when considering the relative advantages of railway and bus service.



One of the busiest traffic centers in New York City, the junction of Broadway, Sixth Avenue and Thirty-fourth Street

At this junction there are an elevated railway, three double-track surface railways and the subway of the Brooklyn Rapid Transit Company. Within 100 yd., or at Thirty-third Street, the northern terminal of the Hudson & Manhattan Railroad is located, while far underneath at Thirty-third Street and

Thirty-second Street are the four tubes of the Long Island Railroad and Pennsylvania Railroad, joining Manhattan Island with Long Island. These various means of transit furnish transportation through this district, which is one of the busiest in the city, at five different levels.

Capabilities of each transportation agency outlined. Effect of geographical distribution on transportation conditions. Trend in rapid transit development

Functions of Rapid Transit Lines in Cities

By *Henry M. Brinckerhoff*

of Parsons, Klapp, Brinckerhoff & Douglas, Consulting Engineers, New York



View on Broadway near Sixty-fifth Street, New York, where the Manhattan Elevated crosses the West Side division of the Interborough Subway

THE average visitor and most residents if asked how the people habitually travel about New York City will answer, "The vast majority on the subway and elevated lines, a smaller proportion on surface cars and a few on buses." This popular conception of the situation is largely due to constant newspaper discussion of subway congestion and the vivid impression made by long crowded trains following one another in quick succession at subway and elevated stations during rush hours.

Studying the statistics over a period of years, we find, on the contrary, that the surface car has borne the great burden of transporting the bulk of the citizens of our large American cities and that only in the past few years has even New York carried one-half of the total daily passengers on its rapid transit systems. This division of the growing New York travel during the past forty years is interesting, particularly as related to the population of the city. Other cities in the United States are now approximately the size that New York was thirty or forty years ago and, growing rapidly, they have ahead of them the probability of the same or similar traction problems.

In 1880 we find that 79 per cent of the passengers on the transportation lines of what we now call Greater New York were carried by surface cars, the population then served comprising about 2,000,000 people.

In 1900, twenty years later, the ratio was still 70 per cent surface car passengers to 30 per cent carried on

rapid transit lines, while the population served had grown to about 3,500,000.

Almost another score of years brings us to 1919, when, after the expenditure during this latter period of more than \$550,000,000 for subways, third tracking and extending elevated lines and additional rapid transit equipment, we find 43 per cent of the passengers still paying their nickels for rides on surface cars.

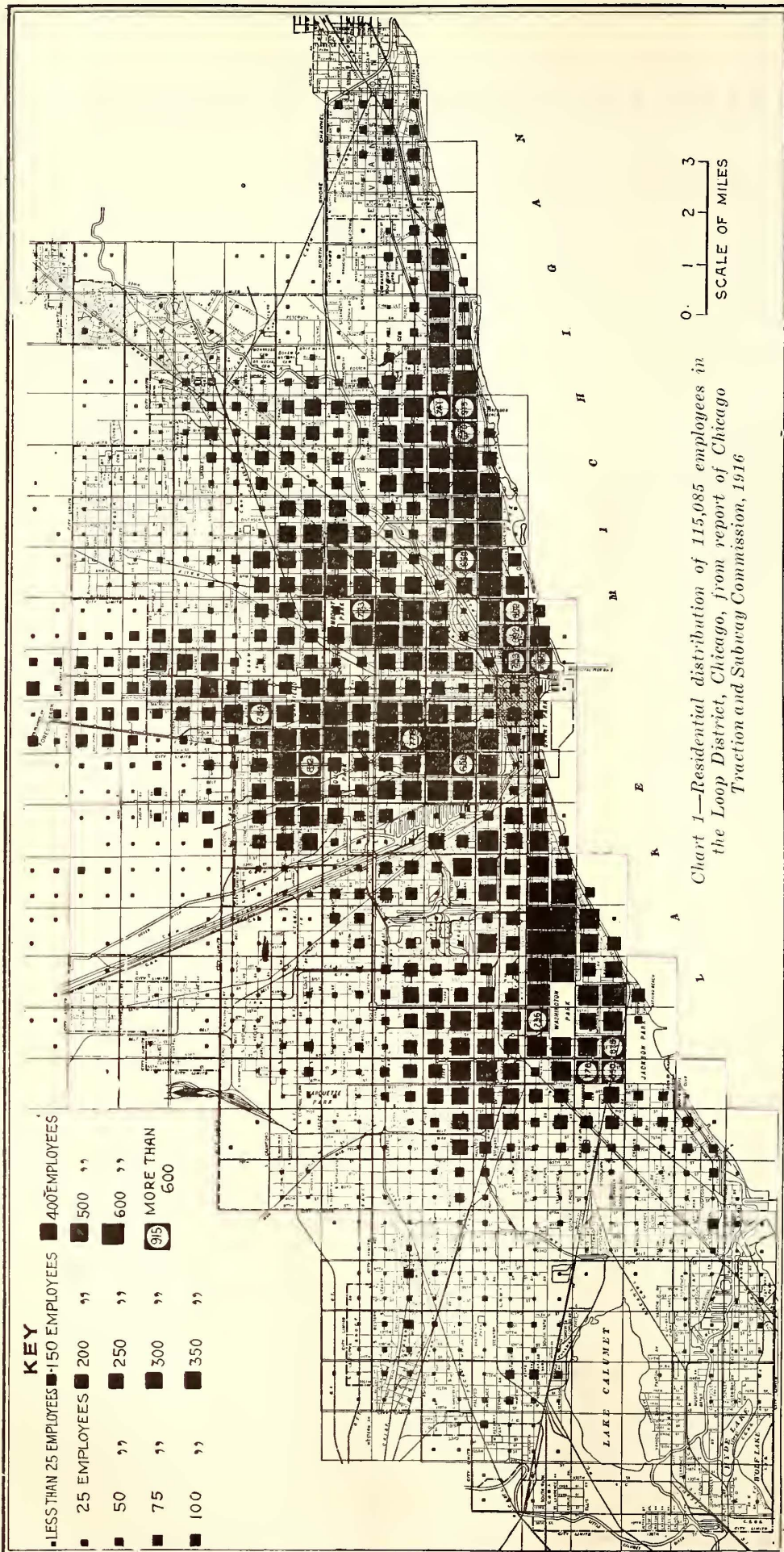
This condition is not peculiar to New York, as we shall see by a study of the history of transportation in other large cities.

In Chicago in 1906, with a population of about 2,000,000, 75 per cent of the revenue passengers were carried by the surface cars, and in 1919, with the population increased to about 2,800,000, 75 per cent of the people are still patrons of surface car lines.

In Philadelphia the Market Street elevated-subway line, with its free transfers between rapid transit trains and surface cars, makes a good showing in passengers carried per car-mile, but as part of the entire city lines it carries not more than 10 per cent of the passengers served by the whole system.

In Boston the surface-subway-elevated lines are so interconnected and the movement of passengers is so complicated by transfer privileges that a division is difficult. However, the proportion of the passengers actually handled here by surface cars is still large.

Turning to England, where the conditions of city development have been quite different, we see in London



an even wider variety in the division of the passengers among the different classes of carriers, but still the rapid transit not in the majority. Here the motor bus (successor to the time-honored horsedrawn vehicle) assumes imposing proportions. The ratios of passengers carried may be taken as about 27 per cent on tram or surface cars, 33 per cent on motor buses and 40 per cent on rapid transit trains.

Greater London, with an area of almost 700 square miles and a population of about 7,250,000, carries one-third of its traveling public about the city in motor buses operated in crowded, heavily trafficked streets.

Greater New York at the other extreme, with a population of almost 6,000,000, distributed over about 327 square miles, or one-half London's area, carries 55 per cent of its city riders on rapid transit lines and not more than 2 per cent on buses.

Chicago, with a population of almost 3,000,000 and an area of about 200 square miles, carries 75 per cent of its travelers by surface cars, while Detroit and Cleveland, now at the 1,000,000 mark in population, are entirely dependent upon surface car transportation.

With such contradictory general facts before us we must apparently go to a more detailed analysis of conditions to draw any valuable lesson from past experience in the large cities of the world. In doing this the first question that presents itself is whether the study of existing systems will be of fundamental value in guiding us to a solution of modern transportation needs in a large city in accord with present-day thought.

Here appears to be the crux of the question. The existing transportation facilities in large cities are the result of private initiative; building for years along lines where greatest

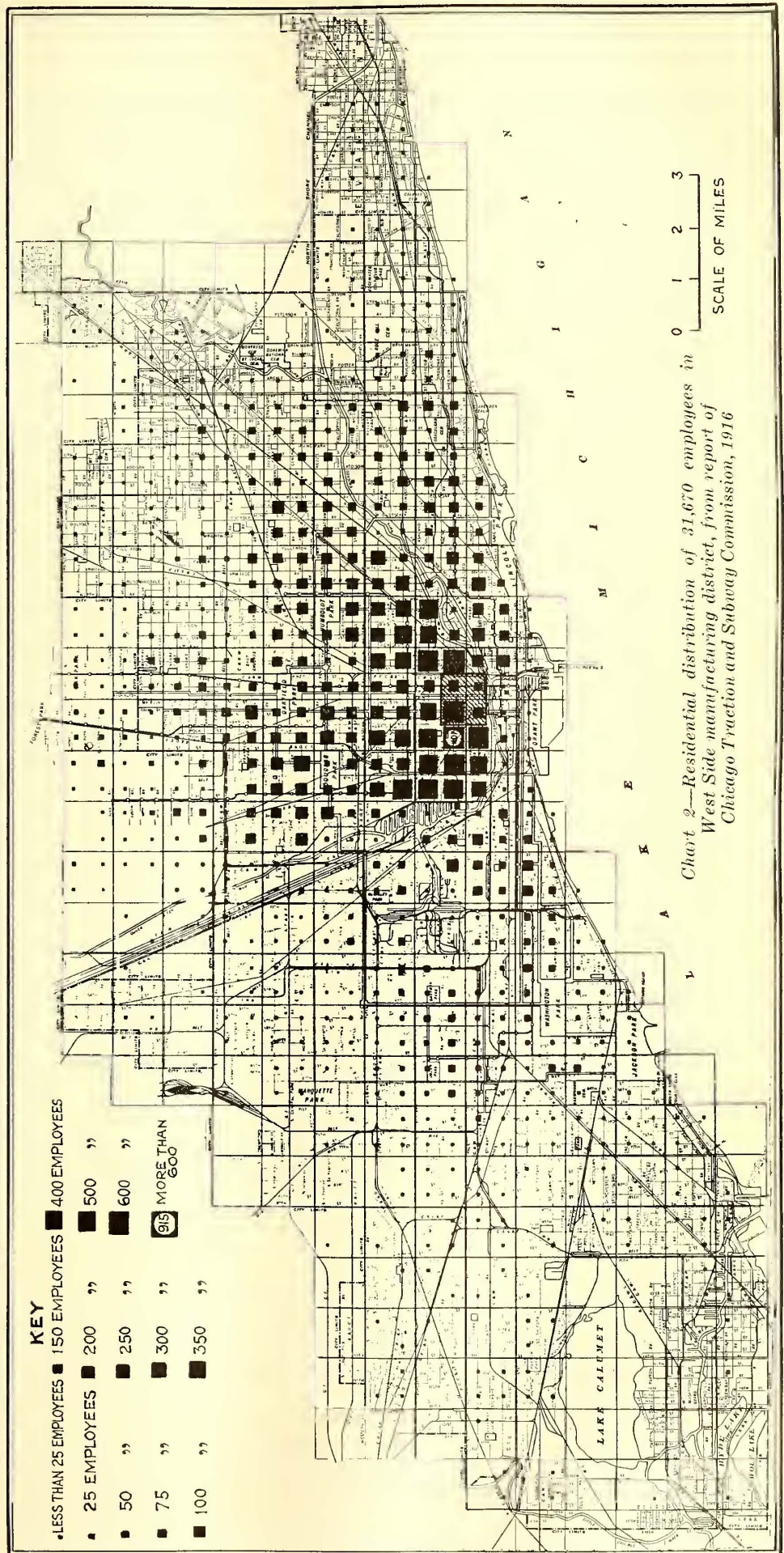
pecuniary profits were to be reaped. Only recently has this guiling motive been supplemented by effective public control, and this has often been directed to meet certain specific needs rather than a general solving of the whole problem.

We are today at a point where a broader view must be taken of city transportation planning in the interest of the traveling public's needs and convenience. The public must pay for the service directly or indirectly, but it must get what it pays for. The idea of the most profitable type of location of lines is therefore no longer absolutely controlling and we are face to face with the problem of supplying transportation to our large cities, as recognized a public necessity as water supply, paving and sewerage. The fact that an adequate circulatory system for a city's red-blooded working units is as necessary for civic growth and health as is a sound arterial system for the human body is becoming more generally recognized. In the solving of this problem city and company must co-operate to overcome the physical, financial and legal obstacles that will be met.

The time has come when a hearing can be obtained for an analysis and discussion of the complex elements of transportation from the viewpoint of the needs of the city as a whole. The purpose of this article is to point out the uses of subway and elevated lines with such a broad view of the situation in mind, but in doing so references to other forms of city transit are necessary to maintain a balance and completeness in the picture.

The real need for extensive transportation facilities in a large growing American city arises principally from the desirability, or often the necessity, for the individual workers' to

¹The term workers is used in this article to denote any wage earner or person having regular employment or business and consequently regular habit of travel.



live beyond walking distance from their place of employment. The hauling of these people to and from their work constitutes the great bulk of the rush-hour traffic, hence a careful study of their riding habits is a valuable index to their transportation needs.

A canvass of the principal factories of the city of Cleveland showed that 52 per cent of their employees lived beyond the walking distance of 1 mile from their shops. Detroit showed 71.8 per cent, and a canvass in Chicago, locating the homes of 350,082 wage earners

travel from their home center in many different directions seeking employment. It is the aggregation of many thousands of such families which creates the diversity in the transportation demands of our large cities.

The Chicago residential canvass when compared with a simultaneous traffic count on surface and rapid transit lines showed that the origin and destination of the daily trips of 50 per cent of the individuals composing the rush-hour crowds had been determined. As an indication of the probable proportion of these rush-hour travelers who require rapid transit, a charting by ¼-mile districts showed that 44.3 per cent made trips to and from work of more than 3 miles and 31.6 per cent of more than 4 miles. The rapid transit lines of the city carried 22 per cent of the total traffic against 78 per cent on the surface cars on the weekdays checked, while for the calendar year the ratio was 25 per cent to 75 per cent.

Adopting the generally accepted idea that more than 3 miles constitutes a legitimate rapid transit ride, the inference is that the elevated lines were inadequate or some other elements influenced the result beyond the mere question of distance. It was found that the principal element was "time," and its closely related factor "direct routing." By means of transfers from line to line the surface system offered routes particularly crosstown, which saved time over less direct although higher speed rapid transit lines.

To determine the time factor the Chicago Loop District was selected and 115,085 workers of all classes employed in this crowded city center were located as to residence, as shown on Chart 1, on which each black square indicates by its size the relative number of workers residing in that ¼-mile area who were employed in the Loop District. These for our purpose can be classified as shown in Table I.

Analyzed by distances from home to work, the division was as shown in Table II.

Deducting the walkers in the last tabulation, it is seen that 39.1 per cent rode 4 miles or less, which closely matches the surface car percentage shown above.

The analysis of this office and retail district canvass gave a good idea of the division of riding of the classes most easily attracted to rapid transit by reasons of ability to live in restricted residence districts and working short hours. A similar analysis of the immediately adjacent factory district west of the river (Chart 2),

TABLE I
Occupational Distribution of Workers in Chicago Loop District

Occupation		Transportation Used	Per Cent
In office buildings.....	32,113	Elevated R.R....	64,847 56
Department and retail stores.....	32,755	Surface cars.....	43,344 38
Clothing manufacturers	10,045	Steam suburban.	3,921 3.4
Banks and general offices.....	26,622	Walkers.....	2,973 2.6
Printers and engravers.	3,304	Total.....	115,085 100
Miscellaneous.....	4,378		
Wholesale dry goods..	5,868		
Total.....	115,085		

from all classes of shops, factories, retail stores and office buildings, showed 75.6 per cent living beyond 1 mile and therefore dependent upon transportation to earn their living.

An exhaustive detail study of the transportation habits of the people of a large city involves a great amount of work and the co-operation of many interests and has not often been undertaken. The most recent complete collection of data of this kind is contained in the report of the Chicago Traction and Subway Commission of 1916 and the figures there developed will here be used as illustrating the basis of the division of riders between surface and rapid transit lines and the causes influencing their choice of routes.

ANALYSIS OF CHICAGO TRANSPORTATION NEEDS

An analysis of the Chicago residential canvass, which covered all employment centers within the city area, showed a wide scattering of nearly all classes of workers over the many residential districts of the city. Thus it was possible to prove the almost universal need for transportation and also the great diversity of routes

TABLE II
Classification of Chicago Loop Workers by Distance Traveled

Total	0-1 Miles %	1-2 Miles %	2-3 Miles %	3-4 Miles %	4-5 Miles %	5-6 Miles %	6-7 Miles %	7-8 Miles %	8-11 Miles %	11-14 Miles %	Over 14 Miles %
115,085	3.7	11.0	11.4	15.6	15.7	12.9	10.5	7.6	6.2	1.7	3.7
Accumulative total, per cent.....	3.7	14.7	26.1	41.7	57.4	70.3	80.8	88.4	94.6	96.3	100.

and combinations of car lines used by people in a single residence district in reaching employment centers, and vice versa the widely separated localities from which the factories drew their workers.

The American wage-earning family averages five persons, father, mother and three children, of whom three are usually workers. Unlike families in England or on the Continent, the children in America do not as a matter of course learn the trade of the parents, but each follows his own bent, with the result that they

including 31,670 workers, showed 16.7 per cent walkers, while 53.6 per cent lived within the 3-mile limit and 69.8 per cent within 4 miles of their shops, 83.3 per cent in this factory district being dependent on transportation.

The difference in these two sections lay almost entirely in the character of the people employed. The average for the whole city was: Walkers (under 1 mile), 24.4 per cent; those living within 3 miles from work, 55.7 per cent; within 4 miles, 68.4 per cent; the per cent of

workers daily using transportation being 75.6 per cent. When rapid transit routes are laid out, therefore, the character of the population to be served is an important element to be considered.

A special inquiry into time-saving covering 6,000 of the above workers in the Loop District (Chart 1) supplied the data for the curve shown on Chart 3. The individuals inquired of for this purpose were selected because they were as conveniently located for reaching either surface or rapid transit lines. They were also distributed over a wide area and at varying distances up to 16 miles from the Loop. This chart therefore gives a good idea of how people of this class divide on the question of time saving in a city like Chicago, other conditions being substantially equal.

TRANSFER FACILITIES

When the original Interborough Subway was laid out many loud criticisms were made of the local and express transfer stations, voicing the idea that on short trips people would not trouble to change cars. Today exchanging from local to express trains and back again for a saving of even a couple of minutes is so common as to have become almost a vice of the New Yorker.

On one surface car line in Detroit a traffic count showed that 85 per cent of the passengers either transferred to or from other lines, only 15 per cent of those carried starting and ending their journey on the line itself. At the City Hall in Detroit the Woodward Avenue line received or delivered 57,817 transfer passengers daily who utilized ninety-two different combinations of routes at this point. A similar condition exists at the Public Square in Cleveland, where 79,451 transfers were observed in twenty-four hours, more than 100 different combinations of lines being used.

The Chicago investigation showed clearly that the transfer privilege at more than 545 intersections of surface lines was a great factor in determining the routing of passengers; from 10,000 to even 25,000 transfers occurred daily at single intersections. Many groups of large numbers each were found who took the first leg of their journey on a nearby surface line and transferred to another surface car, running parallel to a rapid transit line, for a 4, 5 or 6-mile ride.

Careful study of complete twenty-four-hour checks of passengers on the surface and elevated lines of Chicago clearly demonstrated that these two large competitive systems serving a population of more than 2,500,000 distributed over 200 square miles of territory, due to their lack of co-ordination, did not function in such a way as to give the best service of which they were capable.

When the problem of enlarging the Chicago city transportation system as a whole was attacked by the commission it became still more apparent that additions to the existing systems on a basis of unified operation not only gave more capacity for a given expenditure but provided a greater variety of convenient routes to riders and would also be more economical to operate.

Transportation is a necessary function of a city's life as a whole. It is not confined to districts, classes of people or occupations. It is as democratic and cosmopolitan as the population of the city itself. Such being true, a division into separate lines serving only portions of the city is purely artificial, and the result of a system of development of these facilities by in-

dividuals largely influenced by hope of profit and with capital limited by the assurance of a return on their investment has been piecemeal construction.

When taken up from the viewpoint of the interests of the entire city's traveling population the proper arrangement to accomplish a complete solution is a single unified system the elements of which will each give the maximum of service at the least cost, both capital and operating. It is not within the scope of this article to discuss the many legal, financial and other obstacles

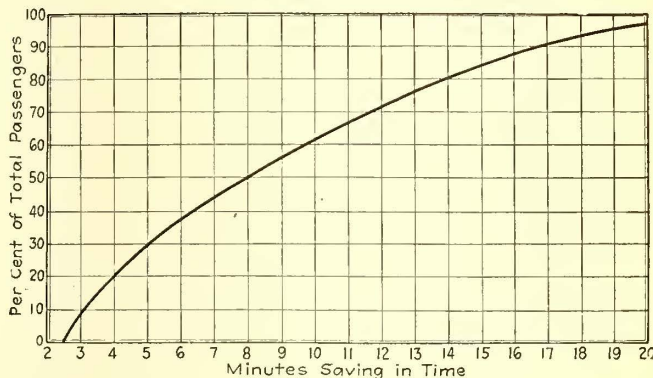


Chart 3—Percentage of total passengers using rapid transit for various savings in time when both surface and rapid transit lines are available

(From report of Chicago Traction and Subway Commission)

to accomplish a general unification of all transit facilities. However, the function of subway and elevated lines is so dependent upon their relation to the other modes of transporting city passengers that whether they should properly be considered as competitive independent systems or should function as part of a harmonious whole seems to warrant the foregoing discussions.

MOTOR BUS, SURFACE, ELEVATED AND SUBWAY LINES

In order to consider the relative value of these four kinds of service in a complete unified city system it is simpler to compare ratios of cost or performance freed from local conditions. Present cost of construction, operating expenses, etc., are so abnormal and are changing so frequently even on the same system that direct comparisons are misleading without a multitude of explanations. For our purpose the following general statistics are typical of good American practice on average large city systems:

Maximum Passenger-Carrying Capacity per hour.—One way, one track: Bus, 1; surface, 1.7; elevated, 6; subway, 7.

This means that large two-car units on surface lines will carry a little less than twice the bus line under similar street conditions. The elevated with eight-car trains will supply six times and a subway with ten-car trains seven times the bus line passenger capacity. This is on the basis of allowing for standees, large cars and maximum peak load conditions.

Speed in Miles per Hour.—Average city conditions (Fifth Avenue Coach Company, 8½ miles per hour): Bus, 1; surface, 1; elevated, 2; subway, 2. The surface cars and buses are about equal in average speed and the elevated and subway twice as fast.

From these two items it is plain that where large crowds are to be handled and the haul is long the subway and elevated are immensely superior, having

seven times the capacity of a bus line and twice the speed. As the presence of large passenger crowds means usually street congestion, these types have the additional advantage therefore of not occupying street space.

Cost of Operation per Car-Mile.—(Fixed charges excluded.) Subway, 1; elevated, 1.2; surface, 1.8; bus, 2. Here the economy of train operation with infrequent stops and on an easily maintained unobstructed right of way places the subway at the top of the list.

Operating Cost per Passenger Carried, 1919 figures.—(Fixed charges excluded.) Subway, 1; elevated, 1.2; surface, 1.4; bus, 2.6. This proportion is taken from averages of the actual 1919 figures of American systems so far as they can be brought into direct comparison. In these figures there is of course reflected the length of haul, in which regard the rapid transit lines have the worst of the bargain as they carry their passengers probably twice as far as the surface and three or four times as far as the bus lines.

Capital per Mile of Line.—Bus, 1; surface, 2; ele-



The completion of the third track on the Ninth Avenue line added greatly to the carrying capacity.

vated, 12; subway, 36. Here the bus line makes the best showing, with the surface line at double the cost and the subway three times that of the elevated.

SUBWAY, ELEVATED AND SURFACE LINES COMPARED

On the face of these figures the subway costs thirty-six times as much as the bus lines and has only seven times the passenger capacity. If, however, the two are compared by requiring the buses to move the subway load, seven lines of buses would be required and a total street width of 230 ft., or four times the width of Fifth Avenue at Forty-second Street. If this widening were charged against the bus system the cost would be fabulous. Similarly, if a subway were built to carry a load of 7,000 passengers per hour, one train every ten minutes would carry them and the fare would have to be ridiculously high to cover the enormous fixed charges. The fact is that such direct comparisons are futile and go to prove that each of these systems has a limited field of its own. Each type should be used for the service to which it is peculiarly adapted and if properly incorporated as part of a single system will reach its maximum effectiveness and efficiency.

In view of these comparisons, it is quite apparent

that subways should be confined to the main arteries of the city system and so far as possible to the densely trafficked districts. As the elevated form of structure supplies the same passenger capacity and speed as the subway the logical plan in the interests of economy is to come to the surface with the subway and extend the service by elevated wherever the building and property damage is not too great. Much talk was indulged in a few years ago advocating the taking down of the elevated railroads in New York, but today with the express service on the third tracks no one could conceive of abolishing this system and replacing it with subways at three times the cost.

When people speak of subways they visualize the New York ten-car train system in rush hours and when they mention elevated lines they think of the old Ninth Avenue, New York, or the Chicago Union Loop lines with their unsightly appearance and noise.

It is a pity that this latter conception cannot be supplemented with more up-to-date possibilities. In a city like New York, with its multiplicity of traction companies, its narrow and infrequent north and south streets and its unprecedented volume of rush-hour traffic, four-track subways paralleling one another may be justified, but in other cities whose rapid transit history is still to be written quite another procedure is not only possible but necessary.

Subways as such have no inherent virtue. They are, as we have seen, three times as costly to build as elevated lines and eighteen times as costly as surface lines. Why then should we not take the surface line, which usually exists and which the subway will parallel, and leaving it on the surface of the street as a local service transfer vertically to the subway express service below.

CONSOLIDATION OF VARIOUS SYSTEMS DESIRABLE

By utilizing the surface lines as local and feeder lines and transferring long-haul passengers down to subway or up to elevated express trains a vast saving can be shown over the building of a competing rapid transit system. This latter, if competitive, must draw its patrons from the limited territory immediately adjacent to its own lines. This lack of transfer surface feeders is one of the causes of the beehive type of apartment housing in New York.

In a radial city like Chicago or Detroit the building of rapid transit lines to all outlying sections is financially impossible. The intermediate areas between trunk lines will be well served by surface lines with transfers to these rapid transit lines.

Such a single system, it can be shown, will give greater facilities than two competing systems and at a far lower cost per capita.

The consolidation of city systems has been frowned upon by some people because it creates a monopoly, but with proper public control this is just the very element necessary for success in giving all classes of people the vast multiplicity of services called for by the activities of a big city.

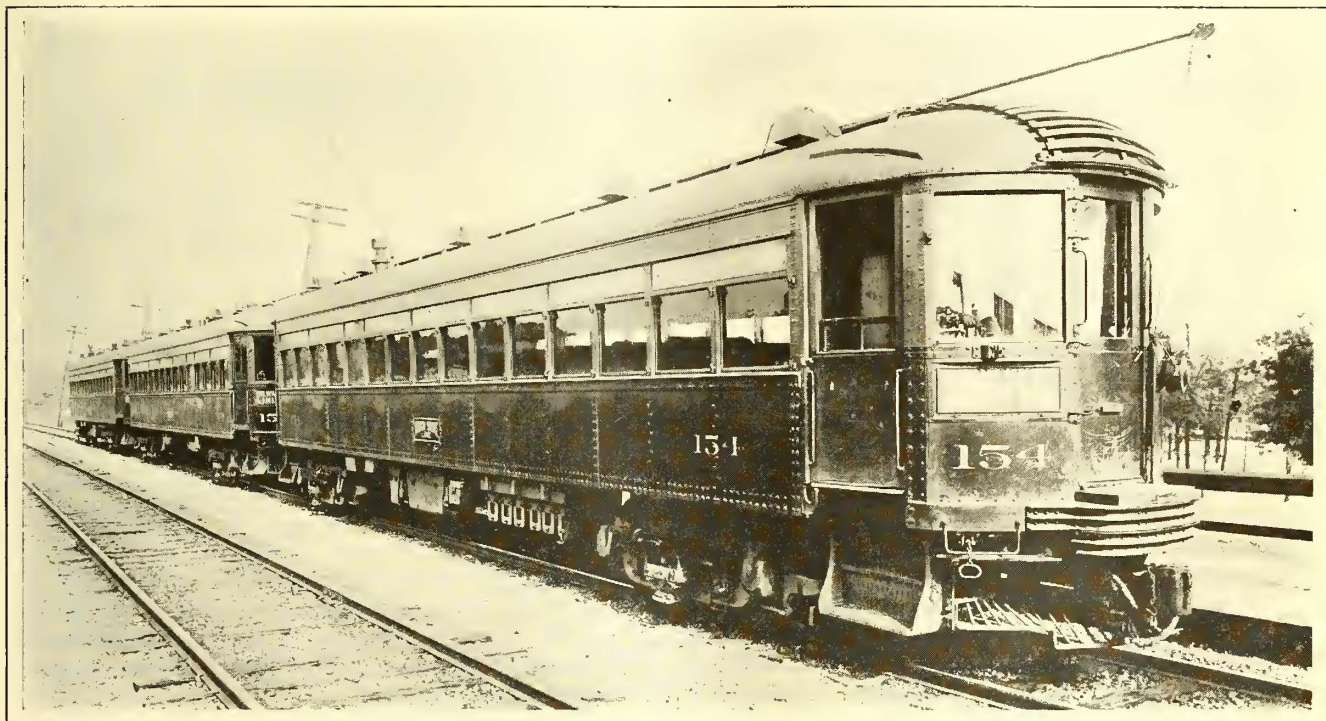
The dismemberment of some of the consolidated New York Traction groups is an object lesson pointing the way in the opposite direction. Subways and elevated lines are necessary parts of the traction system of a great city, but they should have combined with them surface and bus lines as feeders, all functioning as part of a single system.

The operating policies that attract patrons are discussed. Better freight service at higher than steam road rates makes wonderful opportunity

The Possibilities of Interurban Railroads

By Britton I. Budd

President Chicago, North Shore & Milwaukee Railroad, Chicago, Ill.



The North Shore all-steel car limited trains have won many new patrons

THE success of an interurban railroad is measured by the quality of the service it is in a position to give the public. To meet the competition of the steam railroad the interurban line must have many of the characteristics of the steam road and adopt many of its practices and methods. Men in charge of operation of interurban railroads must get away from the idea that they are operating a street car line. That idea has too long retarded their growth and development in many localities.

The traveling public in this generation demands speed. The cost of transportation to most people is a secondary consideration. They are willing to pay a reasonable price if they are given the service they demand. On the other hand if they are not given the service they will not patronize a road no matter how low its rates may be.

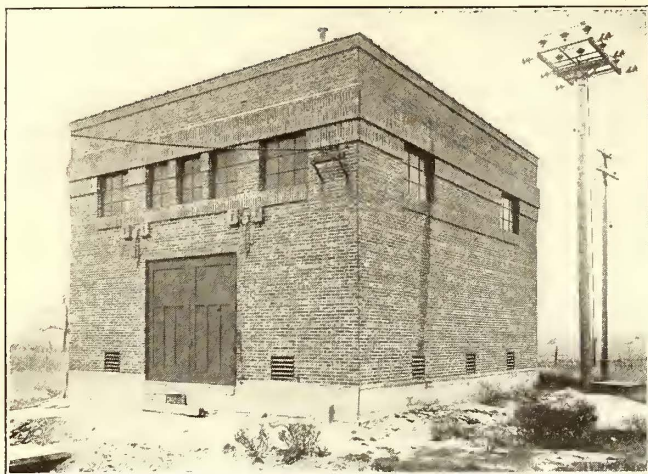
In order to give the service demanded the interurban railroad entering cities of considerable size must have suitable trackage rights and adequate terminal facilities. Most of the interurban railroads in the country today lack such facilities, and that is the greatest handicap in the way of their development. It is one of the problems which must be solved if the interurban railroad is to develop and increase its usefulness to the public.

This serious handicap of the interurban railroad is

generally due to bad engineering in the early days of the electric line. In making that statement I mean no criticism of the early engineers. The bad engineering to which I refer is more often the result of the early engineers having been compelled to follow the line of least resistance and select the most inexpensive route than it is to their lack of foresight or poor judgment. But the fact remains that the trackage facilities of interurban railroads in most cities necessitate low rates of speed and thus throttle the possibilities for expansion.

The operating and engineering methods and practices of street railway companies are not applicable to an up-to-date interurban railroad. The operating methods of a well-conducted steam railroad are greatly superior to those of the average electric railroad. The latter have been developed from the experience gained in street railway operation and still partake of some of the characteristics of the horse-car days.

The character of the service demanded by the interurban railroad is very similar to that of the steam railroad and the same methods of operation must be adopted if the support and approval of the public are to be attained. On entering a city an interurban railroad should not give a local service. The route of least obstruction, where the highest speed can be maintained,



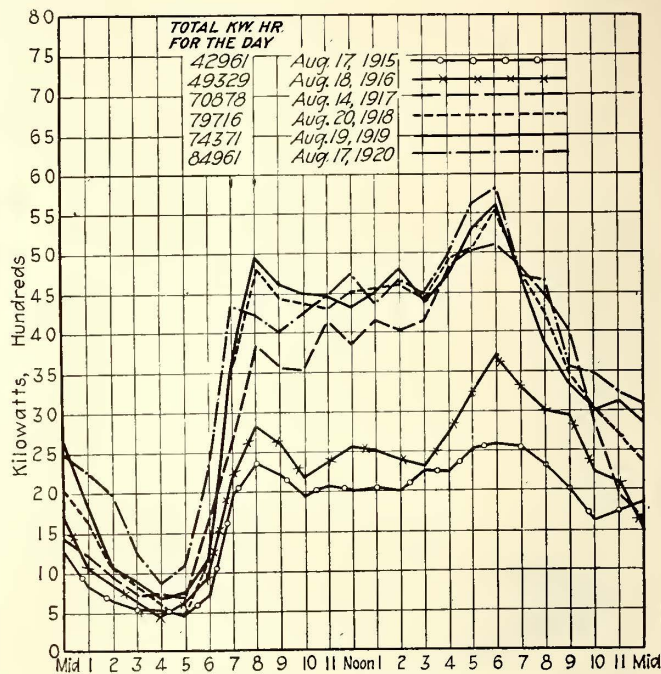
One of the automatic substations which have contributed vitally to the character of service

should be selected and stops should be reduced to a minimum.

To maintain the high rate of speed essential to the success of the interurban railroad today great attention should be given to tracks and roadbed. Short radius cross-overs, turn-outs, wyes and sidings should be avoided. They consume time, rack the equipment and make the passenger uncomfortable. The automobile has produced a change in the mind of the public with respect both to speed and comfort, and the electric railway must, as nearly as possible, measure up to the modern standard of comfort and speed.

The roadbed of an interurban railroad is of the utmost importance where high speed is required. It is the very foundation of the business. The roadbed should never be neglected. In building many of the electric lines not enough attention was given to the work of tiling and ditching. The result is defective track, making high speed impossible and contributing to the loss of patronage that necessarily follows.

The public is more sensitive to track conditions than most operating officials realize. If the roadbed is not well maintained by constant tie and rail renewals, good ballasting and thorough drainage, its condition soon becomes a matter of comment and discussion among patrons. If the public forms an opinion that the track



The load curves indicate the growth as well as the character of the business of the road

is not what it should be the company will find it extremely difficult to overcome that prejudice. It is extremely important that such an impression should not be formed, and the only safeguard against it is the proper maintenance of the roadbed.

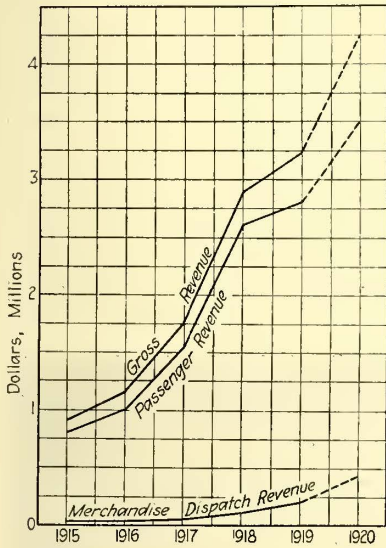
Most interurban railroads spend money in advertising. While I am not opposed to newspaper advertising



All-steel car designed to give the speed that has been an attractive feature of the North Shore service

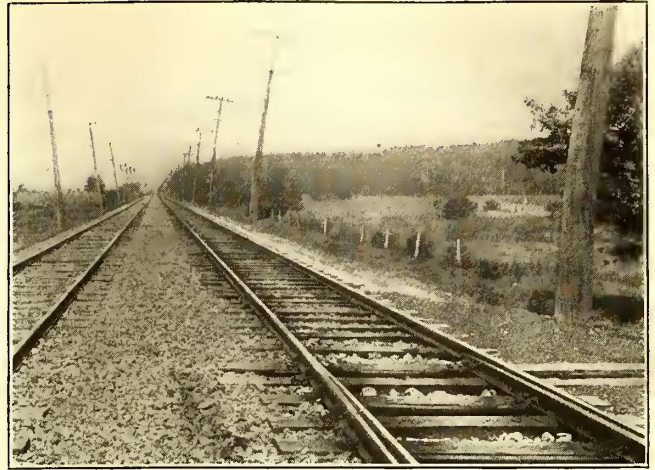
and publicity of all kinds, I am convinced that the best form of advertising is giving the public real service. Glowing advertisements may, and I think they do, help to draw business, but unless a company actually "delivers the goods" it will not hold the business which its advertising may bring. Pleased patrons talking among their friends of the good service given by an interurban railroad are worth a great deal more to a company than paid advertisements. The public cannot be fooled by alluring pamphlets. They demand service, and when they are given that their good will and patronage will follow.

An interurban railroad operating a n y considerable distance should make an effort to fit its service to meet the transportation needs of the people of that particular section. In order to obtain the business of traveling men it may require provision for carrying baggage. It is not infrequent that considerable business is lost to interurban railroads due to lack of this accommodation. This is true of theatrical folk as well as traveling men. Dining



The merchandise dispatch has increasing importance in rapidly growing revenues

car service is also a requirement of business men and traveling men, for it economizes their time. If dining car business is attempted it should be the effort to furnish exceptional service and satisfactory meals. If this is not done, instead of attracting patronage it will have a detrimental effect. Only experienced chefs and waiters should be employed and the strictest attention should be given to the sanitary condition of car kitchens.



The kind of roadbed that makes possible the kind of service that sells

The electric railways of the country have suffered and still suffer from a great many circumstances over which they have no control. But they also have suffered from causes that are within their control. Certainly the industry has enough to meet in the way of real problems without having to meet needless criticism. No matter how poor a property may be, how inadequate its facilities or how much it may be hampered for lack of money, it still can be operated efficiently, at least as efficiently as the circumstances will permit, and give reliable service.

Transportation of merchandise can be conducted successfully on an interurban railroad at rates higher than freight rates on steam railroads, provided the service is better than that on the steam road. It is not necessary for the interurban road to have a pickup and delivery service in order to obtain higher rates from shippers if the quality of the service warrants the higher charges. There are so many objections to a railroad carrying on a pick-up and delivery business that it is not necessary to go into the subject in detail. In the handling of merchandise the interurban railroad must adopt the most up-to-date methods of soliciting, billing, notifying the shipper and adjusting claims



The cars have a comfortable seating arrangement and an inviting interior



An excellent dining car service has attracted many business men who might otherwise patronize steam lines

TABLE I
Merchandise Dispatch Revenue, Chicago, North Shore & Milwaukee Railroad

	1915	1916	1917	1918	1919	1920
Jan.....	\$521	\$853	\$315	\$7,502	\$9,303	\$26,354
Feb.....	495	1,159	244	13,028	6,504	32,547
March.....	590	652	2,381	7,132	8,515	33,341
April.....	390	1,186	2,220	8,259	12,340	40,179
May.....	1,734	2,720	2,732	7,700	18,658	36,157
June.....	1,949	2,986	3,298*	8,405	16,433	39,770
July.....	1,906	3,684	4,255	9,520	17,008	39,329
Aug.....	1,738	2,511	5,689	10,483	19,063	.....
Sept.....	1,706	4,415	3,965	10,562	20,009	.....
Oct.....	4,640	3,827	8,821	11,455	26,863	.....
Nov.....	9,221	3,572	8,616	12,127	22,153	.....
Dec.....	1,896	1,555	6,666	10,278	22,382	.....
	\$26,786	\$29,120	\$49,202	\$116,451	\$199,231	\$247,677

* Operation of merchandise shipments was begun in June, 1917, between Milwaukee and North Chicago. This service was extended to Evanston in December, 1918, and to Montrose Boulevard, Chicago, in November, 1919.

promptly. My experience is that the shipper does not object to paying a higher rate than is charged by a steam railroad, provided his goods are handled in a more expeditious way than the steam road can handle them, and there is no doubt in my mind that the interurban can do that if it is efficiently operated. No road can expect to charge higher rates and give a "Toonerville Trolley" service. It is such methods that have discredited the electric railways and made some of them a joke in the mind of the shipper. What has been said of passenger service applies with equal force to merchandise. The shipper demands service and he is willing to pay for it. The electric railway is reliable 365 days in the year and if it maintains a high standard of efficiency it will get business.

There are wonderful possibilities for the interurban railroads to develop a merchandise service. It is quite possible for them to interchange with other electric lines, even when there is no physical connection, although that necessarily means some delay and adds to the expense. Where physical connection can be made and a through service operated it is of great advantage to the companies as well as to the communities they serve. With the present shortage of steam railroad

TABLE II
Passenger Revenue, Chicago, North Shore & Milwaukee Railroad

	1915	1916	1917	1918	1919	1920
Jan.....	\$52,296	\$58,842	\$81,654	\$100,218	\$206,022	\$205,085
Feb.....	48,391	58,000	72,106	111,892	182,325	216,218
March.....	57,106	64,077	81,872	139,414	197,847	234,297
April.....	64,296	74,041	93,016	136,919	186,381	242,764
May.....	71,702	83,705	111,287	181,370	218,889	291,704
June.....	66,936	88,655	139,858	248,535	237,044	276,542
July.....	91,367	127,030	185,471	326,906	269,983	382,491
Aug.....	88,947	111,552	193,786	352,474	314,102	.....
Sept.....	76,858	107,630	183,139	284,325	281,549	.....
Oct.....	70,293	91,229	137,073	245,649	244,329	.....
Nov.....	63,259	85,585	135,815	251,342	241,746	.....
Dec.....	59,701	83,247	127,308	222,484	229,768	.....

\$812,152 \$1,033,593 \$1,542,385 \$1,601,528 \$2,809,985 \$1,849,101

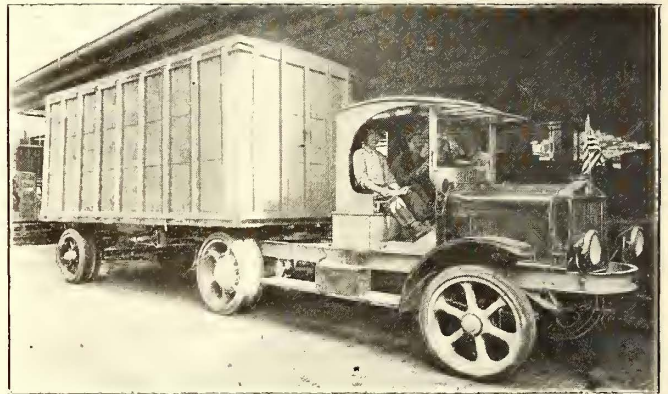
In 1915 passenger rates were on a 5-cent zone basis, length of zone being approximately 2½ miles. In February, 1917, fares were changed to a basis of 2 cents a mile. In October, 1918, interstate and Wisconsin intrastate fares were increased to 2½ cents a mile, Illinois intrastate rates remained at 2 cents. Fares were increased to 2.7 cents a mile on interstate and Wisconsin intrastate business on Sept. 1, 1920.

equipment, terminal facilities, etc., a great opportunity is offered the electric lines to demonstrate what they can do.

It is well known that the motor truck has its limitations. In a northern climate there are weeks and sometimes months when it cannot operate. Even under the most favorable circumstances for the motor truck, the electric railway can transport merchandise cheaper when it has to be carried any considerable distance. The motor truck is a good auxiliary to the electric railway and I see no objection to the electric railways maintaining trucks of their own to transport merchandise to receiving stations where the volume of business justifies it.

The problem of maintaining highways for motor trucks, with loads of from 1 ton to 25 tons, can be met in part by the elec-

tric railways, and the truck manufacturers and municipal, county and state highway officers are coming to a realization of this fact. Wherever possible, the elec-



Tractors with trailers have made possible a downtown station in the merchandise dispatch business

tric railway should feature the slogan, "Use the Electric and Save the Highway."

It is a mistake for the interurban railroad in large communities to centralize its merchandise business too much. Terminal property requires a large amount of capital and when the business is centralized it brings congestion in the trucking, a condition common on the steam roads where it is not unusual for a truck to waste three or four hours trying to make a delivery. The electric lines should be in a position to offer the shipper as an inducement the assurance that his truck or team can go to a convenient receiving station, unload and get away in a few minutes. That is one of the strongest talking points in getting business, and if centralization is going to destroy that feature I do not believe it would be wise. A better plan, I believe, is to locate at various points receiving stations, consisting of a platform, a driveway for trucks and a small office, where shipments may be accumulated and then transported by truck to a point to be loaded on cars. This is being done in Chicago and nearly 200 tons a

day are accumulated at one of these stations.

The rehandling of shipments, of course, should be reduced to a minimum. As to how far a container method will solve this problem I am unprepared to express an opinion. If a majority of shippers shipped from 2 to 5 tons in a container, I can readily see how it could be handled with economy. This, however, is not the case in most instances, so that a container would be only partially filled, or, it would contain several shipments which would require rehandling.

The North Shore Line, operating between Chicago and Milwaukee, has developed in one and one-half years a fast merchandise express business which now exceeds 10,000 tons per month, with a gross revenue of \$50,000 per month. The type of equipment used is shown in an accompanying engraving, together with pictures of one of a fleet of White tractors and trailers used in moving shipments from receiving stations to terminals.

The remarkable growth of the business of the Chicago, North Shore & Milwaukee, as shown in the accompanying tables, forms an interesting commentary

TABLE 111
Gross Revenue, Chicago, North Shore & Milwaukee Railroad

1915.....	\$911,670
1916.....	1,157,191
1917.....	1,751,373
1918.....	2,899,975
1919.....	3,237,921
1920.....	4,250,000*

* Estimated on basis of eight months actual.

on the results which have accrued from operation of the road on the policies as outlined in the foregoing. With the problem at hand that of building up the property, the service given on the North Shore Line has been maintained in the lead of traffic, the effort then having been made to bring the business up to the service. The manner in which the riding has followed the improvements in service has been truly a revelation, it being sometimes difficult to analyze the source of all the business. Since 1915 the number of passengers carried has doubled, the number of passenger car-miles operated has been increased nearly two and one-half times and the revenue from passenger service quadrupled.

The gross revenue of the property at the present time includes about \$600,000 a year miscellaneous revenue in addition to passenger and freight, and this gross revenue has grown in five years from less than \$1,000,000 a year to \$3,230,000 in 1919, and beginning with September of 1920 the gross revenue of the road is at the rate of \$5,000,000 a year.

A very interesting thing about this statistical picture of the North Shore road is that, from a beginning of practically nothing in 1915, the total merchandise despatch busi-

TABLE IV
Passenger Car-Miles Operated, Chicago, North Shore & Milwaukee Railroad

	1915	1916	1917	1918	1919	1920
Jan.....	187,397	201,855	273,213	313,948	473,644	510,459
Feb.....	166,861	189,395	236,565	325,515	429,620	474,978
March.....	187,322	205,720	269,339	402,953	476,672	535,054
April.....	208,352	218,681	306,000	421,763	448,004	532,131
May.....	237,981	261,277	342,896	410,145	487,806	593,620
June.....	241,881	264,598	339,216	460,191	492,408	566,002
July.....	264,220	335,061	455,374	556,795	533,050	646,704
Aug.....	265,944	321,984	466,857	542,451	572,857	.....
Sept.....	256,421	314,661	459,187	513,005	559,081	.....
Oct.....	245,483	295,963	443,162	494,366	563,121	.....
Nov.....	236,120	286,812	418,207	501,164	563,903	.....
Dec.....	225,162	282,665	400,182	499,824	514,045	.....
	2,721,144	3,178,672	4,410,198	5,442,120	6,114,211	3,858,948

ness of the property has been developed until at the present time it is running about \$50,000 per month and constantly growing. In fact, the amount of this business available seems at the present time to be limited only by the company's ability to handle it. While it is overshadowed by the passenger business at present, it should be noted that no particular effort along this line was begun until 1918. This class of business now, however, is showing a growth which promises to give it an increasingly important part in the total earnings statement. The great bulk of this business is made up of less than carload shipments of merchandise that come under the first, second and third class of commodities. The above table of figures on merchandise dispatch revenue includes the l.c.l. business only. No particular solicitation of the lower rate materials or carload shipments is made at the present time, for the entire resources of the property are kept more than busy on the higher rate merchandise l.c.l. shipments. The rates for these shipments on the North Shore road average 30 per cent higher than the similar rates on the competing steam lines. In view of this rate comparison, the fact that the electric line is offered more business than it can handle would seem to demonstrate that shippers are willing to pay a higher rate for a superior service. Plans are being formulated for securing more equipment and to increase the company's facilities so that it will be able to handle the growing volume of this profitable business.

TABLE V
Number of Passengers Carried, Chicago, North Shore & Milwaukee Railroad

	1915	1916	1917	1918	1919	1920
Jan.....	485,680	539,553	626,244	688,717	1,015,278	963,734
Feb.....	455,053	515,874	555,664	721,648	887,197	993,768
March.....	573,802	556,204	571,264	827,919	970,405	1,109,603
April.....	548,475	580,250	643,825	783,517	942,078	1,066,838
May.....	603,211	642,743	795,007	955,129	1,067,230	1,168,124
June.....	571,151	641,649	918,133	1,129,696	1,092,289	1,101,538
July.....	649,803	742,161	1,002,546	1,239,591	1,140,590	1,267,301
Aug.....	642,593	701,463	1,044,615	1,305,555	1,146,834	.....
Sept.....	581,717	634,722	898,194	1,098,741	1,027,972	.....
Oct.....	604,694	653,901	816,230	920,109	1,048,824	.....
Nov.....	551,001	620,681	798,068	1,041,263	1,036,827	.....
Dec.....	545,338	630,468	767,178	978,938	1,050,910	.....
	6,812,518	7,459,669	9,436,968	11,690,823	12,426,434	7,670,906

Safety cars reduce injuries to passengers, they provide safer, better paid and more interesting work for the employees, and they are popular with the public

Results of Safety Car Operation

By J. C. Thirlwall

Railway and Traction Engineering Department General Electric Company



The safety cars on this street in Brooklyn do a good business

THERE are in service today more than 3,000 safety cars, one-man operated; there are on order and in the course of construction about 900 more, and the writer believes this is only a good start. Their value to the industry is only beginning to be appreciated, and eventually, we believe, there can be and will be some 18,000 to 20,000 in service in this country and Canada.

As nearly as the benefits already accruing from existing installations can be approximated it may be said with a fair degree of certainty that the 3,000 cars now are increasing the net income of the roads which operate them more than \$12,000,000 a year; that they have materially improved the public relations of the great majority of the roads using them, and they have provided more comfortable, more interesting and better paid work for more than 5,000 platform men. Against this splendid showing there are practically no offsetting disadvantages. Some few roads have criticised the maintenance, some have felt that changes in the doors or seating arrangement could be made to advantage, some think the ends of the cars must be strengthened against collision. But no general criticism of the design or equipment has been made, and the volume of repeat orders coming in from all sections of the country is the best testimony of the general satisfaction which the standard car has given.

The progress of the safety car idea has been remarkable. Starting late in the fall of 1916, or just four years

ago, the Stone & Webster management placed twelve or fifteen cars in service at Fort Worth, Bellingham and Everett. Within six months it was convinced that it had discovered a big new principle of operation. A number of car and equipment engineers agreed and proceeded to advertise the idea. But by the end of 1917 there were less than 100 safety cars in operation, the installations were small and the whole matter was still in the experimental stage. However, it was during this year that the Stone & Webster operators standardized on a car which was slightly different from Mr. Birney's original design and which with only slight modifications in equipment and dimensions has since been accepted as a standard by the industry as a whole. By the end of 1918 there were between 500 and 600 of these cars in service, and their successful operation in cities of considerable size, such as Seattle, Portland, Houston, Dallas and Kansas City, had given an immense impetus to their general use. By the end of 1919 there were approximately 150 cities in which the safety cars were running and about 1,600 cars were in service.

Today the number of cars in service has nearly doubled, and the number of cities in which they are used is well over 200. When existing orders are completed, within a few months, approximately 250 cities will be using 4,000 of these cars.

The writer has had the good fortune to have been able to observe at first hand the development of safety car operation in the majority of the larger installations,

and his impressions of results are based on his personal observations and on conversations with an unusually large number of operating officials, public service commissioners and engineers, city officials and car riders. He has, as a result of such talks and experience, been absolutely convinced that the light-weight, one-man operated safety car is the best vehicle yet developed with which to meet the average and normal passenger transportation conditions in every city; that it can be operated more economically per passenger handled than any other type of car; that with it a better and more generally satisfactory service can be offered to the public for any given expenditure than with any other type; that it is extremely popular with the riding public, not only because of the improved service that has usually accompanied its use but because of its design and riding qualities, and that its general adoption and wider use hold out better prospects of financial rehabilitation to the average road than does any other physical change that can be made in the operation of the electric railways.

But to confirm these general impressions and to secure accurate and up-to-date data on results actually obtained, particularly in regard to the effect on net income resulting from the use of these cars, a questionnaire was addressed to some forty-odd companies, in every section of the United States, these companies being the ones which were known to have been operating safety cars for one year or longer, prior to June, 1920. Thirty-eight companies, owning more than 1,200 cars, answered, and the summary of their replies and the data submitted form the basis of this article. The thanks of the writer and of the ELECTRIC RAILWAY JOURNAL is extended to the companies named in Table I, which were kind enough to report the questions submitted.

A good indication of the feeling of the operators of the above properties is that at the time the above list was compiled nineteen of the companies had orders in for approximately 350 additional safety cars and at least five others were prevented from ordering more only by difficulties in financing the purchase.

As stated previously, all of these companies had been operating safety cars for periods of from one to three years, a long enough period to enable them to judge with reasonable certainty the capabilities and effectiveness of the car and the results of the service rendered and to ascertain the operating cost as compared with other types. Unfortunately, comparatively few companies

have thought it necessary to segregate their cost accounts as between the safety cars and their other equipment.

COST OF SAFETY CAR OPERATION

However, nine companies, operating 307 cars, submitted complete figures segregated into the five chief operating accounts and comparing the cost per car-mile of the safety car and of their two-man cars, and four other companies, operating 227 cars, gave comparative figures on certain items, such as power and maintenance.

TABLE I
List of Thirty-eight Companies Which Have Operated Cars Prior to June, 1920

Name of Company	Location	No. of Safety Cars Owned	Number Operated	
			Average	Maximum
Brooklyn Rapid Transit, Brooklyn, N. Y.		206	168	192
Kansas City Railways, Kansas City, Mo.		95	69	75
Third Avenue Railway, New York City		90*	64*	80*
The Connecticut Company, Bridgeport, New Haven, Hartford, Conn.		76	65	67
Seattle Municipal Street Railway, Seattle, Wash.		65	28	40
Tacoma Railway & Power Company, Tacoma, Wash.		62	44	58
Trenton & Mercer County Traction Corporation, Trenton, N. J.		60	45	55
Terre Haute Traction & Light Company, Terre Haute, Ind.		56	48	52
Northern Texas Traction Company, Fort Worth, Tex.		50	30	50
Tampa Electric Company, Tampa, Fla.		30	31	36
Colorado Springs & Interurban Railway, Colorado Springs, Col.		35	11	29
Illinois Traction System, Quincy and Decatur, Illinois		34	31	34
Pennsylvania-Ohio Electric Company, Newcastle and Sharon, Pa.		32	21	27
Houston Electric Company, Houston, Tex.		31	27	31
Eastern Texas Electric Company, Beaumont, Tex.		30	12	26
Birmingham Railway, Light & Power Company, Birmingham, Ala.		25	11	20
Philadelphia Rapid Transit, Philadelphia, Pa.		25	16	22
Portland Railway, Light & Power Company, Portland, Ore.		25	20	25
Puget Sound Power & Light Company, Bellingham, Wash.		24	16	20
Virginia Railway & Power Company, Petersburg, Va.		22	17	22
El Paso Electric Railway, El Paso, Tex.		20	18	20
Cumberland County Power & Light Company, Portland, Maine		15	12	14
Bangor Railway & Electric Company, Bangor, Maine		15	10	12
Saginaw-Bay City Railway Company, Saginaw, Mich.		14	11	13
Texas Electric Railway, Waco, Tex.		14	13	14
Dallas Railway, Dallas, Tex.		12	8	11
Springfield Traction Company, Springfield, Mo.		12	12	12
Austin Street Railway, Austin, Tex.		10	9	10
Lincoln Traction Company, Lincoln, Neb.		10	9	10
Louisville & Southern Indiana Traction Company, New Albany, Ind.		10	10	10
Nashville Railway & Light Company, Nashville, Tenn.		10	10	10
Chicago, South Bend & Northern Indiana Traction Company, South Bend, Ind.		10	9	10
Columbus Railroad, Columbus, Ga.		8	6	8
Hot Springs Street Railway, Hot Springs, Ark.		7	7	7
Oklahoma Union Railway, Tulsa, Okla.		6	5	5
		1,255	923	1,127

* The one-man cars of the Third Avenue Railway are not the standard Birney type of safety cars. They are, however, light-weight cars, with safety features, and are, therefore, included. All other cars listed above are of the standard type.

They all agree remarkably closely in the proportionate saving of the safety car as compared with their heavier two-man type, although the total costs of the various roads vary widely due to differences in wage scales, cost of power, schedule speeds, etc.

For instance, one road on the Pacific Coast reports the total cost of operation for its two-man cars as 44 cents per car-mile and for its safeties as 24 cents per car-mile, a reduction of 45 per cent. The records of a road in a smaller city of the Middle West show the same relative figures to be 20.2 cents and 11.5 cents respectively. This corresponds to a reduction in operating expenses of 43 per cent.

The averages of all the figures submitted are as given in Table II.

TABLE II
Operating Costs in Cents per Car-Mile

	Safety Cars	Two-Man Cars	Saving Per Cent
Maintenance of way and structures.....	1.6	3.3	52
Maintenance of equipment.....	1.7	3.6	53
Power.....	1.9	3.8	50
Transportation.....	8.4	13.9	40
General.....	2.4	3.2	25
Total operating cost.....	16.0	27.8	42.5

The percentage of reduction in the individual items and in the total cost per car-mile agrees closely with other data previously obtained by the writer. The variations between records of the various roads are slight, and the records are based on a sufficient number of cars, operating under widely varying conditions, to be representative. Undoubtedly, the averages, as shown

receipts advanced in full proportion to the increased mileage. One company with 100 per cent more service found only 20 per cent more riding. Others report increases, but say that other factors, such as change of fares, fluctuations in population, etc., make it impossible to tell what effect the improved service had on the volume of traffic. Nineteen companies give figures which, averaged, show that with a 52 per cent increase in miles operated they secured a 37 per cent increase in revenue passengers carried. This agrees fairly well with the data presented by H. G. Bradlee at the November, 1918, convention of the American Electric Railway Association.

The companies reporting used about 70 per cent of the cars they owned in all-day service, and in rush-hour service an additional 20 per cent. The average receipts per car-mile were 28.5 cents; the average speed 8.4 m.p.h. The average operating costs were 16 cents per car-mile for the safety cars and 27.8 cents for the two-man, heavier types. The average effect on net income, therefore, for the roads using the safety car on



Although in operation only a short time in Los Angeles, safeties are as popular there as elsewhere

in Table II, can be duplicated by any road and, for equal car mileage, any urban electric railway can secure a reduction of approximately 40 per cent in its operating cost or it can operate 80 per cent more mileage with safety cars than with heavy two-man equipment with no increase in operating expense. It therefore follows that increases in service, or mileage, amounting to 30 per cent, 40 per cent or 50 per cent can be made and still save materially in the operating accounts.

The great majority of installations have been upon the latter basis. Of the thirty-eight companies reporting, only ten made car-for-car replacement. They are in general the smaller cities and own only 124 cars, or less than 10 per cent of the total. Three companies owing 137 cars report 100 per cent increase in service, or two safety cars operated for every two-man car displaced. The remaining twenty-five companies, owning approximately 1,000 safety cars, all show increases in service ranging from 20 per cent to 80 per cent, and averaging 50 per cent.

The effect on riding or on the gross passenger receipts varies quite widely. Some companies report

an improved service basis is shown by Table III, based on a 100-car installation.

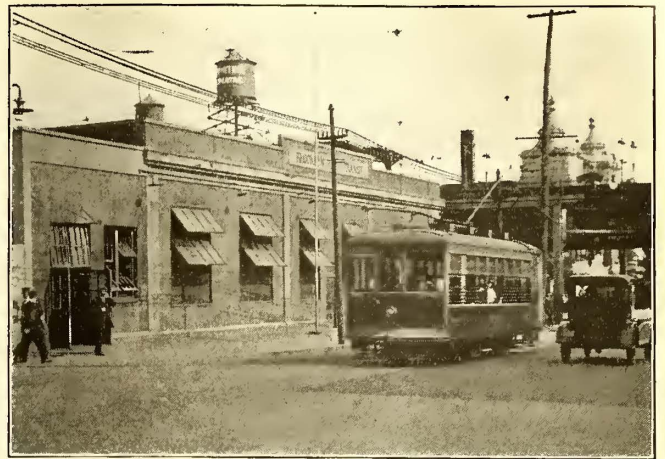
These figures represent almost exactly the average results reported by the companies which gave increased service. After replacing two old cars with three safety cars, and increasing mileage, which is the measure of service, 52 per cent, they still save one-eighth of their former operating cost and raise their gross passenger revenue 37 per cent. The net result is an increase in net income of more than \$3,700 for each safety car purchased, or more than 50 per cent per annum on their present selling price.

SAVINGS FOR A CAR-TO-CAR REPLACEMENT

It is harder to calculate what the roads are saving that are able to make a car-for-car replacement. The properties which have kept records are all in fairly large cities, and all report an improved service. Of course, even in the larger cities there are some lines where traffic is so light that the safety car can be readily applied on existing headways and schedule speeds, and on such properties, using the relative costs of operation



Safety car at loading platform, Kansas City



They pass without trouble under elevated structures

of the foregoing tabulation, the results of car-for-car replacement would be as shown in Table IV.

In the smaller cities, where car-for-car replacement would be the normal rather than the exceptional procedure, wage costs are usually below that of the larger communities and, in most cases, single-truck cars of moderate weight are used. Under these circumstances, the savings in power, maintenance and platform costs

are less, but if we may take the figures from Terre Haute as typical, where the average cost per car-mile for the safety cars is 11.5 cents and for the two-man cars, most of which were single truck, is 20.2 cents, the saving per car purchased on a car-for-car replacement basis, and making the same mileage as in the table above, would be slightly more than \$3,200 per car annually. Of course, in the case of Terre Haute, this

TABLE III

Comparative Costs and Receipts on 2 to 3 Basis

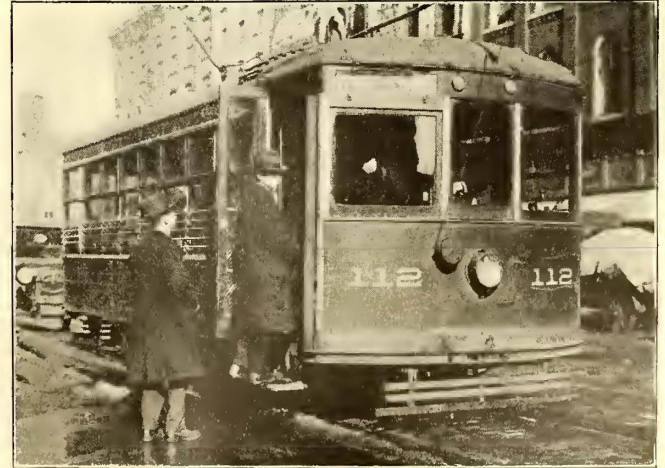
	Two-Man Cars	Safety Cars
Total cars required	67	100
Cars operated sixteen hours daily..	46	70
Cars operated four hours, except Sundays.....	13	20
Car-miles per annum.....	2,393,000	3,644,000
Increase in service.....		52 per cent
Receipts per annum, at 31.7 cents per car-mile.....	\$758,130	
Receipts per annum, at 28.5 cents per car-mile.....		\$1,038,540
Increase.....		37 per cent
Annual operating cost at 27.8 cents per car-mile.....	\$665,254	
Annual operating cost at 16.0 cents per car-mile.....		\$583,040
Decrease.....		12.5 per cent
Operating ratio.....	87.5 per cent	56 per cent
Net income.....	\$82,876	\$455,500
Increased net income.....		\$372,624
Increase per car purchased.....		\$3,726

TABLE IV

Estimated Saving on Car-for-Car Replacement

	Two-Man Cars	Safety Cars
Total cars required.....	100	100
Cars operated sixteen hours daily.....	70	70
Cars operated four hours daily, except Sunday.....	20	20
Car-miles per annum.....	3,644,000	3,644,000
Annual cost of operation at 27.8 cents.....	\$1,013,030	
Annual cost of operation at 16 cents.....		\$583,040
Annual saving per car purchased.....		\$4,300

plan was not followed. A liberal increase in numbers of cars and in the schedule speed was made, and it is gratifying to note that the increased traffic which resulted has paid a far more liberal return on its investment in new equipment than could have been secured by straight replacement. The company's records show an increase in net income of more than \$4,000 per car and good results in the improvement of public relations.



Trenton, N. J., has sixty of these cars in daily operation

A point of great interest to the public and to the operators alike is the relative safety of operation of two-man and of one-man cars. W. H. Burke has treated this subject so exhaustively in a recent issue of the *ELECTRIC RAILWAY JOURNAL* that it is unnecessary to go into any great detail. He demonstrated conclusively that the safety car was well named, that it actually does have fewer accidents than the older cars handled by two men and that personal injuries both of the public and employees are reduced by its use. But some figures along a similar line, derived from the reports of a greater number of companies, may be of interest. The questionnaire sent out in the inquiry on which the

ACCIDENTS INVOLVING PERSONAL INJURY

Total accidents per 1,000 car-miles		Passengers Carried per Injury	
Safety Cars	Two-man Cars	Safety Cars	Two-man Cars
0.39	0.59	123,000	49,000

present article is based called for the relative number of accidents involving personal injuries, both in terms of car-miles operated and of passengers carried. Fourteen companies operating 560 safety cars replied with definite figures. Only one showed any increase in such accidents, one reports no change and twelve report a material reduction. The average of the replies on this subject can be grouped as shown in the above table.

These figures are even more favorable than Mr. Burke's, his data being based on all accidents, whether involving personal injury or not. In addition to the fourteen roads which gave statistics on this subject, seventeen others expressed opinion, and only two of these claimed any increase in personal injuries. The balance report "personal injuries reduced" "step accidents less," etc., but a number say in effect "personal injuries less, but property damage more." In fact, after reading all the replies, the conviction is unescapable that collisions with other vehicles, especially automobiles, are more frequent with safety cars than with heavier types, and that the damage done to the safety car is greater. This condition may and probably will be minimized by changes in the platforms and brake rigging of the cars during the past year. The car builders have made a considerable improvement in these two details, largely as a result of complaints of collision damage.

WHAT ARE THE LIMITING FEATURES

The replies to a question as to what are the factors limiting the use of one-man cars were nearly all alike in the trend of thought. There seems to be a general conclusion that there are no limiting conditions in cities

up to 150,000 unless it be lines crossing a great number of steam road crossings, or a line carrying an unusually large factory load. For all cities, the almost universal answer was that the only limiting factor was track saturation or traffic density, and various operators differ in their ideas as to where this density forces the use of larger two-man cars. One or two believe that lines having normal headways of less than four minutes are unsuitable for the safety car. But a manager in one of the very biggest cities, who has had a wide experience in operating safety cars, says that, on lines with loops at both ends, he "sees no reason why they could not be operated on a thirty-second headway" and that on lines where the car operator has to change ends he is now operating on two-minute headways with satisfactory results. Perhaps a consensus of opinion would be that where, on two to three minute headways, the average maximum load on the safety car exceeds fifty passengers a larger car can be used to greater advantage.

CONCLUSIONS DERIVED FROM STUDY

To the writer all these facts make the conclusion inevitable that the safety car has been such a tremendous success that no urban electric railway in North America can afford to neglect its possibilities; that its use will be very rapidly extended until the bulk of the all-day runs, or basic schedules, in every city will be handled with these cars. Summarizing all of the foregoing data, which only confirm observations and predictions made by the writer for the last three years, we can confidently say that the safety car will, on the average, produce sufficiently more net income to pay for itself in less than two years; that its effect on the finances of a company becomes more pronounced as wages and fuel costs increase, and that no other change in the physical equipment of any road can possibly be made that will so favorably or so extensively affect the operating ratio of the entire property. To many railways its use to the maximum extent will spell all the difference between prosperity and bankruptcy. To many others it will give the ability to pay a liberal return to the stockholders and enhance the value of all their securities. For thousands of platform men it will provide safer, better paid and more interesting work. And to millions of city dwellers, it will offer a more comfortable, a more frequent and more satisfactory service.

And by all of these groups there will be voiced the sentiment, tersely expressed by a good friend of the writer's in Texas, one of the pioneers in the safety car movement, "It is good enough for us!"

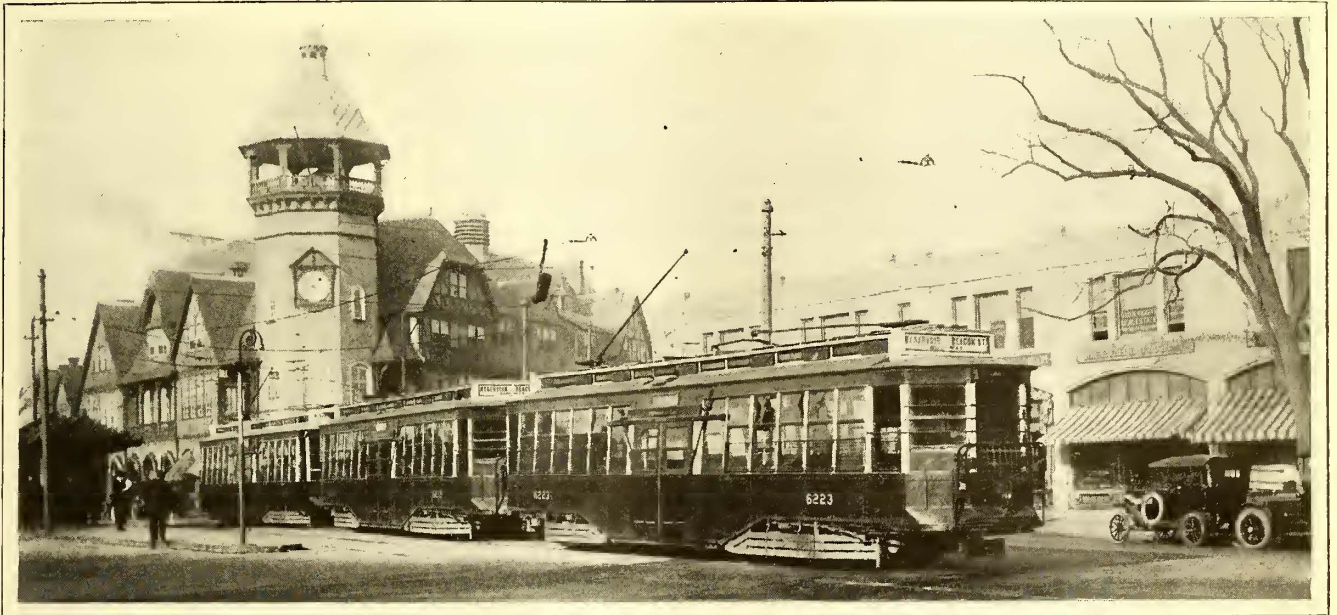


Cross-seat safety car and longitudinal-seat two-man car at Williamsburg Bridge Plaza, Brooklyn

Close relation of efficient schedules to economical operation. The eight-hour-day problem as worked out on the Boston Elevated Railway

The Scientific Arrangement of Schedules

By Edward Dana
General Manager Boston Elevated Railway



Three-car trains used on Reservoir-Beacon Street subway route, Boston. During rush hours these trains operate on a four-minute headway on this route

THE public usually measures street railway service by the trip. The study of traffic has to do with the number of trips operated and their arrangement through the various hours of the day according to the time they start. The science of schedule construction has to do with the arrangement of these same trips, which the traffic survey has definitely established into hours of labor for the men engaged in platform service.

Many people fail to appreciate the complex nature of this whole problem and the fact that, while certain general principles apply, almost every group of trips which has to be arranged as a schedule offers its own particular problem. In consequence, it is neither accurate nor fair to compare schedules in different localities without a complete knowledge of all the factors.

The relation of proper schedules to economical and efficient operation has always been an important matter. The increased cost of labor, with the advance in the price of coal, however, today makes every car-mile operated play an important and vital part in the situation, especially as it applies to fares. The aim of the company should be to draft a schedule scientifically arranged to provide just the proper amount of service to meet the traffic requirements over each route and over each portion of that route. Any more service is wasteful and affects the cost of operation. Any less service is likewise wasteful, by reason of its inadequacy and consequent irregularity, overcrowding or delay, resulting in loss of business and additional expense.

The task of arranging such an ideal schedule for week-day, Saturday, Sunday and holiday time-tables, as well as to meet the varying traffic fluctuations during the seasons by placing in operation short line service, varying the headway or adding trailers, is one of the most important elements today in operating any street railway system.

The second phase of the task is to arrange the work of platform men so as to provide for their working as closely as possible to the stated maximum number of hours as well as to perform the work within another definitely stated period of elapsed time.

The growth of the labor organizations and the enactment of local laws governing hours of labor have resulted in the necessity of a thorough knowledge on the part of not only the operators of street railways but labor executives as to the fundamental principles of schedule construction. In the past street railway companies, believing that they were making an arrangement of trips in the most economical manner, required men to work platform time of ten, eleven or twelve hours, and spread time of from twelve to twenty hours. It is true that thereby the crew force was reduced, which must be the goal in the interests of all concerned under any circumstances, but the distribution of the work was unequal and unfair. In those days there was no guarantee or minimum wage per day, and the result was that after all possible trips were crowded into schedule runs of long platform as well as outside time, proportionately few trips were left. But the trips that

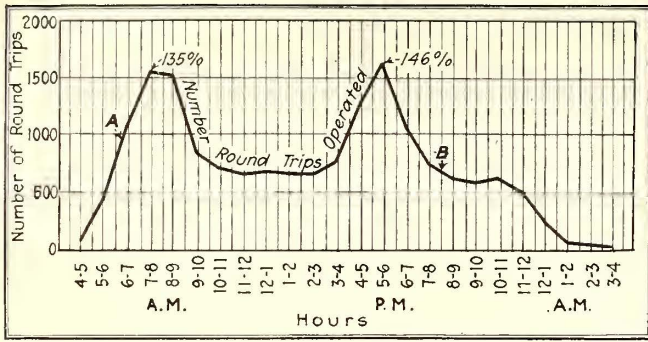


Chart I—Showing distribution of trips on Boston Elevated on Monday, April 12, 1920, a typical week day

were left were trips operated during the morning and evening rush hours, and in most instances they provided only a few hours' work each day for the men required to operate them. The result of this policy was that neither class of men engaged in the business was satisfied. Those men having a regular day's work disliked the long hours required to secure their day's work, and those having only a few trips during the morning and evening rush hours could not earn a sufficient wage to remain in the business. The result was a labor turnover of very substantial proportions, running in some instances to the equivalent of a complete reversal of the force during the year.

Failure to analyze the schedule problem was one cause for this, and while the street railways believed the trips were arranged in the most economical manner as far as cost was concerned, actually when one considers what the expense was, due to accidents and supervision to handle such a labor turnover, it is very easy to see that this was a "penny wise, pound foolish" policy.

It is hardly to be wondered at that when both types

of men, namely, the so-called regular men as well as the extra men, were restless that attention was drawn to the subject of hours of labor on street railways and changes made designed to improve conditions.

During this period of the industry street railway executives were arguing that the old time schedules could not be changed without prohibitive costs, and labor executives were demanding working conditions that absolutely failed to fit the nature of the industry, and

TABLE I
Details of Trips Shown in Chart I

Hours	No. of Trips	Per Cent of Trips	Per Cent of Passengers	Average Revenue Passengers per Trip
4-5	81	0.47	0.23	27.55
5-6	453	2.67	1.72	37.22
6-7	1,064	6.27	6.15	56.77
7-8	1,546	9.11	9.94	63.15
8-9	1,507	8.88	8.91	58.07
9-10	841	4.96	4.02	46.92
10-11	701	4.13	3.81	53.32
11-12	657	3.87	3.76	56.26
12-1	677	3.99	3.92	56.98
1-2	650	3.83	4.69	70.81
2-3	650	3.83	4.84	73.19
3-4	757	4.46	4.84	62.81
4-5	1,253	7.39	8.10	63.46
5-6	1,621	9.55	12.40	75.20
6-7	1,048	6.18	5.47	51.25
7-8	737	4.35	5.00	66.58
8-9	619	3.65	2.77	43.94
9-10	580	3.42	2.69	45.54
10-11	616	3.64	3.36	53.50
11-12	517	3.05	2.15	40.77
12-1	248	1.46	0.74	29.46
1-2	64	0.38	0.23	35.11
2-3	43	0.25	0.16	36.02
3-4	36	0.21	0.10	29.33
Total	16,966	100.00	100.00	982,154*

*Total revenue passengers

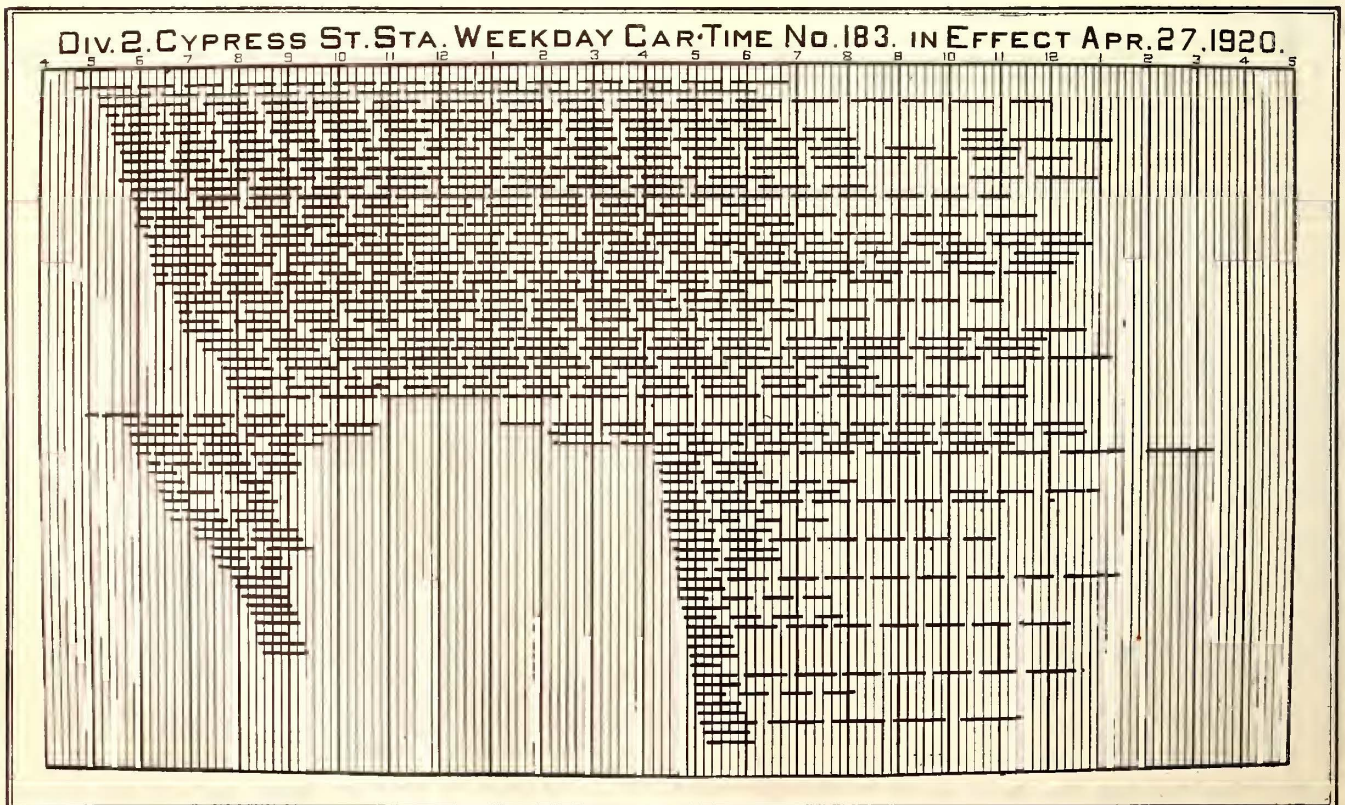


Chart III—Showing car-runs from Cypress Street carhouse April 27, 1920, based on trip schedule shown in Chart II

in extreme cases would actually require double sets of men to perform the work in each rush hour. Meanwhile, but little study was given to the real economics of schedules, to devise ways and means with the smallest possible number of men or so to arrange the work as to provide as nearly as possible an equitable division of the work and yet impose no severe hardship on any group in the service because of spread-of hours on platform service.

Many persons in those days discussed this confusing subject at length without a very definite idea of what it was all about. Today conditions are gradually becoming standardized, and the importance of a thorough knowledge of the subject by the executives of both the railway as well as the labor organization is appreciated. As arbitration becomes more frequent it is absolutely necessary that this subject be shorn of its mystery and both men and management talk the same language with reference to it, otherwise mistakes will surely occur

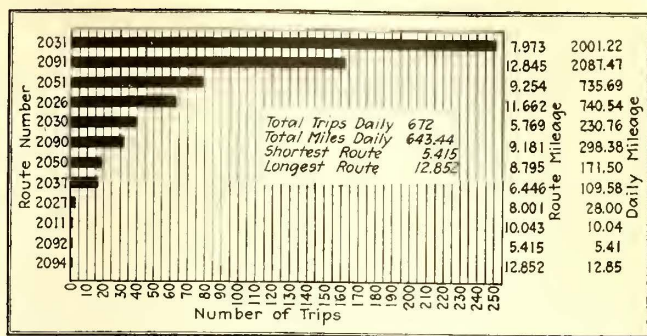


Chart II—Showing trips by routes from Cypress Street carhouse on April 27, 1920

from the decision of a neutral party who through no fault of his own has not had the fundamental economics of schedule construction properly explained both as regards fair working conditions as well as the ultimate cost to the car riders. A consideration, therefore, of the essential factors in schedule making is necessary.

TWO FACTORS IN SCHEDULE CONSTRUCTION

Two underlying factors in schedule construction are most important. The first of these is the relation between the base or normal schedule and the peak demanded in the rush hours, or, in other words, the percentage of excess of service in the rush hours over the non-rush hours. The second of these factors is the spread of hours which are required to insure the morning and evening rush hour trips in excess of the base schedule being operated by the same men. Both of these factors vary in different cities and even in different carhouses in the same cities. Cars serving a factory section of a city must, of necessity, have different hours than those serving a residential section where lawyers or bankers predominate.

TABLE II
 Division of Schedule and Additional Runs by Platform Hours and Spread Hours

	Platform Hours				Total Runs	Eight Hours or Less	Spread Hours						
	6-6½	7-7½	8	8½			8-9	9-10	10-11	11-12	12-13	13-14	
Conductors Schedule runs ..	1	44	440	863	134	1482	147	126	514	171	91	190	243
Additional runs ..		1	149		150	10		6	15	76	36		7
Motormen Schedule runs ..	1	45	399	845	151	1441	159	127	554	200	59	128	214
Additional runs		1	43		44	9		2	16	11			6

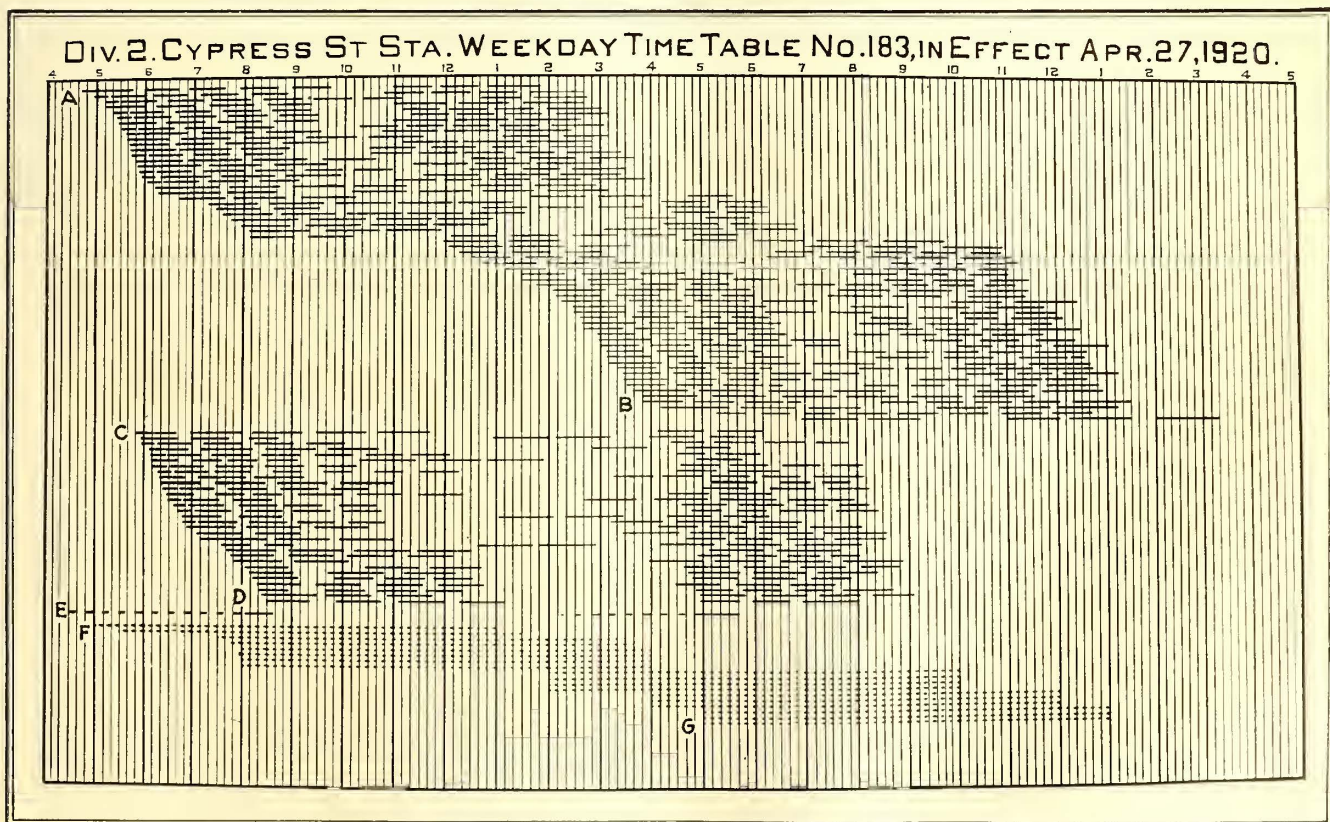


Chart IV—Showing crew-runs from Cypress Street carhouse, April 27, 1920, based on car-runs shown in Chart III

TABLE III
Daily Division of Time of Platform Men

	Total Hours	Per Cent of Total Hours
1. Actual platform time used on schedule (running time multiplied by the number of trips, plus layover time actually used)	19,733	.7126
2. Layover time on schedule between trips (considered as platform time)	3,250	.1174
3. Signing trips—putting up car, etc.	664	.0240
4. Extra time (three-piece run) ten minutes bonus paid	13	.0005
5. Time added to bring platform time to pay period	732	.0264
6. Men on additional runs doing other than schedule work during their cover period	125	.0045
7. Time allowed on additional runs to equal eight hours' pay	794	.0287
8. Penalty time allowed for spread of outside hours	611	.0221
9. Time of cover men other than substitution for schedule runs	773	.0279
10. Time paid for to bring cover men to eight hours' pay	806	.0290
11. Overtime paid schedule men in addition to schedule pay time	88	.0031
12. Overtime paid cover men in excess of eight hours' pay	91	.0033
13. Time delayed paid for	13	.0005
Total hours	27,693	100.00

In order to understand these two factors the reader is referred to Chart I, which happens to show the total trips operated on the Boston Elevated Railway during each hour of the day. It will be noted that the trips required in the morning rush hour are 135 per cent greater than the base time-table requirements, and those in the evening rush hour are 146 per cent greater.

It will also be noted that from the point marked A to the point marked B the necessary span of outside hours is approximately fourteen hours. These two factors in Boston make it absolutely necessary that a certain percentage of the men operating cars must have their day's work spread over a period not to exceed fourteen hours or else more men will be required to perform the work than is a fair and equitable burden upon the car rider. Even with a spread of fourteen hours many men will receive a day's pay, but are not required except for a portion of it, and if still more men were added much more time would have to be paid for to run the same amount of service. In short, in Boston the demands of the business require a minimum spread of fourteen hours on a certain percentage of the runs. Table I gives the information about the trips shown in Chart 1.

To appreciate the details which the schedule constructor faces, a glance at Chart II is sufficient. This chart indicates the relative number of trips on the several routes operated from a single carhouse. It also shows the different lengths of these routes and the total miles operated daily in covering the total of 672 trips. It will be observed that there are trips on long routes and trips on short routes and that the lengths and numbers of trips vary greatly on each of the routes. Some of the routes start from the point where the cars are stored, namely, the carhouse. In consequence, all cars that happen to be in the carhouse cannot be freely used, but a separate group of cars have to be "pulled out" and placed in service on such a line. This adds to the complications, for it is not a simple problem to combine trips into schedule runs if the terminals of the lines are widely separated.

The first important task in schedule making is to

TABLE IV
Distribution of Entire Operating Force of Conductors, Motormen, Guards and Brakemen as of September 14, 1920

Stations	Rated at Station not Including Learners		In Other Depts. or Misc. Work Entire Day*		Sick, Off, Suspended, etc., Entire Day*		Working on Schedule or Additional Runs Entire Day		Men Listed for Scheduled Runs or Additional Runs Getting Off a Portion of Their Work Reporting as Cover Men				Men Performing Work in Addition to Day's Work on Runs or Cover Work											
	Cond.	M'men	Cond.	M'men	Cond.	M'men	Cond.	M'men	Cond.	M'men	Cond.	M'men	Cond.	M'men	Cond.	M'men								
Park St.	189	161	7	6	21	14	148	132	7	3	6	6	0	0										
Milton	169	146	3	3	23	12	134	119	1	2	3	10	1	0										
No. Point	147	147	3	7	24	11	115	117	0	1	5	15	2	0										
Lenox St.	160	159	3	7	23	14	121	125	2	1	11	12	8	5										
Jamaica Plain	134	122	5	13	10	6	105	97	7	6	7	2	2	0										
Reservoir	123	90	2	3	15	5	94	68	4	2	8	12												
Watertown	103	93	1	3	16	12	73	66	2	2	11	10												
Sewall St.	113	123	2	5	18	7	90	92	2	4	1	15	1	2										
Bennett St.	160	173	6	14	20	13	116	131	5	3	13	12	5	5										
No. Cambridge	184	142	3	12	18	7	155	110	3	4	5	9	1	0										
Eagle Street	139	117	3	1	13	9	107	89	6	2	10	16	4	4										
Clarendon Hill	133	110	4	3	12	8	109	91	1	1	7	7	0	0										
Salem St.	130	130	1	7	15	10	105	104	4	5	5	4	3	2										
Sullivan Square	82	85	1	5	9	4	70	69	0	1	2	4	0	0										
Everett	47	47	0	1	6	3	31	37	3	5	7	1	0	0										
Total	2,014	1,849	44	90	243	135	1,578	1,447	48	42	101	135	27	18										
Rapid Transit	M	G	B	M	G	B	M	G	B	M	G	B	M	G	B	M	G	B						
Sullivan Sq.	64	59	165	1	2	3	4	5	45	54	47	108	1	1	3	4	4	6	5	4	6	10	0	0
Dudley St.	65	58	163	4	3	6	4	3	35	52	44	117	1	0	3	4	2	4	0	3	15	0	0	0
Cambridge	47	44	48	1	1	4	3	1	8	36	36	22	3	4	6	4	2	8	0	0	0	0	0	0
Total	176	155	376	6	6	13	11	9	86	142	127	247	5	5	12	12	8	18	5	7	21	10	0	0

* These men are not available for car service during the entire day.

arrange the work of the cars and is commonly known as the car time. Chart III shows the same trips indicated in Chart II, arranged throughout the various hours of the day as the work of the various cars comprising the rolling stock at the particular carhouse.

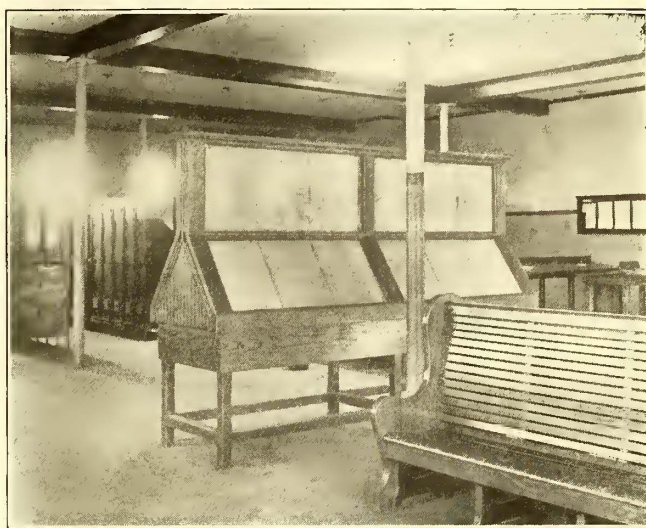
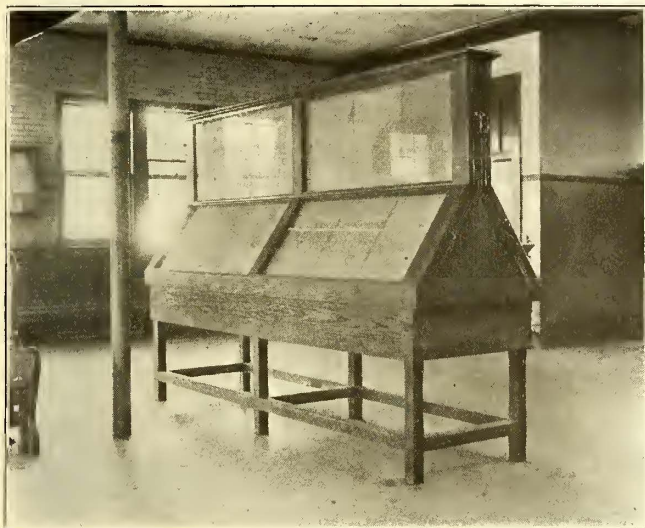
It will be noted that here the same character of peak load condition is apparent. The lines that cross the entire sheet indicate base schedule cars or cars from which is secured maximum service, while during the hours from 6 to 9 a.m. and from 5 to 6 p.m. additional cars are required for a relatively small amount of work. In fact, five cars are required in the afternoon rush hour to perform but a single trip daily.

The arrangement of the car time as shown graphically requires careful and painstaking study in order that the service may be performed with the least amount of

ticular run has but two definite trips, one at 8 a.m. and one at 5 p.m. During the rest of the time, shown in the chart as a dotted line, the crew is on hand to perform such work as may be required.

From *F* to *G* are indicated the periods of work of all men not having schedule runs. These periods are for eight hours' straight time and the men assigned perform such work as may be required, but remain available the entire period and receive pay for the full eight hours. These assignments also vary from day to day, both as to the number of them and the time they start and finish, depending upon the men absent from schedule runs and the traffic conditions of the particular day. They are known as cover periods and the men assigned are called cover men.

While this arrangement of work guarantees to all men



Views in lobby of Clarendon Hill carhouse, showing bulletin board for display of time-tables

investment in rolling stock and, consequently, power requirements, and failure to arrange the trips so that a minimum of cars will be required may mean a very considerable capital investment as well as operating loss.

The traffic study determines the number of trips operated, the length of them, their exact starting time to produce the proper headway and the use of one-man cars, trailers or three-car train service. It is in this field that there is almost unlimited opportunity for constant study to insure the operation of that amount of service necessary properly to handle the traffic and no more. The car time represents the arrangement of the necessary minimum number of cars to render the service, and from the car time is arranged the hours of labor of the men who operate the cars.

Chart IV shows the arrangement of the same trips as shown in Chart III without disturbing their location from hour to hour into day's work for the platform men. From *A* to *B* are shown the runs of eight hours' platform time, completed within eleven consecutive hours' actual time. From *C* to *D* are shown the runs of eight hours' platform time completed within fourteen consecutive hours. In Boston 60 per cent of the runs are completed within eleven consecutive hours and 40 per cent between eleven and fourteen outside hours.

E represents a single run of the class known as additional runs, of which there are relatively few and which do not form a part of the percentage governing scheduled runs. These runs provide a definite full day's work, but not entirely of platform work. This par-

working eight hours' pay, it meets the requirements of traffic with a minimum number of men and is sufficiently flexible to meet varying traffic fluctuations. It has an advantage both to the men and the company in that all schedule trips are operated each day by the same men, and the cover men have from day to day a definite assignment, as compared with the previous arrangement of work for extra men which was never the same and shifted daily from early trips to late trips, so that the extra man's time was almost never his own.

The number of runs and their spread of outside hours, as well as platform hours, are shown in Table II. When the schedules are completed it becomes important to know the exact number of man-hours utilized daily by platform work, and Table III indicates the subdivisions of time into its various factors.

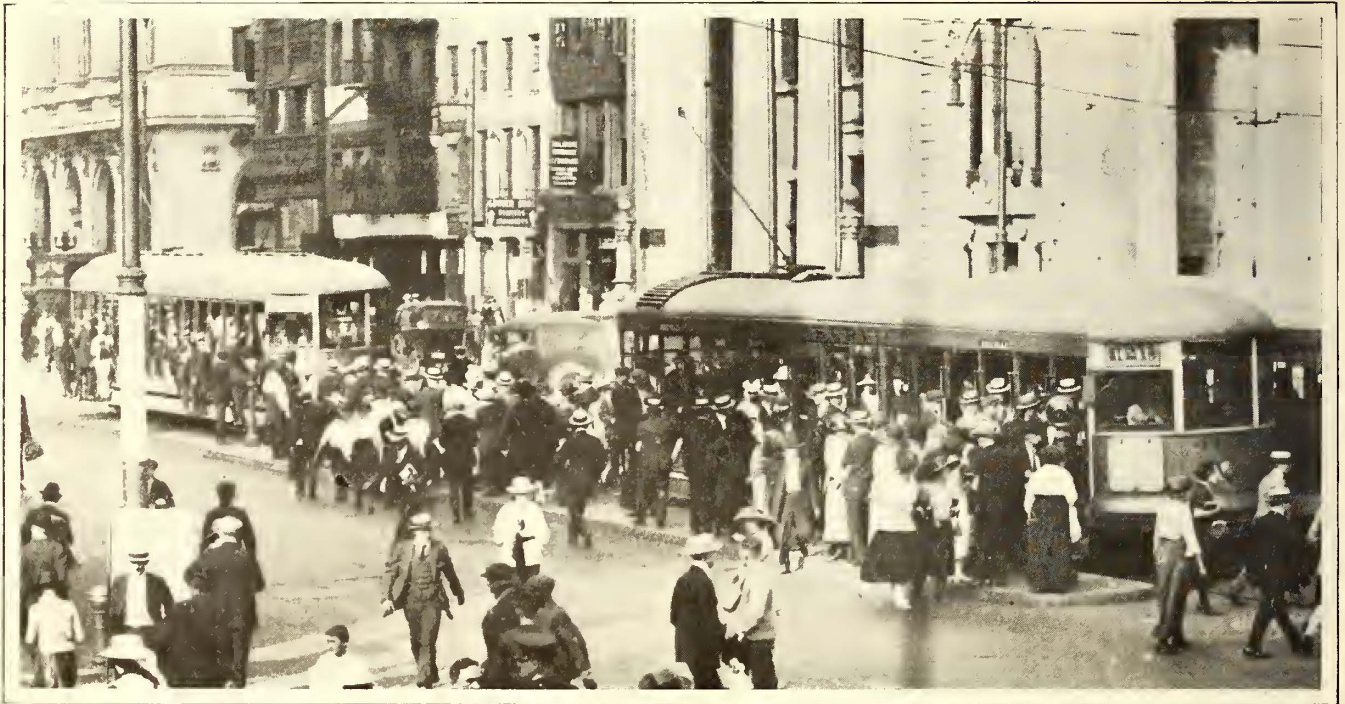
The distribution of the entire uniform force is indicated in Table IV, showing various locations from which men are rated and the number actually working on runs, doing miscellaneous work, absent, etc.

Given reasonable working conditions which fit the peculiar nature of the street railway industry and fair compensation, it seems to me the time has arrived when the rank and file of the employees on the platforms ought to exert every effort to assist in the efficient and economical operation of street railway properties in the interests of the car riding public. Whatever they do to increase production by the elimination of lost motion and inefficiency will surely result in mutual benefit to men, management and car riders.

Present and future tendencies. Problems and methods of attack. Results of the application of transportation fundamentals in American cities

Surface Transportation in Congested Districts

By *John A. Beeler*
Consulting Engineer



A double berth loading platform on Broad Street, Newark, N. J., which economizes stopping time

THE function of any transportation system is to give service, and in that word are centered all the operating problems of the transportation industry. The word "service" today in connection with transportation means good service, *i. e.*, the transportation of people quickly with comfort and safety and at a reasonable charge.

Good transportation service is as absolutely necessary to the growth and prosperity of any city today as air, water or light. In fact, transportation to a large community is second only in importance to air and water.

Good transportation service is essential to business prosperity and it is safe to say that 80 per cent of the mercantile business of the country is located along car lines. The merchants of Bridgeport, Conn., recently discovered that a cessation of street car service meant a material loss in their receipts even though, apparently, jitneys handled the traffic adequately. Other cities have furnished similar examples.

When municipalities realize this fact and also that the relief of traffic congestion in congested districts is a primary element in good transportation there will be a great improvement in the community prosperity. Street cars will be given the right of way over general traffic because an increased speed for street cars means an increase in speed of all street traffic.

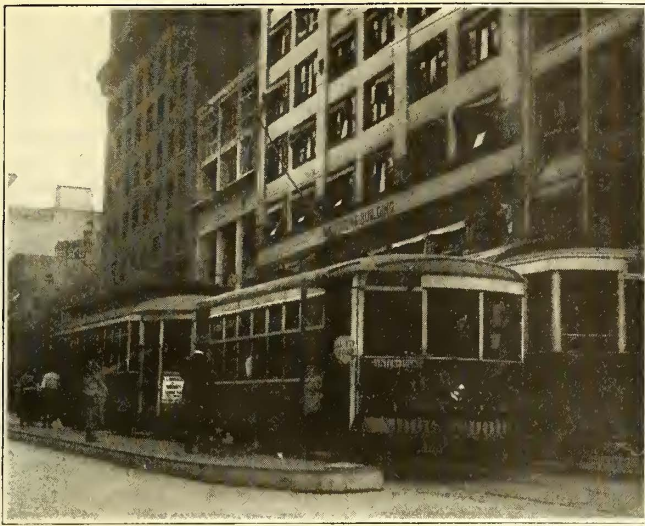
On the other hand, the railways themselves must understand they are now dwelling in a competitive age,

that the private automobile and the motor bus have come to stay and that the pedestrian is always to be reckoned with. The street railways, although they have been unjustly handicapped in many ways because the other modes of transportation have been favored by their failure to overcome local conditions of congestion, have themselves accelerated the development of the motor bus and the private automobile and have encouraged the pedestrian as competitive transportation agencies.

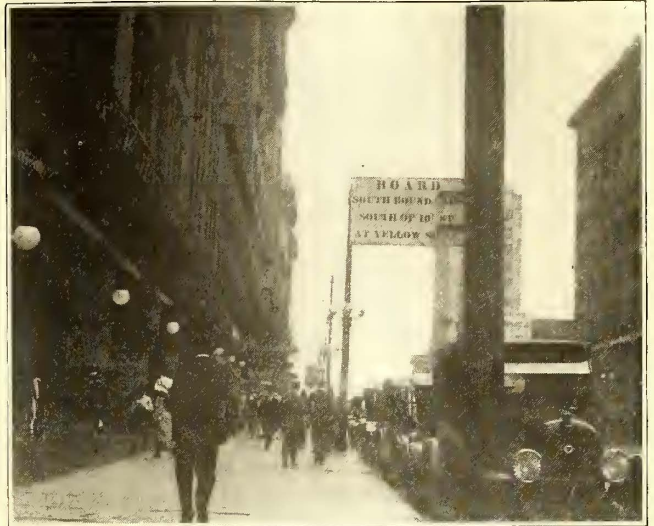
There is today more opportunity for improving the handling of traffic in our cities than in almost any other field of endeavor. The conditions in every city differ in detail, but the general methods for improving service are fundamental. The specific application of the needed remedies must be preceded by a correct diagnosis of the troubles. In the following paragraphs an attempt will be made to point out some of the points of attack in an effort to improve the transportation conditions in a city.

A TRAFFIC STUDY ESSENTIAL

One of the first essentials for improving the service is to secure the co-operation of the municipal and railway authorities in an open-minded study of the situation. This study should not be confined to the railway service but should cover the traffic systems as a whole. The speed of all cars on all lines, the headway, the reg-



Kansas City has put in a number of temporary loading platforms



Instruction sign giving directions for boarding cars in Kansas City

ularity of operation, the habits and customs of the passengers, the traffic conditions in congested districts and at busy intersections, the routes, the tendency in city growth and development are all factors to be considered.

The prime requisites of service that are demanded today by the public are dispatch, regularity and frequency, and the more methods of transportation available the more transportation will be used. The luxury of yesterday becomes the necessity of today. Time saving is demanded in all branches of industry. A few years ago comparatively few people rode on the Twentieth Century Limited. Today this is one of the heaviest trains between New York and Chicago, and two or three sections are frequently required. Time is money now more than ever. Cutting down wasted time means not only decreased expenses but increased receipts per car-mile because more passengers are attracted to the cars.

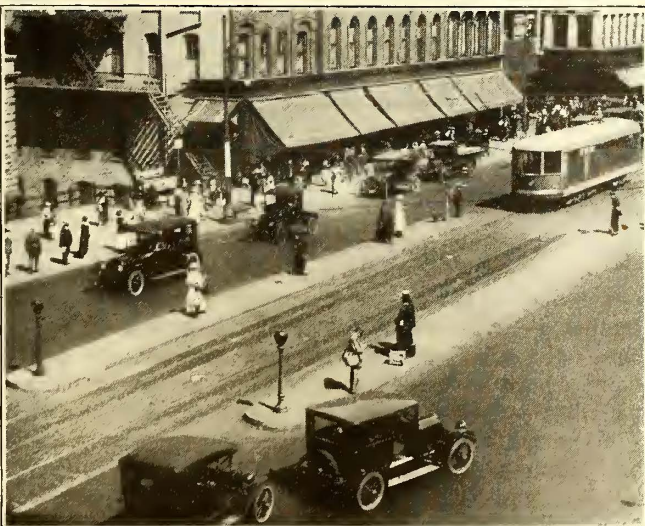
The development of transportation methods follows closely the development in the speed of transportation vehicles. Take the horse car, the cable car, the electric car, the automobile, the elevated and the subway. Each has shown an increase in speed over its immediate predecessor.

Quicker transportation does not mean higher maximum speed, but it can be obtained by a lessening of road delays, overcoming congestion, more direct routing, quicker loading and unloading, and regularity of service. These will be considered briefly in the order named.

CUTTING DOWN ROAD DELAYS

Much of the time lost by cars through road delays would be avoided if all companies realized the value of seconds. Many of them do not seem to understand that a stationary car costs almost as much in operating expenses per car-hour as a moving car. Transportation service and income depend on the distance moved by each transportation unit in unit time. Receipts are proportional to car-miles, but expenses are very nearly proportional to car-hours. One company may be prosperous while another is bankrupt, even though they may have earnings at the same rate per car-mile and make the same number of car-miles per annum, because the cars of the first company average more miles per car-hour than those of the second company. A difference of one mile per hour may make or break a company.

A simple and direct attack can be made on this cause



The loading platforms in Newark, N. J., are lighted by lamp posts at each end



The "car-always-in-sight" principle is illustrated in this view from Vancouver, B. C.

of delay by determining from the studies of the speed made on the different routes what schedules are too slow and then applying remedies to each route that will relieve conditions. Waste time may be due to many factors, such as too many so-called safety stops or fire stops, stops too close together, stops in wrong locations, unnecessary positive stops. One of the greatest factors of road delay is the so-called safety stop. At grade crossings where the conductor dismounts and flags the street car across the railroad tracks much time frequently is wasted. This is anything but a safe method, as experience has demonstrated that nine times out of ten the conductor simply goes through the motions, thus relieving the motorman of responsibility. In one instance, which came under my notice recently, a car stopped at a crossing and the conductor walked across the track to a distance of about 25 ft. on the other side, where he pulled a lever that operated a derail which permitted the street car to cross the railroad. After closing the derail on looking up he was amazed

are made by cars before passing the diverging point in the lines. Instead of passing through the neck and out beyond, they stop in the neck, delaying those behind.

Electric switches and automatic signals can be used to advantage to save time. Recently I observed a place where it required a minute for the motorman to walk over, throw a hand signal and return to the car. Today a minute is worth 5 cents, as the average car-hour expense is at the rate of \$3 in these days of high wages. The saving of a total of five minutes on a line with a five-minute headway will permit the saving of \$15,000 per year and make available one car for additional service.

TIME CAN BE SAVED IN FARE COLLECTION

The introduction of fractional rates of fare instead of the even 5-cent fare has caused a loss of from $\frac{1}{2}$ to $1\frac{1}{2}$ m.p.h., due to increased difficulties in fare collection. Metal tickets, front end collection, and prepayment areas rightly placed may help to eliminate this loss.

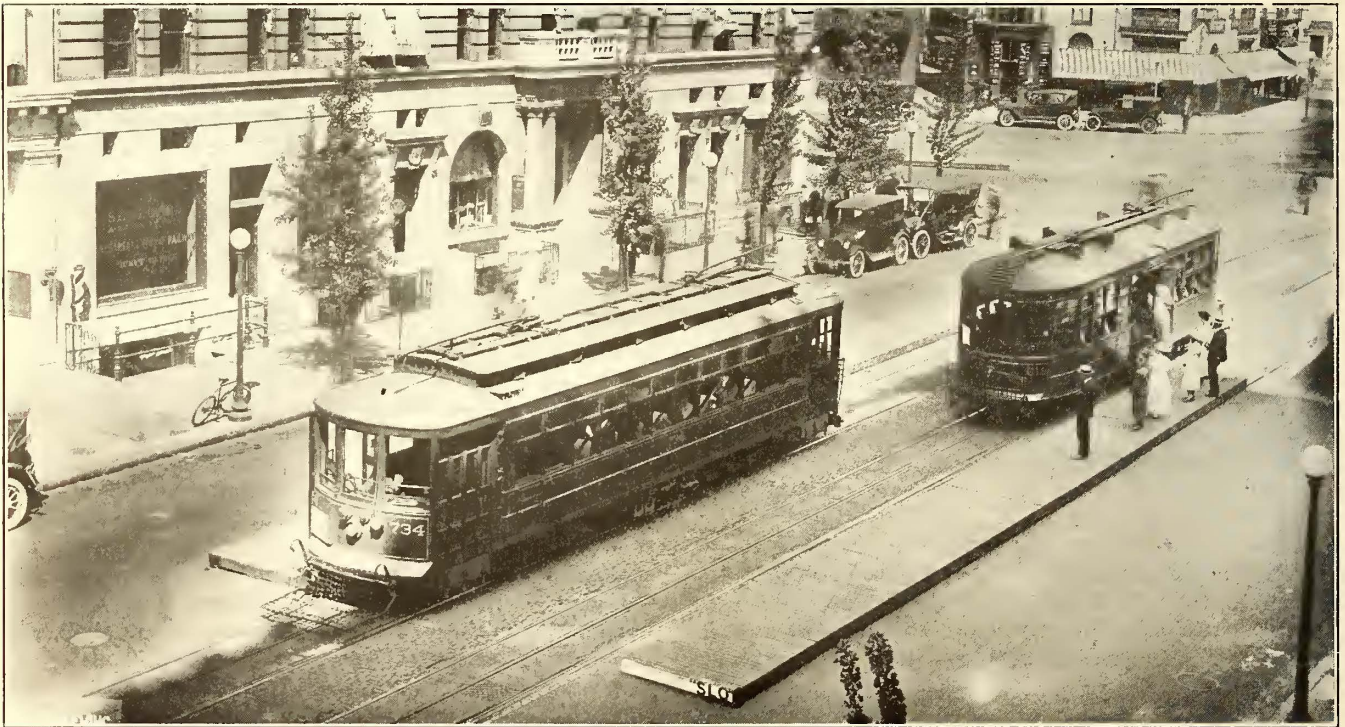


Photo by Harris & Ewing.

Loading platforms at New York Avenue and Fourteenth Street, Washington, D. C.

to see a freight engine and caboose between the street car and himself. Where the view is unobstructed it is much safer to place the responsibility undividedly on the motorman. A railway flagman or gateman, who is familiar with operating conditions and schedules, is the safest man to rely upon if a grade crossing has to be flagged. These old railway men know when to expect the trains, they can detect the rumble of the approaching train on the rails, they are not dazzled by the change from light to dark as is the street car conductor.

Another element that causes waste road time is slipshod instruction of trainmen in handling of cars, especially in accelerating and braking. A normal rate frequently found is 1 m.p.h.p.s. when it should be nearer to 2 m.p.h.p.s. Stops may also be placed in the wrong position. On single tracks, cars can often make their stops on the sidings, yet more frequently they stop on either side of the siding and block the line. Frequently much congestion is caused for the reason that stops

The method of making change is an important factor. In general, with fare boxes, it has been demonstrated that where a metal ticket is returned to the passenger to place in the box with change for the balance due, collections are accelerated.

Front end collectors at points where many passengers board the cars and prepayment areas, where they can be installed at not too great expense in central localities, facilitate car movement. The prepayment area for the passenger means also that he has a centralized loading point where he can wait in comfort, secure a seat and usually be more sure of cars being on schedule time. For the railway company it often obviates the necessity of issuing paper transfers and thus saves expense, delay and improper use of the transfer privilege.

On many systems where it is not possible to have such stations in central areas they can be installed to advantage in suburban centers. Trunk lines can enter these terminals and feeder routes using safety cars or

motor buses can be used to distribute the traffic in the suburb. The use of a terminal station is not usually advisable where cars have to go considerably out of their way or through congested districts to enter it.

SPEEDING CAR MOVEMENT IN CONGESTED DISTRICTS

Where the streets are taxed to capacity, one of the first remedial steps to be taken is to restrict the parking of automobiles. This should be done without fear or favor, and the loading and unloading of heavy trucks should be reduced to a minimum, especially during the rush hours.

Traffic regulations are difficult to enforce but they are essential to expedite car movements across intersections and between loading points in the congested districts. The street car should have the right-of-way over general vehicular traffic as it carries more passengers per unit, and its passengers use it from necessity more than for pleasure. Another reason is that the street car is on fixed tracks and cannot dodge in or out of the traffic stream. Experience has proved that an increase in street car movement means a similar increase of vehicular traffic movement and that all traffic is expedited by co-ordinating its movements with those of the street car. In one city where the speed of the street cars in the congested district during the rush hour was increased 68 per cent, the actual number of street cars passing through the district per unit time increased 58 per cent. This gave an actual increase of 58 per cent in the service rendered during the rush hour and did not require a single additional car.

Double berthing of cars helps to speed up traffic as it gives schedule leeway and permits of passing at intersections more than one car at a time. It is particularly beneficial when there is a very frequent headway. Actual trial has demonstrated that the more opportunity there is for double berthing the less the necessity for it, as cars more quickly resume their normal spacing.

Much can be done also with the spacing of car stops. Too close spacing of stops will demoralize schedules, especially during the rush when all stops are being made and when service is most needed. Extra cars then added usually will then simply make extra stops and not add to the capacity of the line. They may be in the neck of the traffic bottle or too near the point of greatest vehicle congestion.

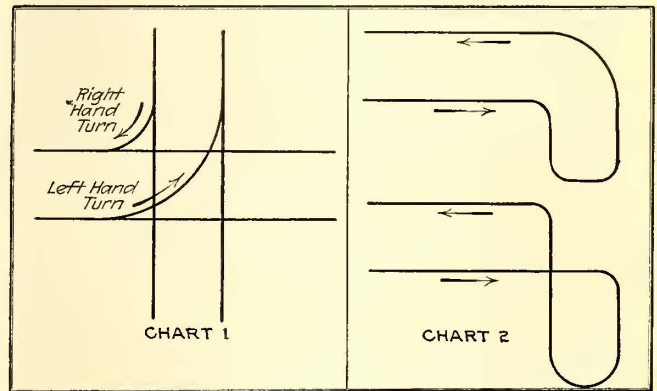
Custom fixes methods for doing things and often is hard to overcome. Where a merchant objects to a beneficial change in street conditions, such as a change of a stop, he must be shown that what he objects to from a selfish standpoint is really a benefit to him, because it means an increase in the number of people who can travel to and from his store in comfort and not a mere congestion of people at that point. To reduce this congestion means a greater number of cars per hour and faster service. A decrease in the trip time means an enlarged area available for his customers.

SKIP STOP VERSUS EQUALIZED STOP

The theory underlying the skip stop for both congested and outlying sections of the city is good so far as it means the elimination of unnecessary stops. The name "skip stop," however, is unfortunate because it gives the impression that the public is being deprived of a convenience. This handicap in its name, combined with poor judgment in the establishment of stops, largely explains the unpopularity of the system in many cities. A better name for a plan of re-establishing stops is

"equalized stops." The stops should be placed where they will serve the greatest number and as nearly as possible on the basis of equal spacing. This is a fundamental requirement for good service. The number of stops per mile not only limits the speed but controls the amount of service possible to render with a given equipment. When stops occur eight to the mile, which is about right for urban service, the motorman must apply the brakes, bring the car to a stop, open the doors, wait until the passengers are on or off, close the doors, accelerate the car and get it back to speed, and do all of this once in every forty-five seconds, when the average speed between stops is 10 m.p.h. It can be readily seen that it is very difficult, where the number of stops made actually exceeds eight, to give good service. To eliminate every other stop is irrational as often stops have been placed at greatly varying distance, and some have been incorrectly located, so that conditions might be made worse instead of being improved by such a method for fixing stops.

In one large city where the stops were placed on an average of 700 ft. apart in the congested districts and



Diagrams showing the effect of turns and loops on traffic

in some instances 1,000 ft. not one complaint was received from the public, for the reason that congestion was relieved and service greatly bettered.

PRINCIPLES OF CAR ROUTING

A great improvement in traffic conditions can be obtained in most cities by properly rerouting the cars. The routes in many cities were established more than a generation ago, and through the development of cities and of transportation agencies, conditions have utterly changed in many localities. Often rerouting combined with a rescheduling so as to fit the cars to the traffic requirements will release many cars for additional service where badly needed. This enables the cars to serve the public better and at the same time increases the earnings. In one large city, for instance, without any change in tracks or equipment, a general adjustment of stops and loading methods generally enabled 100 cars to do the work for which 113 were formerly required. This was followed by a new routing schedule which further increased the capacity of the original 100 cars, enabling them to do the work of 126. This was equivalent to a gain of twenty-six additional cars for each one hundred operated without any increase in investment or fixed charges.

The fundamental purpose in determining car routes is to secure *direct* routes. That is to say, the object is

that the maximum number of passengers should reach their destination quickly and as far as possible without transfer. In through-routing the purpose is to balance traffic through the center of the city and thus save car mileage.

Car mileage in the congested district can also often be saved by a rearrangement of tracks and loops. Frequently a through routing can be effected in the congested district where lines are equally balanced, much delay avoided and substantial savings effected.

The effect of right-hand and left-hand turns depends on the width of the street and the traffic conditions. In general a left-hand turn delays cars on the other tracks and a car takes 20 to 40 per cent more time to make such a turn than to turn on a right-hand curve. In a recent test the average time on a left-hand curve was fourteen seconds as compared to ten seconds on a right-hand curve. This time element is important as time cannot be made up readily in congested districts.

Chart I shows the effect of the right-hand and left-hand curves under the conditions assumed. The car



Photo by Harris & Ewing

Loading platform at Ninth and F Streets, Washington

must travel a greater distance in the intersection and also tends to impede other car movements across the intersection on the other tracks.

Chart 2 has been drawn to illustrate two methods of providing for loops in a congested district. The relative merits of the two methods depend upon the extent of the congestion at the corners where the turns occur. In general, the number of left-hand turns should be reduced to a minimum, and at many of the congested street intersections in large cities all left-hand turns for vehicles other than the street cars have been prohibited in order to expedite traffic.

LOADING AND UNLOADING

The possibility of the loading platform in relieving street congestion in cities has not been realized or utilized to the extent it should have been. The loading platform functions to relieve congestion on sidewalks, speeds up street car schedules, and makes for the comfort, convenience and safety of the public.

The car patron standing on the leading platform is safe from the moving crush of vehicular traffic and out of the way of the pedestrian. He escapes a last minute dash through the street vehicles, and general street traffic can move while the street car stands still without danger or detriment to the car patron. From the railway standpoint the possibility of the load-

ing platform is also important. It saves at least $\frac{1}{3}$ second per boarding passenger exclusive of the time saved by the car waiting while passengers cross the traffic stream to reach the car.

The loading platform is not suitable to very narrow streets, but if the distance between the car tracks and the curb on one side is wider than is absolutely necessary to accommodate one line of moving vehicles and not wide enough for two, space that otherwise would be practically wasted is often available for a loading platform. For instance, in a street where there is $13\frac{1}{2}$ ft. between the sides of the car and the curb and only 8 ft. is required for the line of moving vehicle traffic, there is available $5\frac{1}{2}$ ft. of waste space. A width of $3\frac{1}{2}$ ft. can be utilized to advantage in this case for a loading platform, leaving 10 ft. available for vehicular traffic, which is ample to give satisfactory clearance.

Successful loading platforms range from a minimum of $3\frac{1}{2}$ to 6 ft. in width. The usual width is about 5 ft. They should equal one car in length or the length of two cars at double berthing point.

The loading platform should be at least 9 in. high to avoid danger from vehicles and to offer to its patrons a feeling of security and distance from the moving vehicles near the platform.

The loading platform functions properly when the people are on the platform before the car arrives. Double berth platforms are best and are successfully used in many cities at heavy traffic points.

Much can be done in speeding the loading and unloading of passengers, also, by a proper design and arrangement of car doors and steps. In general every entrance and exit to a car should permit a double file of passengers in order to avoid delay.

Most street car schedules have been made by a cut and try method, and the tendency has been to add time as congestion increased instead of attempting to relieve the congestion and tighten the schedule. Without increasing the maximums, it is sometimes assumed that the higher the average rate of speed the more numerous the accidents, but this is not borne out by the facts. I recall one instance where a change in speed from 8 to 10 m.p.h. was accompanied by a reduction in accident cost of from 4 per cent to 1 per cent of the gross receipts.

Faster and more regular schedules mean more business. A pedestrian looks on a street car with contempt if he is walking faster than the car is moving, but often will ride a short distance if the cars move much faster than he can walk. Greater regularity in schedules is equivalent to additional cars. A difference of one minute each way on a ten-minute headway for two successive cars means that they are 20 per cent off the schedule spacing, while with a five-minute headway they would be off 40 per cent.

The secret of maintaining a good schedule is in keeping every one concerned attending to business, and no one item is more essential than to maintain correct running time for cars throughout the system. This involves a good method of time checking at terminals and on routes as well as accurate watches for trainmen and inspectors. The inspector should check the trainman's time whenever he boards a car. There are today too many starters not starting, inspectors not inspecting and dispatchers not dispatching on railway systems all over the country.

Increase in car speeds can be accomplished only by detailed attention to several sources of delay which are enumerated and commented upon

Increasing Schedule Speed on City Railways

By *Victor B. Phillips*

Assistant to the Vice-President Cleveland (Ohio) Railway



Cleveland Railway's older type of train with center-entrance, center-exit motor car

QUITE aside from the advantage of faster and therefore better service to car riders, higher schedule speeds may be urged on the grounds of substantial money savings. Two items of cost, namely, platform labor and fixed charges on rolling stock, bear a very simple and fixed relation to schedule speed. For given traffic conditions it is necessary to supply a certain number of car-miles in order properly to handle such traffic. If by means of higher speeds it is possible to make a car and its crew cover twice as many car-miles in a given time it is evident that the cost of platform labor and the fixed charges on cars will be cut in half. Inasmuch as these charges constitute more than one-third of the total cost of operation, maintenance and all fixed charges, it follows that any substantial reduction in these charges is a matter of importance.

In the case of the Cleveland Railway, for the year 1919, with a schedule speed of 10.82 m.p.h. (without lay-overs), platform labor cost 11.9 cents per car-mile and fixed charges on cars, including interest at 6 per cent per annum, amounted to 2 cents per car-mile. The latter figure includes only 1 per cent for depreciation due to obsolescence, as it is considered that depreciation in general is a function of car-miles and that obsolescence is of relatively little importance.

It is, of course, quite likely that the cost of equipment maintenance per car-mile would be materially

affected by change in schedule speed. The cost of painting per car-mile would be somewhat less, inasmuch as the condition of paint is a function of time rather than of mileage. On the other hand, it is likely that damage to car bodies from collisions would be substantially greater with the higher schedule speeds. On the whole, it may be said that the cost of equipment maintenance per car-mile will not be appreciably changed by an increase in schedule speed.

To what extent accident claims would be increased by higher speeds is problematical. Where increases in schedule speed are contemplated, this item should be given consideration. Examination of accident and traffic statistics for the Cleveland Railway over that period during which schedule speeds were increased fails to show any marked increase in accidents from this cause.

Fig. 1 shows graphically the relation between schedule speed and the cost of platform labor plus fixed charges on cars per car-mile.

There are many ways of increasing schedule speed. In any particular analysis the cost of putting into effect any one or several of these means of increasing speed must be deducted from the savings mentioned above. The more important of the many ways of increasing speed are the following:

1. Increase in rate of acceleration.
2. Increase in maximum speed.

3. Increase in rate of retardation.
4. More rapid loading and unloading.
5. Reduction in number of stops.
6. Elimination of delays due to street traffic.
7. Use of loops rather than switches and Y's, especially in congested districts.

The above will be considered in order.

In Fig. 2 are shown a number of speed-time graphs based upon actual tests made on the Euclid Avenue line of the Cleveland Railway system. They are shown one

The difference in voltage which was in part the cause of the more rapid acceleration in this case was 54 volts. The corresponding increase in speed represents a saving in platform and fixed charges of approximately 1.1 cents per car-mile.

Regarding the matter of weight, in the last few years some improvement has been effected in the design of street cars whereby the weight of the car is materially reduced for the same carrying capacity. This reduction in weight has been effected largely by a better dis-

TABLE I
Statistics of Train Operation by Seventeen Companies

Name of Company	All Day-Train Operation as Well as Rush Hour	Make-up of Train	Seats per Motor Car	Seats per Trailer	Average Schedule—Speed of Train in m.p.h.		Average Schedule—Speed of Single Cars in m.p.h.		Maximum Number of Trains Past Any Point per Hour per Track
					Rush Hour	Non-rush Hour	Rush Hour	Non-rush Hour	
Boston Elevated Railway	Yes	M. C. & T. M. U.	52; 56	62	9.92	9.92	9.92	9.92	102
All Brooklyn Surface Lines	Yes	M. C. & T. M. U.	48	62	8.72	10.47	8.72	10.47	...
Capital Traction Company	*No	M. U.	48	48	8.50	8.50	8.50	8.50	...
Cincinnati Traction Company	Yes	‡M. C. & T.	35	60	8.40	.....	8.77	8.95	8
Cleveland Railway	Yes	M. C. & T.	56	60	10.28	10.91	10.30	10.82	35
Detroit United Railways	Some lines	M. C. & T.	43	56	10.25	10.25	10.25	10.25	63
Louisville Railway	*No	M. C. & T.	45	45	10.15	.....	10.15	10.15	10
Memphis Street Railway	†Yes	M. C. & T.	44	56	10.13	†10.36	10.36	10.80	17
Milwaukee Elec. Ry. & Lt. Co.	*No	‡M. C. & T. ‡M. U.	46-59; 59	54-59; 59	9.22	.....	9.22	9.75	...
Montreal Tramways Company	†Yes	‡M. C. & T. M. U.	42	45	8.59	9.40	8.59	9.46	30
New Orleans Ry. & Lt. Co.	Yes	M. C. & T.	44	62	9.02	12.03	8.07	9.06	10
New York State Railways, Rochester Lines	*No	M. C. & T.	48	52	8.40	.....	8.40	8.80	130
Omaha & Council Bluff Street Railway	*No	M. C. & T.	47	60	8.77	.....	8.77	10.50	8
Peoples Railway, Dayton, Ohio	*No	M. C. & 2T.	44	60 each	8.88	.....	9.00	9.00	...
Pittsburgh Railways	*No	M. C. & T.	42; 56	60	9.35	.....	9.35	9.42	35
Public Service Railway	*No	M. U.	50	50	8.75	.....	8.75	9.30	...
United Railways Company of St. Louis	Yes	M. C. & T.	57	68	10.08	10.54	10.08	10.54	12

* Operate during rush hour only.
† Operate on regular schedule Saturday and Sunday only.
‡ Motor car with trailer equipped with control apparatus.

M. C. & T.—Motor car and trailer.
M. U.—Multiple unit.

above the other so as to have a common base line of time. The total area under each of these graphs represents distance. Graphically, our problem is to increase this area as much as possible.

GETTING THE CARS UNDER WAY MORE QUICKLY

Acceleration may be increased in three ways, namely, improvement in line voltage, use of more powerful motor equipment and use of lighter cars.

To illustrate: The diagrams in Fig. 2 represent conditions at the rush hour in Cleveland, at which time line voltage is considerably lower than at other times and at which time trailers are used. To show the effect of increasing the voltage and taking off the trailers, the graph B' has been drawn and superimposed on B. Graph B' has been so laid out on this chart that the distances between stops, as represented under each cycle of the two graphs, are the same for B and B'. The braking rates are the same in the two cases.

From this chart it is found that the more rapid rate of acceleration represented in B' results in an increase in schedule speed from 9.92 m.p.h. to 10.59 m.p.h.

tribution of steel and has amounted to as much as 15 per cent of the weight of the motor car.

One of the arguments in favor of the modern one-man car has been its greater rates of acceleration and braking, which have been possible on account of the light weight of the car per passenger carried. This last is especially true during the non-rush hours when cars are not loaded to capacity.

NOT MUCH CHANCE TO INCREASE MAXIMUM SPEED AND BRAKING RATE

It will be seen from the speed-time graphs in Fig. 2, which are based on average data for a number of runs, that cars do not reach the maximum possible speed. Under average conditions the motorman starts coasting and then applying the brakes before sufficient time has elapsed to permit such maximum possible speed to be attained. For this reason, under the traffic conditions which usually obtain in city streets, there is little to be gained by equipping cars for a maximum speed which is almost never reached.

Due to the high schedule speeds already in effect in

Cleveland, the rate of retardation represented by the speed-time graphs shown in Fig. 2 is very nearly the maximum obtainable, and presumably this is rather generally the case. Of course, the effect upon schedule speed of an increase in the rate of braking has already

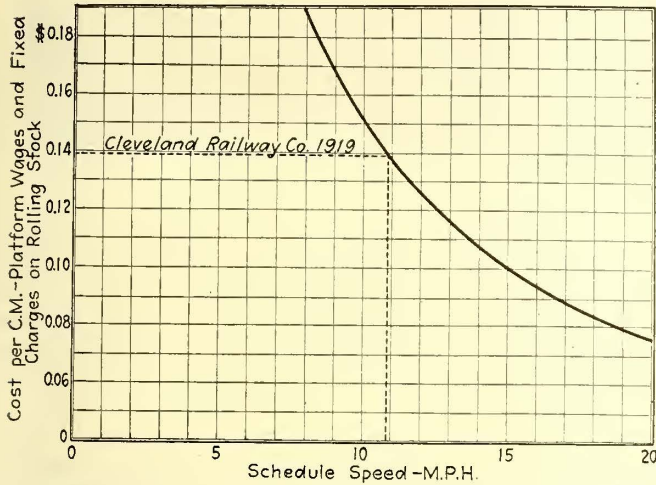


Fig. 1—Curve showing decrease in operating costs produced by increase in schedule speed

been indicated in the example of increased acceleration cited above. This effect upon schedule speed is precisely the same for the two cases.

MORE RAPID LOADING AND UNLOADING IS IMPORTANT

The relative importance of rapid loading and unloading in its effect on schedule speed can readily be seen by referring to the diagrams in Fig. 2. The average length of stop on the Euclid Avenue line of the Cleveland Railway during the rush hour is 7.43 seconds in the congested district and 6.9 seconds in the non-congested district. Both of these figures are somewhat less than those which obtain in other cities where similar conditions exist.

In Cleveland a large amount of time has been saved by operating cars leaving the congested district as pay-

leave cars and those coming toward the congested district as pay-enter cars. By this arrangement fares are collected in the outlying districts where people get on and off cars in relatively small numbers. A train comprising a center-entrance and center-exit motor car and similar trailer can be loaded with a total of 200 passengers in one minute by using the pay-leave system. This rate of loading is regularly accomplished on the Cleveland Railway system in the case of cars loading at the Public Square during the rush hour. On the cross-town lines where there is no single congested district, but instead are numerous points where heavy loading and unloading occur, the Peter Witt car and Peter Witt system of pay-as-you-pass is used. On these lines it has been found that this system is by all odds the most satisfactory and saves a great deal of time. In general, the more important methods of speeding up loading and unloading of passengers are as follows:

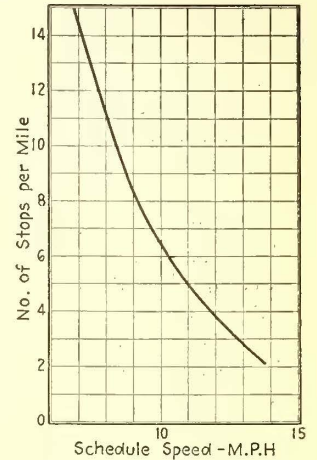


Fig. 3—Stops per mile plotted against schedule speed

1. The pre-sale of tickets and tokens in a large number of conveniently located stores.
2. The pre-collection of fares by passing passengers through a gate or even by using a portable fare box and stand placed on the streets at the more congested loading points.
3. The use of tokens or tickets where the fare is an odd number of cents.
4. Various arrangements of loading stations, such as safety islands, platforms, the queue system, aisles, etc.
5. Various arrangements of car entrances, exits and location of fare box.

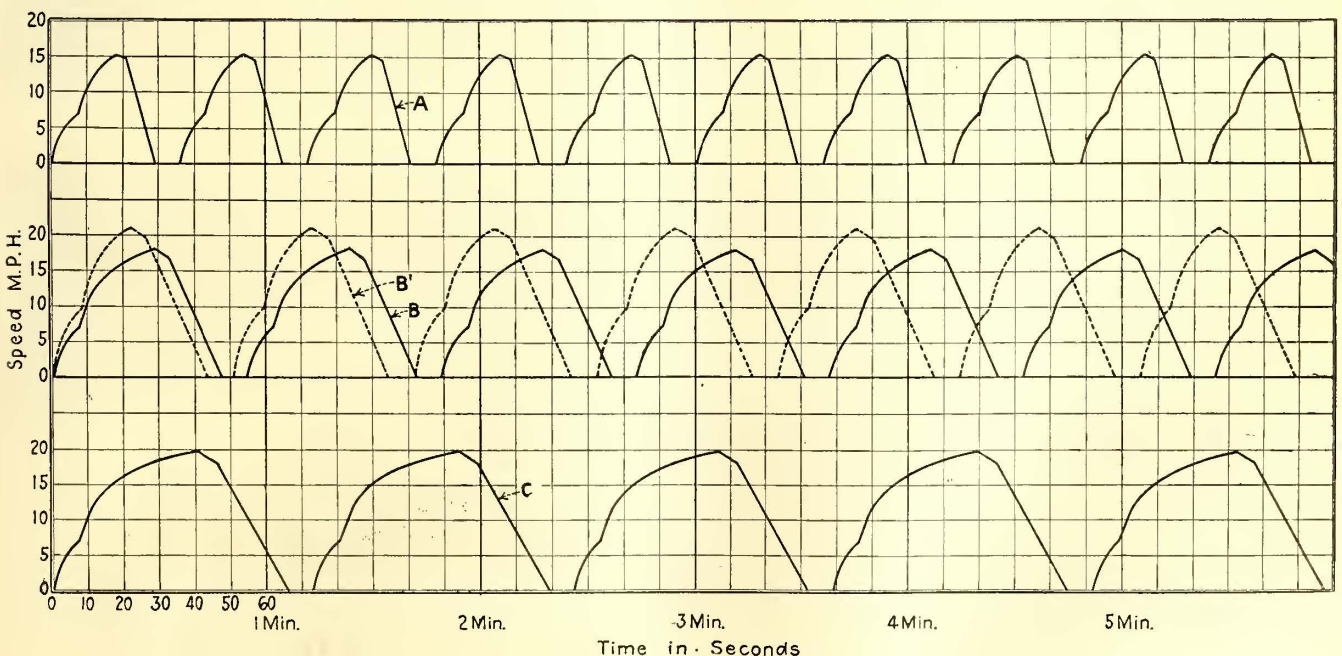
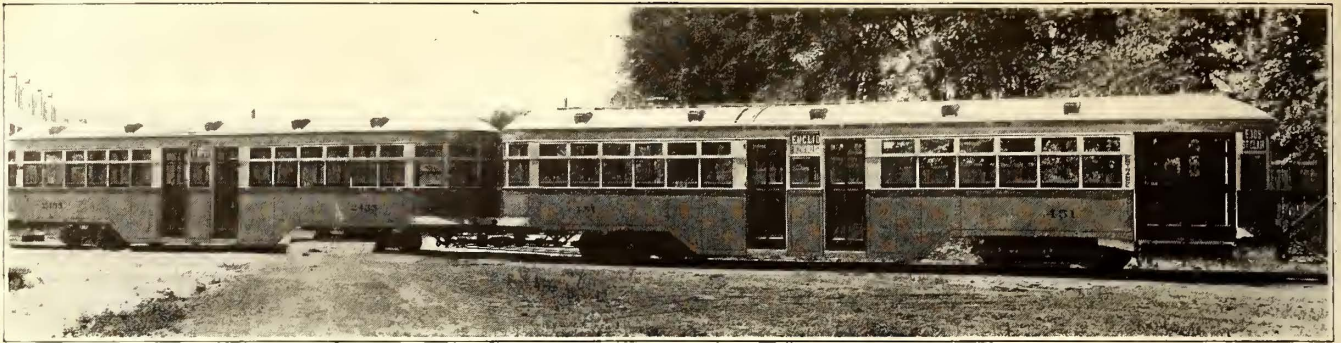


Fig. 2—Time-speed graphs for the determination of the relation of schedule speed and the frequency of stops



Latest type of train used by Cleveland Railway

It is difficult, in an article such as this, to generalize or to present specific data that will be of general value regarding the effectiveness of these several means of speeding up the loading and unloading of cars. Each depends upon local conditions.

The pre-sale of tokens and tickets in stores has been used to good effect in Baltimore. The pre-collection of fares by means of portable fare boxes and stands placed on the streets at the congested loading points is now being successfully used in Kansas City. The Cleveland Railway in certain cases is using the pre-collection system, notably during the hours of congested traffic at amusement parks and in certain factory districts.

With regard to the arrangement of car entrances and exits, the writer believes that the Peter Witt car represents the last word. Cars of this type recently purchased by the Cleveland Railway are provided with a wide front entrance which permits the simultaneous loading of two streams of passengers. In these same cars a panel has been introduced between the center-exit doors, the fare box being placed between these doors. Passengers from the front half of the car are unloaded by the forward center exit door, paying as they pass the fare box. Passengers from the rear half of the car are unloaded by the rear center exit door. Passengers passing from the front to the rear of the car pay as they pass the fare box. These passengers are generally the long-ride passengers, and in this way the long ride and short ride passengers are kept separate, as is desirable.

Several years of experience with center-entrance, center-exit cars, in which there is a well in the center of the car opposite the doors, has developed many

unsatisfactory features to this arrangement. It has been found that the well, with step leading to the forward and rear parts of the car, is the cause of much confusion around the doors and fare box. In this type of car accidents during boarding and alighting and those involving falling inside the car are double what they are for the Peter Witt type.

Graphs A, B, and C in Fig. 2 have been laid out with a view to showing the effect upon schedule speed of frequency of stops. In all three graphs the same acceleration rates have been used. Braking rates are somewhat greater in the case of graph A as compared with graph B, and in the case of graph B as compared with graph C. This must necessarily be the case inasmuch as the somewhat slower rate of braking must be used in braking from a higher maximum speed.

By comparing the areas under the three graphs, the relation shown in Fig. 3, between the number of stops per mile and schedule speed, has been determined for the particular conditions obtaining during the rush hour for a motor car with trailer on the Euclid Avenue line of the Cleveland Railway. It will be seen from the shape of this curve that the schedule speed is affected relatively more as the number of stops per car-mile is reduced. In other words, the slope of the curve is greater at the right. The reason for this is that where the number of stops is comparatively small, cars have more opportunity of reaching a high maximum speed.

By considering the curve of Fig. 3 in connection with the curve of Fig. 1 it may be seen that reduction in the number of stops per mile from eight to four will effect an increase in schedule speed from 9.2 m.p.h. to 11.8 m.p.h. and that this effects a saving of approximately



Older type of front-entrance, center-exit car loading and unloading

3.6 cents per car-mile in the cost of platform labor and fixed charges on rolling stock.

It is to be borne in mind that reduction in number of stops will to some extent decrease the number of short-distance rides.

It is probable that delays due to street traffic may be materially reduced in some cases by the rerouting of cars so as to use those thoroughfares where street traffic congestion is less. Notable results have been accomplished recently along these lines in Kansas City, where a very marked increase in schedule speed has been effected.

During the past winter, the making of good schedule speeds in Cleveland was seriously interfered with by vehicular traffic on the car tracks. After several of the heaviest snowstorms the city authorities were totally unable to clear even the main thoroughfares of snow. The railway company, however, did succeed in keeping its lines open and the space between its tracks continually cleared.

The result of this was that practically all vehicular

Square. This system has been effective not merely in eliminating delays due to interference between cars of different lines but also by greatly facilitating the loading of cars. Congestion in the downtown section of Cleveland has also been mitigated to some considerable extent by the looping back of cars at the edges of this district, and in this way the reduction of the number of cars actually entering the congested district has been achieved.

INCREASED POWER DUE TO INCREASED SCHEDULE SPEEDS NOT IMPORTANT

Nothing has been said in the foregoing with reference to the increased power required to increase acceleration and attain higher maximum speeds. The writer has no precise data with which to calculate these additional power requirements. It has been found that cars operated during the rush hour on somewhat slower schedule speeds use slightly less power than do these cars during the base schedule. This difference, however, is quite small. The cost of energy per car-mile is



Train of new type in action, at Public Square, Cleveland

traffic took to the car tracks, thereby delaying schedules. As was natural, blame for these delays was placed by the public upon the railway company. It is worth consideration that every effort be made to promote co-operation between city authorities and electric railway companies to the end that main thoroughfares throughout their entire width be cleared of snow. It is right and proper that every pressure be brought to bear upon city authorities to clean streets more expeditiously after snowstorms.

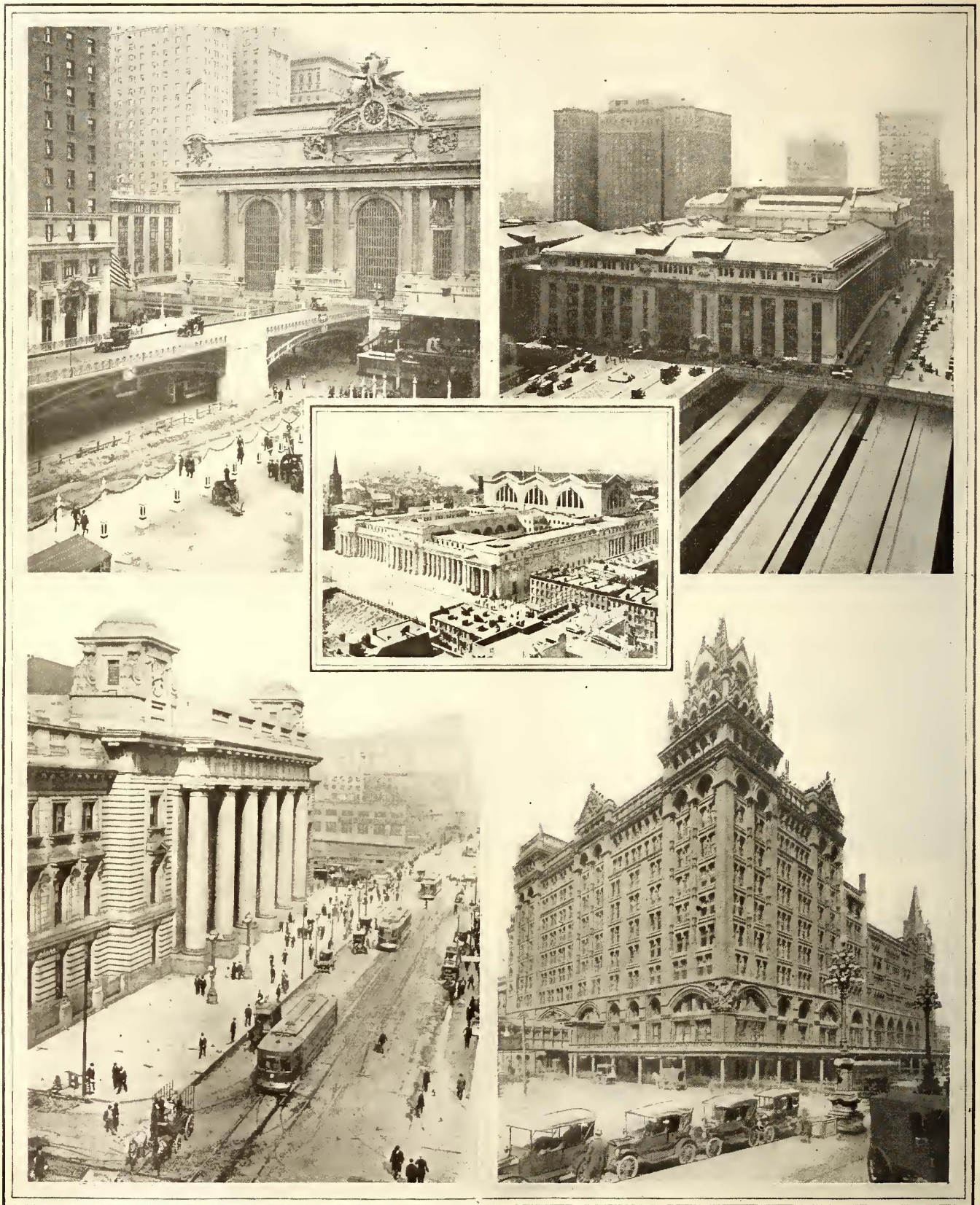
LOOPS HELP IN THE CONGESTED DISTRICTS

The Cleveland Railway has used with great success a system of loops in its downtown congested district. These loops are so arranged on the Public Square that there is no interference between cars of different lines. All cars coming into the Public Square by way of Euclid Avenue use a single loop. This loop is not used even in part by the cars which enter the square by any other street than Euclid Avenue. The same thing holds true of all the other streets leading into the Public

relatively a small part of the total cost of operation, not more than 7 or 8 per cent. For this reason it may be considered that additional power requirements for higher schedule speeds are practically negligible so far as cost is concerned.

The ELECTRIC RAILWAY JOURNAL has recently collected by means of a questionnaire considerable data on the subject of train operation from a large number of representative street railways throughout the country. The figures brought out by a compilation of this data, as given on page 658, are interesting. The schedule speed of trains during the rush hour in sixteen cities varies, the minimum being 8.40 m.p.h. and the maximum 10.28 m.p.h. So far as the effect of the use of trailers upon schedule speed is concerned, it is probable that the above figures indicate very little, inasmuch as traffic conditions in the streets during the rush hour are much more of a limiting factor than is the use of trailer cars.

Four great railroad terminals handling congested suburban traffic



Top—Grand Central Terminal, New York Central Railroad, New York City. At left—The south façade showing the viaduct, located in the center of Park Avenue and crossing over Forty-second Street, by means of which street traffic is shunted around the station away from the narrow adjacent streets. At right—A general view of Grand Central Terminal from the north. In center—Bird's-eye view

of the Pennsylvania Railroad Station, New York City, the New York terminal of the Long Island Railroad. This view was taken from the Seventh Avenue side before the erection of the Pennsylvania Hotel, which would now occupy the foreground of picture. Bottom, at left—Front of Chicago & Northwestern Railway Station, Chicago, Ill. At right—Broad Street Station, Pennsylvania Railroad, in Philadelphia.

Experience and practice of Long Island Railroad are covered in detail and data for other roads which are handling dense suburban traffic are given

Handling Suburban Traffic at Congested Centers

By *C. Francis Harding*

Head of School of Electrical Engineering, Purdue University



Suburban train, Philadelphia-Paoli electrification, Pennsylvania Railroad

THE rapid growth in population of the large cities of this country during the past few years has imposed difficult problems upon the railways which serve the communities around these centers. The methods developed for transporting large numbers of people within restricted periods of time are therefore appropriate subjects for consideration in this special issue devoted to "mass transportation."

In order to render the topic as tangible as possible the Long Island Railroad, which serves a considerable part of New York's suburban population, has been made the basis of the main part of this study. This road was one of the pioneers in electrification and its business is largely made up of suburban passenger traffic. Table I is reproduced to illustrate the characteristic features of the Long Island's traffic by comparison with three other roads which also have large suburban business. In addition data have been compiled as to the situation on the Pennsylvania's Philadelphia terminal, the New York Central's New York terminal, the Illinois Central's and Chicago & Northwestern's Chicago terminals and the New Haven's Boston and New York terminals.

CONDITIONS IN AND AROUND NEW YORK

Taking up first the New York region in general and the Long Island's territory in particular, it is safe to say that new homes, which are both comfortable and convenient, have been made available for 1,000,000 residents of New York as a result of the well-planned de-

velopment of the electric railroads in that vicinity. Fifteen years ago the New York business man was obliged to travel the length of Manhattan Island in order to reach his home in reasonable time. The rapid-transit system in use and proposed at that time provided little opportunity for the resident of Brooklyn or Queens to get to his office promptly and in comfort. Yet in spite of this fact there were to be found within twenty minutes' ride of Wall Street some of the most attractive residential districts that any city could desire. The "airplane" view on page 669 indicates very clearly the undeveloped possibilities of this section.

Progressive railway officials, generously provided with imagination and foresight, have built up during the intervening period a most extensive network of electrified high-speed railroads. These have resulted in enormously increased passenger and freight traffic, and indirectly have developed very greatly the residential and industrial possibilities of the entire district immediately east of the business center of New York City.

The argument, often presented with less concrete evidence for its support, that passenger and freight traffic and finally increased population follow the development of adequate, rapid and comfortable railway service is forcefully emphasized in the case of the Long Island Railroad in the Borough of Queens in particular.

The number of passengers carried by the Long Island Railroad has increased during the past fifteen years from 18,199,000 to 64,067,000 per annum, a ratio of 353 per cent. Of this present passenger traffic, which rep-

TABLE I
Traffic Data for Four Roads for 1919
 Reproduced to Illustrate Characteristics of Long Island Railroad's Traffic*

	Long Island R.R.	N.Y., N.H. & Hartford R.R.	N. Y. Central R.R.	Illinois Central R.R.
Mileage operated.....	398.38	1,965.76	6,040	4,793.22
Train mileage:				
Freight train-miles.....	410,035	5,896,941	25,870,044	15,169,784
Passenger train-miles.....	6,061,233	14,153,385	32,656,740	13,613,502
Mixed train-miles.....	6,886	79,604	277,746	218,764
Special train-miles.....	24,060	8,344	14,569	45,508
Freight traffic:				
Revenue freight moved (tons).....	5,912,833	27,873,747	99,208,314	38,245,714
Revenue freight one mile (tons).....	127,868,238	3,169,098,542	21,567,568,497	9,994,435,480
Revenue tons one mile per mile of road.....	320,971	1,586,451	3,568,798	2,085,119
Average haul per ton (miles).....	21.63	111.44	217	261.32
Average revenue train load (tons).....	295.26	504.39	824	649.47
Average rate per ton per mile (cents).....	4.915	1.557	0.87	0.715
Freight earnings per revenue train-mile.....	\$14.772	\$8.01	\$7.20	\$4.645
Passenger traffic:				
Passengers carried.....	64,067,541	100,938,578	67,594,465	31,002,734
Passengers carried one mile.....	1,022,941,429	2,023,988,204	3,376,508,355	946,075,908
Passengers one mile per mile of road.....	2,567,753	1,063,678	615,014	197,378
Average distance per passenger (miles).....	15.97	20.05	49.95	30.52
Average rate per passenger per mile (cents).....	1.526	2.212	2.527	2.529
Passenger earnings per revenue train-mile.....	\$2.575	\$3.64	\$3.23	\$1.730

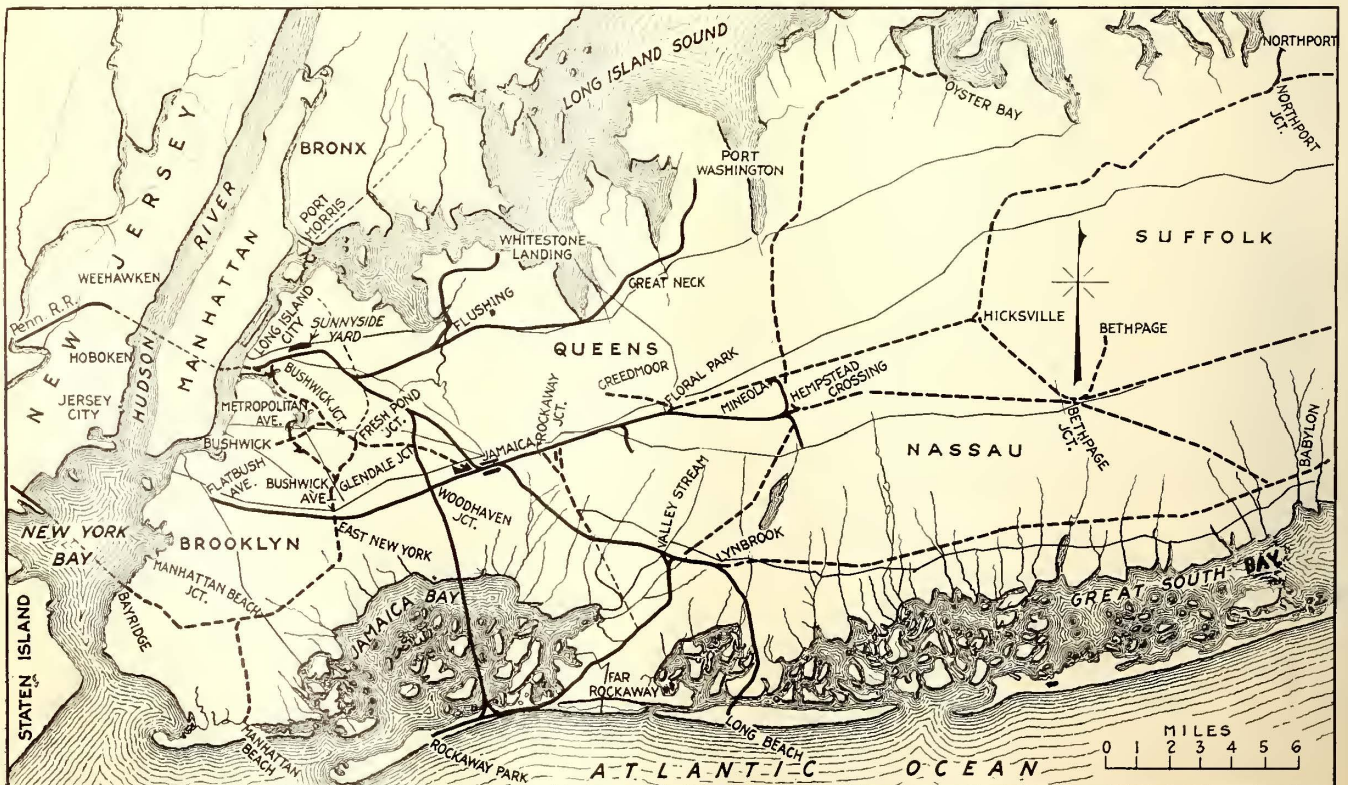
*Compiled by Poor's Publishing Company.

resents 70 per cent of the total business of this railroad, 367,057 passengers are riding on monthly commutation tickets. As a parallel to this, freight tonnage has increased since 1905 at a corresponding rate, as indicated in Fig. 1.

During the last decade, however, the population of the Borough of Queens, directly east of the business center of New York, has increased 64.5 per cent, while that of Manhattan itself has actually decreased, as indicated by the last census. The combined population of Brooklyn and Queens, after an increase of 30 per cent, is now approximately 2,500,000, which is in excess of that of Manhattan. Chicago, Detroit and Philadelphia

only, of all the cities of the country, exceeded the Borough of Queens during the year 1919 in plans and cost estimates filed for new buildings and additions. Of the \$46,000,000 proposed for building construction in this borough during the year, more than 60 per cent is to be expended for homes. The diagram reproduced in Fig. 1 indicates in a very striking manner the relation between growth of population and passenger and freight business in the district affected.

This railroad had the honor of being one of the first steam railroads in the United States, having been incorporated in April, 1834. The original railroad was constructed from the village of Greenport, L. I., to the



Electrified and steam zones on the Long Island Railroad. Solid lines show electrified track; dotted heavy lines, steam-operated railway

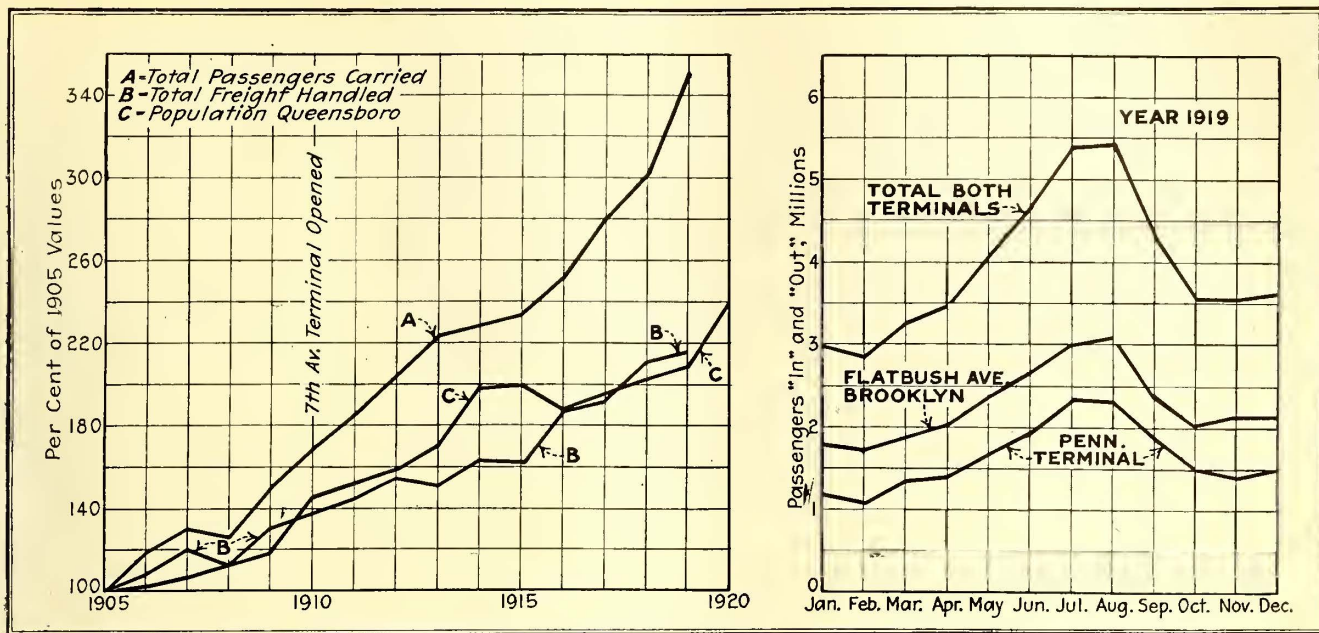
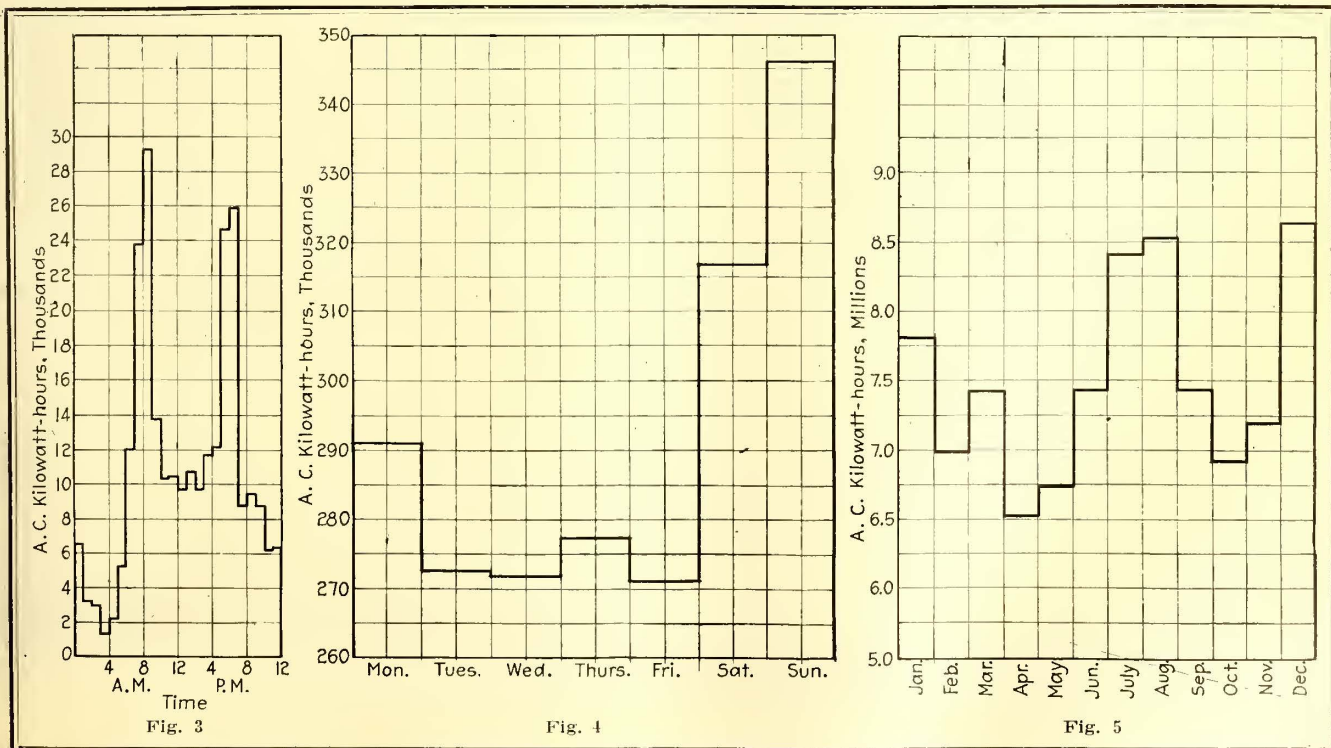


Fig. 1—Increased population usually results from adequate passenger service. Fig. 2—Passengers “in” and “out” of terminals, Long Island Railroad, 1919

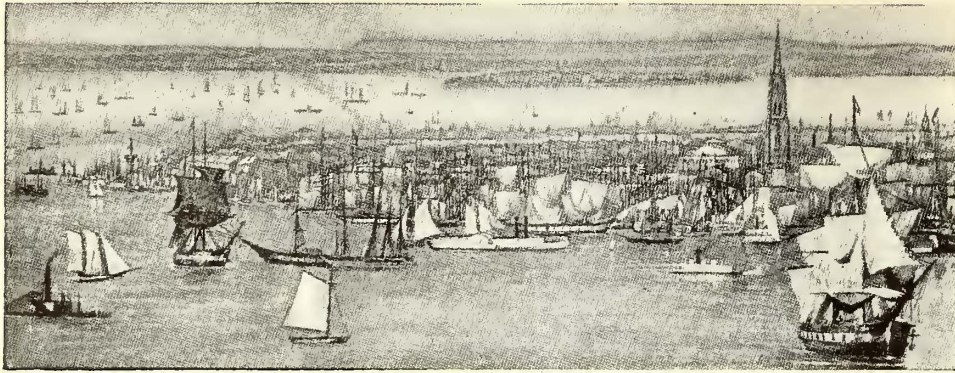
water’s edge in the village of Brooklyn in order to connect with the steamboats at the former town. Thus a through line of transportation was established from New York to Boston. Long Island City and Jamaica, always important business centers upon Long Island, were connected in 1860, while Far Rockaway Beach was included in the system as early as 1873.

Control of the Long Island Railroad, greatly enlarged but still operated entirely by steam, was purchased by the Pennsylvania Railroad in 1901, and the road was electrically equipped at the time of the electrification of the Pennsylvania’s New York terminal.

Aside from the vast residential and industrial areas in close proximity to a great city which are tapped by this system, enormous freight and passenger car storage yards, so necessary at the waterfront terminus of a transcontinental system, were provided thereby. The famous Sunnyside Yard at Long Island City, indicated upon the accompanying map, which comprises 190 acres, has a capacity of 2,000 cars with 73 miles of track. A loop, possibly of greater value for freight than passenger service, will be noted extending from Long Island City through Fresh Pond, East New York and Manhattan Beach Junction to the Bay Ridge



Energy Demands on Long Island Railroad. Fig. 3—Typical hourly load, summer schedule, July 15, 1920. Fig. 4—Typical daily load, summer schedule, year 1920. Fig. 5—Monthly load, year 1919



The Battery in 1855

wharves, from which point the Pennsylvania Railroad ferry makes connection with the New Jersey docks. Furthermore, the tracks of the Long Island Railroad connect with all the important points of access to "Nature's great playground," as Long Island has often been called. Four hundred miles of shore line on ocean, sound and bays, not to mention the many fresh-water lakes on the island, attract thousands of summer resort tourists. On Sunday, July 4, this year, the road exceeded all previous records, when it transported 20,000 passengers to Rockaway Beach from New York City, 15,000 from Brooklyn and 25,000 from East New York and other points on the Atlantic division. Thus a total of 60,000 pleasure-seeking passengers were successfully handled to one beach only with a prearranged schedule upon a single day.

EARLY RESULTS OF ELECTRIFICATION

Soon after the acquisition by the Pennsylvania Railroad, the Long Island Railroad found it desirable to improve its connections between Queens and Brooklyn. This development between the Jamaica and Flatbush terminals involved a great deal of grade crossing elimination and tunnel construction, which led primarily to the first electrification, inaugurated July 26, 1905. The successful and economical results of such operation over 70 miles of track brought about the change to electricity, between 1905 and 1910, of practically all the lines within a radius of 25 miles of New York City. The cost of this operation was found to be sufficiently below that of steam practice to pay fixed charges and provide a surplus in addition. Figures quoted by George Gibbs, chief

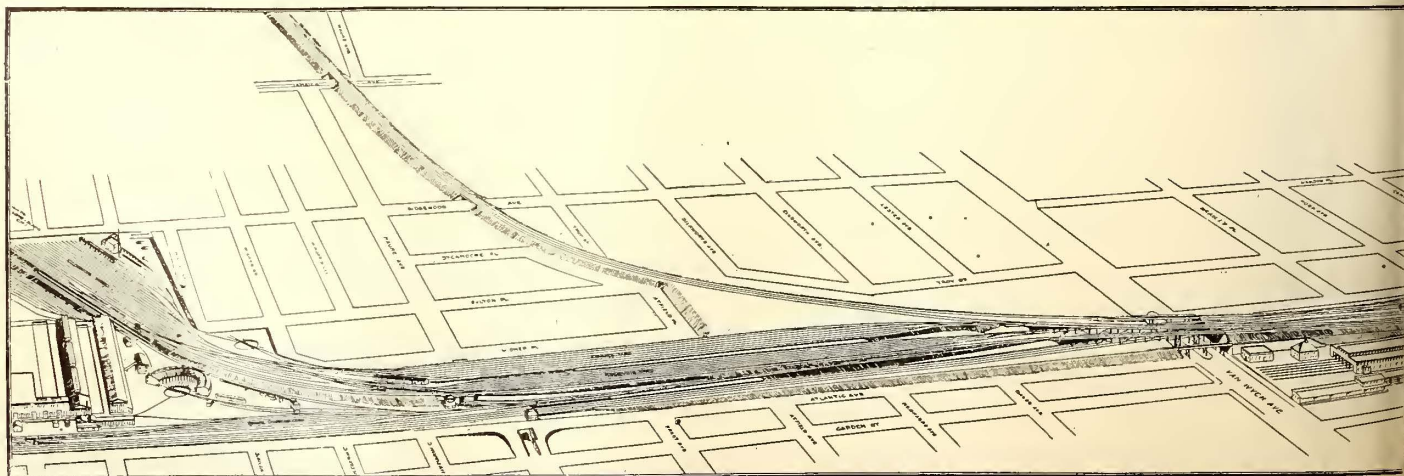
engineer of the Pennsylvania Terminal & Tunnel Company, in the ELECTRIC RAILWAY JOURNAL, March 28, 1910, page 534, indicated a reduction in cost as compared with steam operation from 27.95 cents to 17.8 cents per car-mile. This saving was 1.94 cents per car-mile greater than that obtained upon the West Jersey & Seashore Railroad, probably because of the difference in type of traffic handled by the two roads. The cars used at that time were small ones

of the subway type operated from a third-rail supply at 600 volts, direct current, to make them interchangeable with those of the Manhattan subway. As early as 1901 plans were being laid for an electrified terminal in Manhattan for the Pennsylvania and Long Island. The following, quoted from the official plans, in the *Street Railway Journal*, Dec. 21, 1901, is significant:

After years of exhaustive study the conclusion has been reached that a terminal line, operated by electricity, is in every way the most practical, economical, and the best, both for the interests of the railroad company and of the city . . . As the railroad will be wholly underground and operated electrically . . . it will not be objectionable in any way. There will not be any smoke, dirt or noise, and as all the surface property may be built upon after being utilized underneath for railroad purposes the neighborhood of the station will be improved instead of marred, as is often the case when railroad lines are constructed on the surface or elevated.

TABLE II
Passengers Carried In and Out of Terminals,
Long Island Railroad

	Pennsylvania Station	Flatbush Avenue, Brooklyn	Total on Road
1910.....	1,417,903 (4 mos.)	13,455,991	30,978,615
1911.....	6,219,859	14,094,003	33,867,228
1912.....	7,732,184	15,772,402	37,319,812
1913.....	9,629,026	17,501,524	40,606,183
1914.....	11,031,845	18,064,729	41,634,223
1915.....	11,807,512	18,135,150	42,629,325
1916.....	13,224,258	19,666,344	45,802,722
1917.....	14,459,259	23,118,805	50,796,028
1918.....	15,595,142	23,824,123	55,004,086
1919.....	19,843,245	27,544,000	64,067,541



Track elevation and other improvements,

Steel, multiple-unit trains were, as a result of this decision, operated through tunnels under the East River to the Pennsylvania Station on Sept. 8, 1910.

During the first ten months of such operation an increase of 92 per cent in the number of passengers carried on the Long Island Railroad was experienced, while the corresponding figure on the Pennsylvania Railroad was 31 per cent. The growth since that time is clearly indicated in Table II. The variation in traffic during the successive months of 1919 is plotted in Fig. 2. An inspection of these graphs will show, in a striking manner, the peak load encountered during the summer upon this railroad due to the heavy traffic to the summer resorts on Long Island.

Passenger receipts on the former road were found to be 160 per cent greater after electrification. In 1911, according to George Gibbs*, the operation of 8,600,000 car-miles over 152 miles of electrified track of the Long Island Railroad was accomplished at a cost of 24.2 cents per car-mile, including depreciation. A car-mileage of double that previously maintained was found to be possible, with decreased failures. The train-mileage between failures had been tripled during this period as a result of electrical operation. Where electric locomotives were used the cost of their operation per mile was, at that time, 5.91 cents, as compared with 8.83 cents for steam locomotives on the New Jersey division and 11.9 cents on the entire Pennsylvania system.

TRANSFER PROBLEMS SOLVED

The next problem to be confronted in planning the transportation of large masses of people into and out of this large city terminal was that of a central transfer point for distribution over Long Island. Sixteen trains per day, carrying a relatively small group of through passengers for Montauk and other eastern sections of the island where the road has not been electrified,

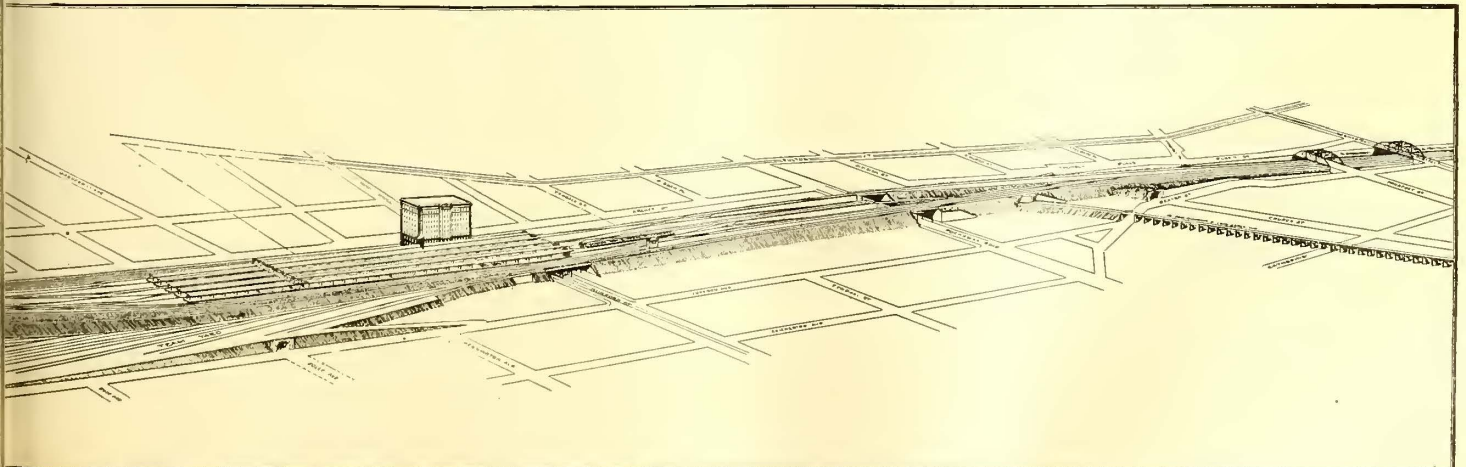
*ELECTRIC RAILWAY JOURNAL, March 23, 1912, page 463.



The Battery in 1920

are transferred from electric to steam locomotives at Long Island City soon after they leave the river tunnels. This is not, however, the logical center of distribution for the bulk of the traffic leaving the Pennsylvania Terminal for Long Island. Jamaica, which has been for a long time the hub of the island, was naturally selected for such a transfer station. Most of the passengers from New York City, therefore, change cars at this station.

The concentration of so much traffic upon the tracks centering in this locality, in which the grade crossings had not been abolished, brought up the problem of track elevation and the erection of a rather elaborate transfer station as early as 1903. This has been particularly well worked out in accordance with the perspective drawing reproduced herewith. The Jamaica station, shown in the cut on page 670, as operated since March, 1912, is remarkably well adapted to the severe service to which it is subjected. Three through tracks in each direction are provided, with concrete platforms at the level of the car floor. Two tracks with separate platforms take care of the local traffic. In addition, one run-around track is provided in each direction for the through non-stop passenger and freight trains. Certain tracks are very definitely assigned to regular routes and permanently marked with signs which prove a great convenience to the traveling public in locating the train desired. A number of guide signs in-



Long Island Railroad, Jamaica, N. Y.



The Battery in 1855

wharves, from which point the Pennsylvania Railroad ferry makes connection with the New Jersey docks. Furthermore, the tracks of the Long Island Railroad connect with all the important points of access to "Nature's great playground," as Long Island has often been called. Four hundred miles of shore line on ocean, sound and bays, not to mention the many fresh-water lakes on the island, attract thousands of summer resort tourists. On Sunday, July 4, this year, the road exceeded all previous records, when it transported 20,000 passengers to Rockaway Beach from New York City, 15,000 from Brooklyn and 25,000 from East New York and other points on the Atlantic division. Thus a total of 60,000 pleasure-seeking passengers were successfully handled to one beach only with a prearranged schedule upon a single day.

EARLY RESULTS OF ELECTRIFICATION

Soon after the acquisition by the Pennsylvania Railroad, the Long Island Railroad found it desirable to improve its connections between Queens and Brooklyn. This development between the Jamaica and Flatbush terminals involved a great deal of grade crossing elimination and tunnel construction, which led primarily to the first electrification, inaugurated July 26, 1905. The successful and economical results of such operation over 70 miles of track brought about the change to electricity, between 1905 and 1910, of practically all the lines within a radius of 25 miles of New York City. The cost of this operation was found to be sufficiently below that of steam practice to pay fixed charges and provide a surplus in addition. Figures quoted by George Gibbs, chief

engineer of the Pennsylvania Terminal & Tunnel Company, in the ELECTRIC RAILWAY JOURNAL, March 28, 1910, page 534, indicated a reduction in cost as compared with steam operation from 27.95 cents to 17.8 cents per car-mile. This saving was 1.94 cents per car-mile greater than that obtained upon the West Jersey & Seashore Railroad, probably because of the difference in type of traffic handled by the two roads. The cars used at that time were small ones

of the subway type operated from a third-rail supply at 600 volts, direct current, to make them interchangeable with those of the Manhattan subway. As early as 1901 plans were being laid for an electrified terminal in Manhattan for the Pennsylvania and Long Island. The following, quoted from the official plans, in the *Street Railway Journal*, Dec. 21, 1901, is significant:

After years of exhaustive study the conclusion has been reached that a terminal line, operated by electricity, is in every way the most practical, economical, and the best, both for the interests of the railroad company and of the city. . . . As the railroad will be wholly underground and operated electrically . . . it will not be objectionable in any way. There will not be any smoke, dirt or noise, and as all the surface property may be built upon after being utilized underneath for railroad purposes the neighborhood of the station will be improved instead of marred, as is often the case when railroad lines are constructed on the surface or elevated.

TABLE II
Passengers Carried In and Out of Terminals,
Long Island Railroad

	Pennsylvania Station	Flatbush Avenue, Brooklyn	Total on Road
1910.....	1,417,903 (4 mos.)	13,455,991	30,978,615
1911.....	6,219,859	14,094,003	33,867,228
1912.....	7,732,184	15,772,402	37,319,812
1913.....	9,629,026	17,501,524	40,606,183
1914.....	11,051,845	18,064,729	41,634,223
1915.....	11,807,512	18,135,150	42,629,325
1916.....	13,224,258	19,666,344	45,802,722
1917.....	14,459,259	23,118,805	50,796,028
1918.....	15,595,142	23,824,123	55,004,086
1919.....	19,843,245	27,544,000	64,067,541



Track elevation and other improvements.

Steel, multiple-unit trains were, as a result of this decision, operated through tunnels under the East River to the Pennsylvania Station on Sept. 8, 1910.

During the first ten months of such operation an increase of 92 per cent in the number of passengers carried on the Long Island Railroad was experienced, while the corresponding figure on the Pennsylvania Railroad was 31 per cent. The growth since that time is clearly indicated in Table II. The variation in traffic during the successive months of 1919 is plotted in Fig. 2. An inspection of these graphs will show, in a striking manner, the peak load encountered during the summer upon this railroad due to the heavy traffic to the summer resorts on Long Island.

Passenger receipts on the former road were found to be 160 per cent greater after electrification. In 1911, according to George Gibbs*, the operation of 8,600,000 car-miles over 152 miles of electrified track of the Long Island Railroad was accomplished at a cost of 24.2 cents per car-mile, including depreciation. A car-mileage of double that previously maintained was found to be possible, with decreased failures. The train-mileage between failures had been tripled during this period as a result of electrical operation. Where electric locomotives were used the cost of their operation per mile was, at that time, 5.91 cents, as compared with 8.83 cents for steam locomotives on the New Jersey division and 11.9 cents on the entire Pennsylvania system.

TRANSFER PROBLEMS SOLVED

The next problem to be confronted in planning the transportation of large masses of people into and out of this large city terminal was that of a central transfer point for distribution over Long Island. Sixteen trains per day, carrying a relatively small group of through passengers for Montauk and other eastern sections of the island where the road has not been electrified,

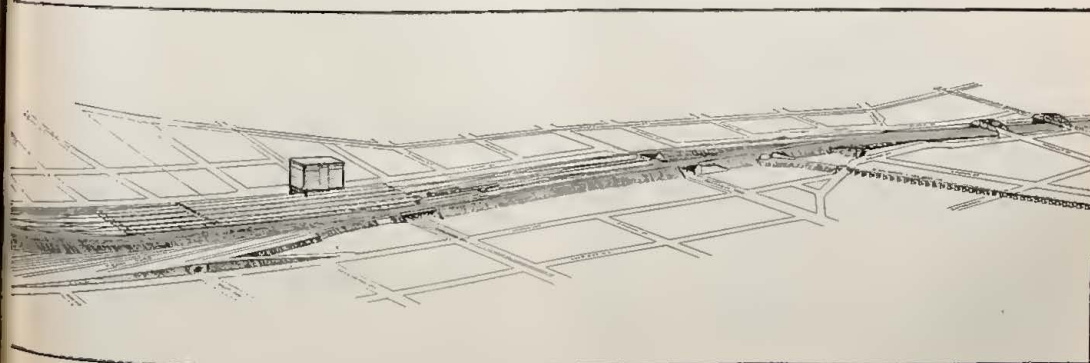
*ELECTRIC RAILWAY JOURNAL, March 23, 1912, page 463.



The Battery in 1920

are transferred from electric to steam locomotives at Long Island City soon after they leave the river tunnels. This is not, however, the logical center of distribution for the bulk of the traffic leaving the Pennsylvania Terminal for Long Island. Jamaica, which has been for a long time the hub of the island, was naturally selected for such a transfer station. Most of the passengers from New York City, therefore, change cars at this station.

The concentration of so much traffic upon the tracks centering in this locality, in which the grade crossings had not been abolished, brought up the problem of track elevation and the erection of a rather elaborate transfer station as early as 1903. This has been particularly well worked out in accordance with the perspective drawing reproduced herewith. The Jamaica station, shown in the cut on page 670, as operated since March, 1912, is remarkably well adapted to the severe service to which it is subjected. Three through tracks in each direction are provided, with concrete platforms at the level of the car floor. Two tracks with separate platforms take care of the local traffic. In addition, one run-around track is provided in each direction for the through non-stop passenger and freight trains. Certain tracks are very definitely assigned to regular routes and permanently marked with signs which prove a great convenience to the traveling public in locating the train desired. A number of guide signs in-



Long Island Railroad, Jamaica, N. Y.

dicating the destination of each particular train are displayed by station attendants previous to the departure of the train. As a result of the careful location of platforms between trains involving the transfer of many passengers, and the detailed direction signs provided, thousands of such transfers are readily made each day with no difficulty.

Forty-one west-bound trains, averaging seven cars each, pass through this station daily during the period between 8 and 9 a.m. Personal observation on the Fourth of July by a disinterested passenger, who had

406 large and 122 small cars, leaving margins of but 4½ and 9 per cent respectively for inspection and repair. It is estimated that the railroad is at least 150 cars short in its electrified zone. Of these, seventy are on order, with promise of possible delivery this fall. An adequate supply of cars cannot be provided until additional funds are available.

TRAIN SCHEDULES MAINTAINED WITH GOOD RECORDS

All trains are operated in accordance with a predetermined semi-annual printed time schedule. This is prepared to meet the traffic demands as nearly as possible as a result of a study made of the performance of similar periods during past years, combined with the growth of traffic during the years in question. Changes are made usually about the middle of May and

October. Additional trains are necessary during the summer months to handle the excess traffic of that season. This excess is evident from Fig. 2. With the schedule once established, the variations in daily and hourly loads are provided for by the operation of more or fewer cars per train.

In order to take care of the extraordinarily heavy beach travel on Sundays during the summer months, the Sunday time-table is changed about the last week in June. The revised schedule continues in effect until the first or second Sunday following Labor Day, with the provision, of course, for many additional trains.

Tables IV to VI show the various runs and operating conditions upon the electrified section of the Long Island Railroad.

The number of employees assigned to a train is based primarily upon standard railroad practice, but owing to the short hauls and numerous stops upon this system additional collectors are necessarily added to the regular crews in accordance with the number of cars in the train. This varies on different divisions of the road and is somewhat affected by the class of travel handled. These extra trainmen work regularly on certain trains and have regular runs assigned to them.

occasion to make several transfers at this point, proved conclusively that adequate provision had been made for the comfortable and prompt handling of very large crowds. Upon this particular week-end, including the holiday, all previous records of passenger transportation were exceeded, with a total number of 1,569,800 passengers handled.

Table III sets forth some interesting figures for five-day holiday week-end periods for this and previous years.

Although these crowds have been successfully handled thus far by using every available car and by carefully planning the extra schedules in advance, the margin of cars available for inspection and repair is too small for conservative operation. The Long Island Railroad operates 394.56 miles of road, of which 85.69 is electrified. The total track mileage is 964.48, of which approximately 220 miles of track is operated by electricity. A total of only 558 multiple-unit cars are available at present for this service, of which 424 are large motor cars, Type-M-P-54; ninety-one are trailers, and 134 are of the small M-P-41 type, used in the Brooklyn service, which are not interchangeable with the trailers. The regular morning-hour rush requires

**TABLE III
Holiday Traffic on Long Island Railroad**

	1915	1916	1917	1918	1919	1920
Passenger-train movements.....	5,015	5,361	4,897	4,857	5,179	5,470
Passenger-car movements.....	24,773	27,321	24,094	26,519	30,674	31,054
Baggage-car movements.....	1,369	1,508	1,382	1,342	1,481	1,353
Freight and work-train movements....	374	411	356	368	382	392
Freight-car movements.....	7,939	8,986	8,124	8,386	7,821	8,651
Passengers carried.....	917,917	1,029,721	1,023,265	1,121,560	1,433,600	1,569,800
Carloads of express and baggage.....	780	1,077	977	874	894	916

**TABLE IV
Typical Runs—Electric Service, Long Island Railroad**

Terminals of Run	Express or Local	Length of Run, Miles	Number of Stops	Average Distance		Running Time, Minutes	Schedule Speed, Miles per Hour
				Between Stops, Miles	Running		
Pennsylvania Station.....	Local	19.9	15	1.33	49	22.4	
Pennsylvania Station.....	Express	19.9	7	2.85	39	30.6	
Pennsylvania Station.....	Local	13.3	9	1.48	31	25.8	
Pennsylvania Station.....	Express	11.3	1	11.3	17	39.9	
Pennsylvania Station.....	Express	24.6	1	24.6	36	41.0	
Pennsylvania Station.....	Local	24.6	15	1.64	52	28.4	
Pennsylvania Station via Ozone Park	Express	25.8	10	2.58	50	31.0	
Pennsylvania Station.....	Local	19.2	10	1.92	42	27.4	
Flatbush Avenue.....	Express	20.0	8	2.50	42	28.6	
Flatbush Avenue.....	Local	15.9	15	1.06	41	23.3	
Flatbush Avenue via Ozone Park....	Express	22.5	13	1.73	50	27.0	
Flatbush Avenue.....	Express	9.3	3	3.10	17	32.8	
Flatbush Avenue.....	Local	13.2	16	0.83	39	20.3	

The nature of the hours of employment on the Long Island Railroad is governed entirely by the agreements with the various brotherhoods generally in effect upon standard railroads. It is often difficult to plan an effective employees' schedule in accordance with such agreements which will at the same time meet the demands of morning and evening peak loads of traffic. The trainmen are paid upon a combined hourly and mileage basis. This involves either a 140 or a 100-mile run in a standard eight-hour day as a basis for ten hours' normal pay. In many cases this work must be made up of two four-hour shifts, one in the morning and the other during the evening rush period.

ELECTRIFICATION OF TERMINALS MAKES ITSELF FELT IN IMPROVED SERVICE

It is difficult to draw any comparison between electric and steam operation, so far as the numbers of employees or employee-hours are concerned. When the electric service was first inaugurated upon the Long Island Rail-

road for incoming trains. Occasionally during the rush hours one or two tracks of the Pennsylvania Railroad are used in addition. Yet with this limited number of tracks, between 8.01 and 9 a.m. thirty-two west-bound trains were scheduled to arrive and ten east-bound trains to leave. Between 5.02 and 6.01 p.m. twenty-seven east-bound trains leave and nine west-bound trains arrive.

It is interesting to compare this with conditions at the London terminal of the Great Eastern Railroad, which probably handles the largest number of steam trains in a stub-end terminal. There forty trains per hour have been operated with six tracks. This system, however, has a provision for shunting the steam locomotives around the stub-end terminal tracks, thus greatly increasing the number of locomotive-hours available for active duty.

Disinterested inspection of the trains on the Fourth of July by a representative of the ELECTRIC RAILWAY JOURNAL indicated that very few passengers were standing



Courtesy of Wm. D. Bloodgood & Co., Inc.,
Real Estate, Long Island City

"Airplane" view of Long Island, looking east from Manhattan

road the schedule speed of trains was materially increased and the time required for setting trains and departing from the terminals was considerably decreased. Since that date many suburban stops have been added and more trains operated in proportion to the traffic demands in order to give better service. Thus the advantages of electric traction show themselves in improved service rather than in a reduction of train-hours or employee-hours. It would be quite impossible, however, to operate present schedules in and out of the terminals with steam traction.

At the Flatbush Avenue terminal of the Long Island Railroad in Brooklyn twenty-six trains per hour are handled during the rush period upon six tracks. Contrast this procedure with steam traffic at the Long Island City terminal fifteen years ago, when difficulty was experienced in taking care of from fifteen to twenty trains per hour on sixteen tracks.

In the Pennsylvania Station, New York, the Long Island Railroad uses regularly six or seven tracks for departing trains and has the use of any and all tracks

in the cars in spite of the tremendous crowds that were traveling. Extra ticket booths, placed in the waiting rooms for the sale of tickets to the beaches, where traffic was particularly heavy, in addition to the twelve ticket windows, making twenty-one positions in all, had been established to relieve the congestion and keep the passengers in a favorable state of mind. Such little points as these have their marked psychological effect upon the riding public and yet involve little additional cost and trouble.

Cars on this road are inspected every ten days. The mileage basis of inspection has been discarded in favor of the time method. At present forty-nine cars per day are being handled by the two inspection shops. This process of repair and maintenance was described in detail in the ELECTRIC RAILWAY JOURNAL, June 5, 1920, page 1136. In addition, inspectors are employed between 1 and 9 a.m. at the various yards, where cars are stored for the night. This procedure takes care of minor repairs, such as brakeshoe changes, adjustments, etc. Groups of cars, numbering from thirty-five to eighty-

five, are available for such inspection at five different yards located at various points upon the system.

POWER CONSUMPTION AND OPERATING COSTS

Considerable improvement has been made lately by the Long Island Railroad in energy consumption in regular operation. Table VII indicates the fact that whereas the electric motor car-mileage increased in 1919 over 1918 by a margin of 9 per cent and the steam car-mileage by 3.2 per cent, yet the make-up of trains has been so carefully planned that the trailer car-mileage has advanced 137 per cent. This improved operation, without detriment to schedules, is reflected in the energy consumption, which, it will be seen, has been reduced from 87.4 to 83.4 watt-hours per ton-mile at the third rail. A portion of the extra energy consumption in 1918 must, however, be attributed to the very severe weather conditions encountered during the winter of that year.

The cost of energy set forth in this table naturally shows an increase due to rise in fuel and labor costs, although the maintenance charges have been held remarkably close to the figures established in 1918. The cost increases are reasonable in view of the general increases which have occurred.

TRAIN DISPATCHING METHODS

Practically all trains in the electrified zone are operated without train orders unless unforeseen difficulties or delays arise. In such cases the train crews are instructed by telephone from the dispatcher's office at Jamaica. Telephone outlets are available to trainmen every 2,000 ft. throughout the electrified zone. Trains, in cases of trouble, are then detoured by the dispatcher, either upon an extra track or in another direction around one of the many available loops upon the sys-

tem. Passengers waiting at stations from which trains are likely to be delayed indefinitely are notified of such delay in order that they may make other plans if desired. Such announcements are always appreciated by the patrons of the road, who would prefer to know the facts promptly rather than be kept in ignorance of the possibilities of reaching their destination.

The most densely operated sections of the road are equipped with automatic block signals, while the other portions of the road are operated under the "absolute manual block" rules.

At terminals records must be filled out by the conductor of the departing train, giving details of time, train make-up, etc., while upon arrival at its destination a more complete report is required, giving the causes of delays, if any, the number of passengers carried, etc. These are filed in the dispatcher's office.

Train orders, not affecting the rights of a superior train, may be given orally over the telephone and confirmed by both conductor and motorman of the train involved. Superior orders, subordinating the rights of trains otherwise having right-of-way, must bear the personal signatures of both conductor and motorman as an extra precaution against any possible misunderstanding.

Train dispatchers upon the Long Island Railroad recognize the impossibility of handling the traffic into such a terminal as that of New York City by means of steam locomotives. Upon being asked the question, "Is operation by means of steam locomotives possible?" the chief dispatcher answered, "Certainly not! What would you do with the locomotives when you got them in there? The switching of trains in and out of the station with steam locomotives under such short headway and with the limited track capacity is out of the question."



Transfer station and office building at Jamaica, L. I.

TABLE V

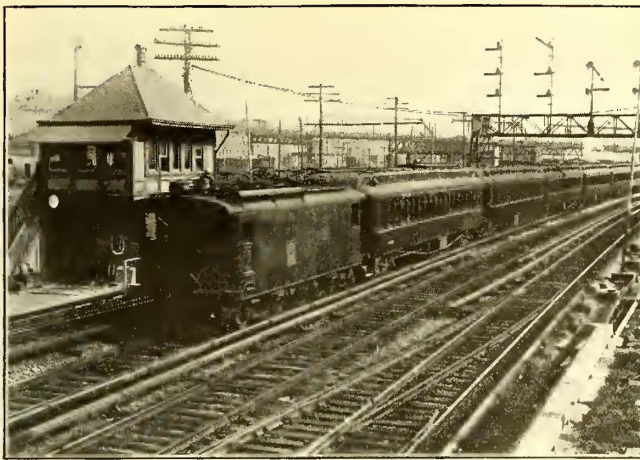
Train-Miles per Route-Mile—Steam and Electric Operation, Long Island Railroad

Year	Train-Miles		Route-Miles		Passenger Train-Miles per Route-Mile	
	Steam	Electric	Steam	Electric	Steam	Electric
1910	3,129,862	1,855,972	374.0	54.8	8,369	33,868
1911	2,936,184	2,553,219	363.1	64.7	8,086	39,462
1912	2,812,853	2,552,525	360.8	66.0	7,797	38,675
1913	2,272,809	2,845,878	354.0	74.1	6,420	38,406
1914	2,181,539	3,276,387	343.2	87.2	6,356	38,720
1915	2,102,766	3,202,617	341.2	90.3	6,104	35,466
1916	2,199,080	3,155,538	341.2	90.3	6,445	34,945
1917	2,291,552	3,435,192	341.2	90.3	6,716	38,042
1918	2,509,660	3,305,852	341.2	90.3	7,355	36,610
1919	2,544,043	3,576,097	341.2	90.3	7,456	39,602

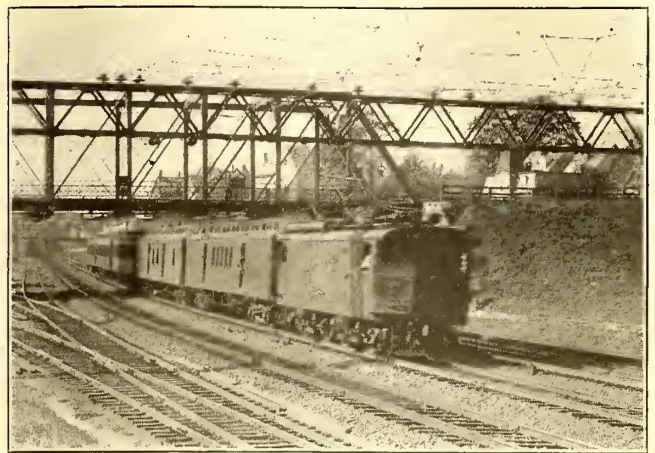
TABLE VI

Car-Miles per Route-Mile—Steam and Electric Operation, Long Island Railroad

Year	Car-Miles		Route-Miles		Car-Miles Per Route-Mile	
	Steam	Electric	Steam	Electric	Steam	Electric
1907	14,441,861	3,830,911	378.5	38.0	38,175	100,200
1908	13,071,445	4,945,719	372.4	42.0	35,105	117,720
1909	13,535,123	5,754,436	371.4	44.8	36,460	128,350
1910	13,945,133	7,134,366	374.0	54.8	37,282	130,200
1911	13,534,626	9,497,738	363.1	64.7	37,260	146,730
1912	12,991,882	10,624,172	360.8	66.0	36,040	161,000
1913	12,302,872	12,039,426	354.0	74.1	34,770	162,750
1914	11,062,474	13,783,793	343.2	87.2	32,230	158,100
1915	10,957,699	13,832,618	341.2	90.3	32,110	153,200
1916	11,653,425	14,875,807	341.2	90.3	34,160	164,700
1917	13,036,476	15,507,970	341.2	90.3	38,200	171,800
1918	13,905,068	15,679,570	341.2	90.3	40,750	173,600
1919	14,353,592	18,059,377	341.2	90.3	42,050	200,000



New Haven train on New York Central track near New York City



New Haven train under 11,000-volt contact line on its own right-of-way

It should be remembered also, in considering the test of "mass transportation" upon the Long Island Railroad, that this road was called upon during the war to handle the soldiers of fourteen divisions located at Camps Mills and Upton, Long Island. Six thousand special trains involving 61,247 cars were required to transport more than 3,000,000 troops during the period from July, 1917, to October, 1919. This was in addition

to more than 1,000,000 passengers and furloughed soldiers who traveled to and from the camps as individuals. During the heaviest month of this traffic 307,000 soldiers were transported to and from the camps and embarkation docks in 476 special trains. This was followed by the record-breaking landing in France in August, 1918.

By summarizing the density of passenger traffic of

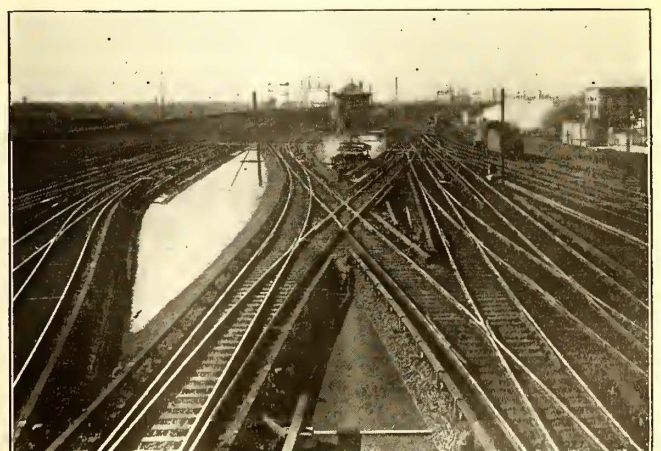
TABLE VII
Operating Data and Costs, Long Island Railroad

	1918	1919		1918	1919
Car-miles—motor*	14,920,207	16,266,607	Watt-hours per ton-mile at power house—summer months, no heater load	92.0	91.3
Car-miles—trailer*	759,363	1,792,770	Cost of power per car-mile at power house	\$0.0604	\$0.0624
Car-miles—steam	13,905,068	14,353,592	Cost of power per train-mile at power house	.2990	.3228
Train-miles—electric*	3,333,390	3,496,958	Cost of maintenance of transmission line per car-mile	.0047	.0053
Train-miles—steam	2,528,863	2,494,043	Cost of maintenance of transmission line per train-mile	.0221	.0274
Car-miles permile of track—electric	6,958	8,010	Cost of maintenance and operation of substations per car-mile	.0121	.0110
Average cars per train—electric	4.71	5.17	Cost of maintenance of substations per train-mile	.0570	.0458
Average cars per train—steam	5.50	5.76	Cost of maintenance of third-rail and track bonding per car-mile	.0071	.0070
Kilowatt-hours per car-mile at power house		5.17	Cost of maintenance of third-rail and track bonding per train-mile	.0330	.0362
Kilowatt-hours per train-mile at power house		25.72	Cost of power at car shoes per car-mile	.0843	.0857
Kilowatt-hours per car-mile delivered to third rail		4.15	Cost of power at car shoes per train-mile	.3971	.4431
Kilowatt-hours per train-mile delivered to third rail		21.46			
Watt-hours per ton-mile at power house	108.8	103.3			
Watt-hours per ton-mile delivered to third rail	87.4	83.2			

* Includes traffic over P. R.R. tracks between Sunnyside Yard and Pennsylvania Station, N. Y., amounting to about 10 per cent.



Chicago elevated railway crossing Northwestern tracks



Looking east from Jamaica station, Long Island Railroad

TABLE VIII

Transmission and Distribution System Construction, Long Island Railroad

Electrified track, miles.....	225.65
Transmission line (longest distance), miles.....	26
Number of substations (permanent).....	15
Number of substations (portable).....	3
Substation rated capacity, kw.....	56,000
Power station rated capacity, kw.....	67,000
Length of pole lines, miles.....	75.24
Chestnut poles in line.....	2,353
Creosoted poles in line.....	565
Steel poles in line.....	393
Underground conduit system, miles.....	12.5
Underground conduit system, duct-miles.....	435.23
Underground cable system, miles.....	46.4
Signal circuit, miles.....	50.05
Number of lightning-arrester houses.....	9

three representative electrified steam roads of the East, as in Table IX, it is evident that conditions on the Long Island Railroad represent the application of electric traction to the densest traffic which is encountered on any of the electrified zones of trunk lines in the country.

The commutation traffic on the Long Island Railroad is particularly heavy as compared with through passenger or freight service. In 1905 the number of passengers who purchased and used regular monthly commutation tickets was 76,644 upon the entire system. Last year this figure had increased to 367,057, representing an increase of 380 per cent. Although this commutation traffic aggregated last year about 47 per cent of the total passengers carried 1 mile, the revenue from that 47 per cent was less than 24 per cent of the total revenue. This indicates the expensive nature of such traffic. To state it differently, the average return from this commutation traffic was three-quarters of 1 cent per mile. This reduces the return from the average passenger upon this road to 1.53 cents per mile, while the other roads of the United States averaged about 2.65 cents per mile and the bulk of the steam railroad traffic paid 3 cents per mile.

TABLE IX

Passengers Carried per Mile on Three Representative Railroads in 1919

West Jersey & Seashore Railroad.....	1,091,807
New York, New Haven & Hartford Railroad.....	1,019,641
Long Island Railroad.....	2,570,205

Although the numbers of commuters have greatly increased over last year, the gross earnings of the company for June, 1920, showed a falling off of \$75,000, as compared with the same month of last year (due to the troop business handled in 1919), while the operating expenses showed an increase of over \$200,000. The cost of doing business is so high that, with the present rate structure, the more passengers that are handled the greater is the financial loss. The problem therefore is necessarily one of asking the passenger, particularly the commuter, to pay the actual cost of good service rather than attempting to reduce the quality of service to approximate the income.

THE SUBURBAN SITUATION ON OTHER ROADS

The Long Island Railroad suburban business has been treated in detail in this article because the road's traffic is so largely a suburban proposition. Data have, however, been secured from several other railroads whose suburban business is considerable. These data vary in character on account of the different operating conditions and methods of record keeping, hence cannot be combined in a general table.

New York Central Railroad.—The number of commutation passengers carried by the New York Central in 1919 was 20,707,352, an increase of 3,030,533, or 17.6 per cent, over 1918, and 4,446,347, or 25 per cent, over 1917; the increase in 1918 over 1917 being, therefore, 1,415,814, or 12 per cent. These figures indicate actual rides by commuting passengers and are many times the number of tickets sold.

About 75 per cent of the commutation service of this road is out of New York City, other commuting

TABLE X

Commutation and School Tickets Between New York City and Selected Stations on Hudson Division, New York Central Railroad, April, 1918, 1919, 1920

Station	Miles from New York	Mileage of Sixty Trips	Monthly Tickets Sold April, 1918†	Monthly Tickets Sold April, 1919†	Monthly Tickets Sold April, 1920†	Old Monthly Commutation Rates	New Monthly Commut'n Rates	Rates per Mile Under New Schedule	Increase in Fare per Trip Cents*
125th Street.....	4.2	252	...	...	...	\$3.36	\$4.03	1.59	1.1
University Heights.....	8.7	522	138	129	125	5.34	6.41	1.22	1.7
Spuyten Duyvil.....	10.4	624	32	47	60	6.16	7.39	1.82	2.05
Ludlow.....	13.7	822	309	366	662	7.15	8.58	1.04	2.88
Yonkers.....	14.5	870	448	638	1,353	7.43	8.92	1.02	2.48
Glenwood.....	15.6	936	298	336	589	7.65	9.18	0.98	0.55
Hastings-on-Hudson.....	18.8	1,128	240	297	412	8.31	9.97	0.88	2.77
Dobbs Ferry.....	20.0	1,200	190	219	286	8.47	10.16	0.84	2.82
Irvington.....	22.0	1,320	145	190	216	8.75	10.50	0.79	2.92
Tarrytown.....	24.5	1,470	653	700	979	9.08	10.90	0.74	3.03
Ossining.....	30.2	1,812	417	578	805	10.12	12.14	0.66	3.37
Croton-on-Hudson.....	33.9	2,034	114	125	186	10.56	12.67	0.62	3.51
Peekskill.....	40.6	2,436	237	317	447	12.16	14.59	0.59	4.05
Beacon.....	58.3	3,498	52	67	83	15.90	19.08	0.54	5.3
Newburgh.....	58.3	3,498	25	14	21	15.90	19.08	0.54	5.3
Poughkeepsie.....	72.8	4,367	54	73	123	18.59	22.31	0.51	6.19

* Increase based on sixty trips per month.

† Number of passengers carried may be greater than number of tickets sold as figures include family commutation tickets good for any member of purchaser's family.

cities on the system being Buffalo, Cleveland and Chicago.

Under the new schedule of rates, 20 per cent above those prevailing until recently, the average rate per mile which will be paid by commuters in the New York City district will be 0.8 cent per mile. The average commutation ticket will cost \$11.57. The previous respective figures were 0.675 cent and \$9.60. The commutation rate per mile varies according to distance, ranging from 0.5 cent for the maximum distance of 72 miles to Poughkeepsie to 1.59 cents for the 4-mile ride to 125th Street, New York City.

Table X shows details of the commuting business in April, 1918, 1919 and 1920 out of New York for a few typical stations on the Hudson Division, selected from among the total of thirty-eight.

Pennsylvania Railroad—Philadelphia Electrification.—This electrification consists of the Paoli and Chestnut Hill lines, and the purpose of undertaking the present electrification and of extending it later to other suburban lines is primarily to secure increased capacity in Broad Street Station and yard, which were badly congested under steam operation.

Careful analysis by a special operating committee of the movements under steam operation through the more important routes leading from the station to the main running tracks and yards lead to the conclusion that an increased capacity of from 20 to 25 per cent could be secured by this electrification. The improvements in operation under electric traction are such as to lead the operating people to believe that the estimates were substantially correct. The train service, of course, has changed materially under the new method of operation and a marked growth in traffic has been experienced.

The keeping of records during war years under government operation was curtailed and no data by years are available. The following figures for the year 1919 with comparative notes regarding previous steam conditions are, however, available:

1. The number of miles of main line electrified tracks is 106.1 and, including yards, the total mileage is 117.28.
2. The number of trains handled in both directions during the evening maximum traffic hour for both lines is fifteen and the corresponding number of cars is about eighty-four.
3. The average number of cars per train throughout the year is about four and the maximum number in rush hours in the heavy-travel direction is eight.
4. The number of trains per day operated at present is regularly 149. In certain seasons additional trains are run and, of course, the number of cars per train is varied from time to time. Comparisons with previous steam operation are not of any great value.

TABLE XI

Time-table of Running Time and Scheduled Speed, P. R.R., Philadelphia Electrification

	Broad Street to Paoli		Broad Street to Chestnut Hill	
	Steam	Electric	Steam	Electric
Running time, local trains, min. 57*	21	50	49	33
Schedule speed, m.p.h.	21	24	24½	21.8
Per cent increase over steam . . . .	..	14	16¾	6

* Steam trains could not maintain schedule by two to five minutes.

5. The running time and schedule speed as given in time-tables at which these trains operate is shown in Table XI.

6. The car-miles operated for the first and second years of full electric operation were: For the year ended April 1, 1919, 2,538,524 and for 1920, 3,020,000, an increase of 18.9 per cent.

7. The year 1919 shows an increase of 17 per cent in passenger receipts over 1918. Electric operation was inaugurated on the Paoli line in 1915 and on the Chestnut Hill line early in 1918.

New Haven Railroad.—The route mileage in the Boston suburban zone of the New York, New Haven & Hartford Railroad is fifty-four. In addition the New Haven has a considerable commuting traffic out of the Grand Central Terminal (the New Haven uses the New York Central Terminal for part of its New York suburban traffic). Out of Grand Central the following numbers of New Haven passengers were handled in the respective years mentioned: 1916, 14,412,974; 1917, 12,445,338; 1918, 12,201,891; 1919, 14,285,883.

Table XII shows the business at the Boston terminal for five years, past and gives information as to the terminal itself.

Illinois Central Railroad.—A heavy suburban traffic is handled by the Illinois Central Railroad at its Chicago terminal. Table XIII contains full information as to this suburban traffic and the facilities available therefor. This terminal is now operated by steam, but early electrification is contemplated.

Chicago & North Western Railway.—Another railroad which does a large suburban business out of Chicago, employing steam motive power, is the "North Western." For the year ended Dec. 31, 1919, this road handled 13,540,417 passengers on its Wisconsin division, including 8,671,437 on the Milwaukee line and 3,622,014 on the Harvard line. On the Galena division 3,622,014 were carried, a total of 17,162,431 passengers. The passenger revenues were: Milwaukee line, \$1,860,895; Harvard line, \$713,610, and Galena division, \$613,231; total, \$3,187,736. Table XIV gives

TABLE XII

New Haven Railroad's Terminal Traffic at Boston, 1915-1919

	1915	1916	1917	1918	1919
Number of passengers handled into and out of terminal	26,182,177	27,769,416	29,612,351	29,281,270	34,233,541
Average number of trains per day in and out of terminal—summer	504	505	444	434	472
Average number of trains per day in and out of terminal—winter	479	478	419	408	457
Maximum number of trains during the five-year period in and out during one day	690				
Number of terminal tracks	28				
Approximate area of terminal, acres	31				
Miles of road in suburban zone	55.45				

data as to the number of trains required for this business. In this case the week-end travel is lighter than the regular daily traffic.

SUBURBAN TRAFFIC AND ELECTRIFICATION

The data of terminal traffic of steam roads which have been given in this article show the part which electrification is playing in helping solve the suburban transportation problem. Obviously the Long Island Railroad could not handle its terminal traffic by steam even if steam locomotives were permitted to enter New York City through the East River tunnels. In Philadelphia the terminal capacity was greatly increased by electrification and the Illinois Central will enjoy similar results when its present plans are carried out.

In Boston the New York, New Haven & Hartford Railroad, which is still operated by steam, has handled a steadily increasing suburban traffic during the past five years which now represents over 130 per cent of that in 1915. The increase of fare upon the Boston Elevated Railroad was no doubt the cause of a portion of this growth in traffic. During this period, however, the average number of trains handled in and out of the South Station has been reduced by 6.5 per cent as a result of limited equipment. This extra traffic, necessarily carried with reduced equipment, resulted in standing loads with little if any increased operating cost. It was a typical case of enforced impairment of quality of service rather than the provision for adequate service at increased rates. It is quite probable that the new rates will cause some of the patronage to revert to the electric lines and more or less automatically adjust the abnormal condition. Electrification, if immediately available, would have solved the problem.

There is no question but that present conditions in all of the large city terminals are more favorable than ever before to electrification. Rapidly increasing density of traffic, limited track and equipment facilities, greatly increased costs of fuel and labor and the demands for

TABLE XIV
Trains In and Out of Chicago Terminal,
North Western Railway, 1919

	—Through—			—Suburban—			Grand Total
	In	Out	Total	In	Out	Total	
Monday to Friday, inclusive.....	39	42	81	118	112	230	311
Saturday.....	39	42	81	115	112	227	308
Sunday.....	32	28	60	45	49	94	154

prompt and efficient suburban service to sections of the community where living conditions are tolerable point to electric operation. It is not necessary to emphasize further the well-proven arguments for electrification, of lower operating costs, increased value of real estate located over terminals, power conservation, elimination of smoke, shorter headway possible due to rapid acceleration, etc. The advantages, both economic and esthetic, are obvious and therefore generally conceded.

The problem then is to secure the necessary funds to take care of the first cost.

In conclusion, a few words regarding the power end of terminal electrification may be in order.

Although marked savings have been effected in the operating methods and efficiency of electrified railroads, rising costs have more than absorbed these. For example, when the New York Central Railroad was electrified energy was produced with 2.85 lb. of steam per kilowatt-hour. Economies practiced in the generation of this energy have now reduced this figure to

2.2 or 2.3 lb. per kilowatt-hour. At that time, however, coal was purchased at \$1.99 per ton. Now this road is paying \$7.20 per ton for fuel. In those days stoker operators could be called upon to keep the equipment in repair during periods of light load. Now, as they demand machinists' rates for this work, a separate staff of mechanics must be maintained for the purpose and the time of the stokers is used to less advantage.



Park Avenue approach to Grand Central Terminal, New York, from south

TABLE XIII
Chicago Suburban Traffic of Illinois Central Railroad, 1915-1919

	Year Ended June 30		Year Ended Dec. 31		
	1915	1916	1917	1918	1919
Total passengers carried for year.....	12,681,298	13,699,341	13,815,447	12,818,552	15,257,398
Miles of track in suburban zone.....	82.32	82.32	82.32	82.32	82.82
Passenger train-miles.....	1,300,957	1,323,835	1,419,635	1,419,635	1,417,938
Average miles per passenger.....	8.00	8.04	8.18	8.26	8.23
Average cars per train.....	4.5	4.4	4.4	4.2	4.3
Number of terminal tracks.....	6	6	6	6	6
Area of suburban terminal yards—car capacity.....	279	279	279	279	279
Average time required to set train and remove locomotive, minutes..	2	2	2	2	2
Total suburban employees engaged in suburban zone.....	490	506	509	519	481
Train employees in suburban zone.....	242	258	261	265	258
Number of trains per day in and out terminal:					
Average, weekday.....	288	294	308	312	306
Maximum, weekday.....	298	302	315	326	320
Sunday.....	132	132	134	138	134

Steam trunk lines have formed physical connections with the underground roads so as to permit through travel without change

Relieving London's Congestion

By a Correspondent
London, England



Main line of the Great Western at Ealing, Western London suburbs, showing train on District Station siding, a Central London underground train and a long distance express train

IN A RECENT review of the present state of traffic in London, Lord Ashfield, the chairman of the underground group of passenger transit agencies, stated that the difficulties with which his organization had to contend would be relieved in a large measure by the development of the policy of linking up the underground lines with the suburban lines of the trunk railroads. Lord Ashfield, American electric railway officials will recall, was formerly, as A. H. Stanley, the general manager of the Public Service Railway of New Jersey. Some account of recent developments in the undertakings that he now controls in the British metropolis should prove of interest to readers of this paper.

PRESENT STATE OF PASSENGER TRANSIT IN LONDON

Railway extension in London and the normal development of existing facilities were, of course, held up by the war, and consequently a great deal requires to be accomplished to bring the urban railroads into line with the increased demands now being made upon them. One of the chief difficulties is the congestion of traffic that occurs at certain hours of the day, a difficulty induced primarily through the altered conditions of labor, the general adoption of the eight-hour day being responsible, as in American cities, for overwhelming volumes of traffic having to be dealt with during short periods of the morning and the evening. A con-

tributory cause is the development of the central area of London as a commercial center, the demolition of extensive parcels of residential property, and the erection on their site of large blocks of business premises taking place rapidly and continuously. This latter factor in itself constantly adds to the number of passengers journeying to and from the central area, and the burden placed upon the urban railroads will become even heavier during the next two or three years when the many new housing schemes scheduled for various parts of the outer suburbs will have materialized.

Briefly, the London railroads have not only to make up the leeway lost during the five years of the war but have to cope at the same time with an inordinate increase of traffic arising through the changes brought about by the war. The problem is further complicated by the fact that the British railroads generally are sustaining heavy deficits in operation, with the result that the investing public is chary of providing the additional capital that is essential for new construction and other much-needed improvements.

The question of passenger traffic in London has twice been the subject of special inquiries by Parliamentary commissions, once in 1903 and again so recently as 1919. Both commissions reported very strongly in favor of a traffic board being set up as a supreme authority in all matters relating to passenger transit in Greater London. The duties of the traffic board would be to

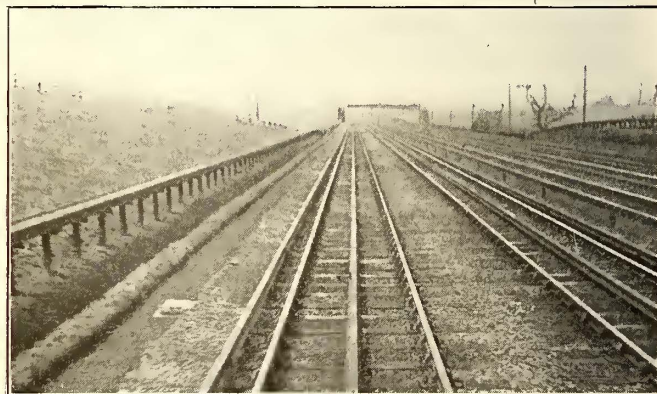
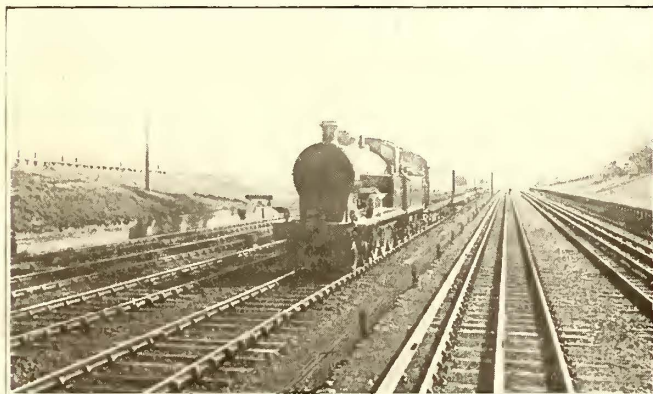
co-ordinate the operations of the various transport agencies and to regulate and direct all of them as a single entity. Up to the present, however, this recommendation—the adoption of which should help in the betterment of traveling facilities in the English capital—has been accorded no practical consideration by the government. Co-ordination, it is true, exists among certain groups of undertakings—such as those controlled by Lord Ashfield—that are under a single direction, but generally competition for traffic is rife. This means that each transit agency or group of agencies is influenced in its activities by a keen regard for its own immediate interests, instead of one and all working together on harmonious lines to deal with the problem in the best interests of the traveling public.

There are nine trunk railroads operating lines in London and its suburbs; two groups of underground railways, one of which—that directed by Lord Ashfield—controls the motor bus concerns and also two of the more important suburban street railways; the London County Council, which operates the street railways within the county area, and various small street railway undertakings which are operated by the municipal authorities in the outer suburbs.



The project of making physical connections between the underground lines and the suburban lines of the trunk railroads serving the British capital was inaugurated some forty years ago by the District Railway, the parent line of the group of transport agencies with which Lord Ashfield is associated. In its early days of steam operation the District extended its lines into the western suburbs and made physical connections at two separate points with the suburban lines of the London & South Western Railway, an important trunk railroad with extensive branches in the metropolis. Through these connections the District trains were enabled to run direct from the City (the term city in relation to London is applied only to the square mile or so—the heart of the modern metropolis—that constituted the London of the Middle Ages), to certain towns of the outer area. It also permitted trains of three steam railways to run through to the City over the District Railway tracks.

When the District system was electrified in 1905, however, the steam-hauled "foreign" trains were withdrawn in nearly every case, and at the present time these lines in the Central London area are scarcely capable of accommodating the traffic worked over them by the



At and near Harrow station, North Western Trunk Railway. Eight miles from tunnel zone, the Underground's tracks run by the side of tracks for long distance steam traffic

Notwithstanding certain increases that have been made in fares, all the foregoing traffic agencies are at present being operated at a loss. Wages, materials and the other items of operating expenses have risen to an enormous extent, and even with the further increases of fares that are contemplated it is questionable whether the London traffic agencies will be able to extricate themselves from their present difficulties. The street railways in particular are in bad plight. None of the privately owned concerns pays its way or has done so for some few years past, while the County Council undertaking is faced with a deficit on the current year of operation equivalent to a rate of sixpence on the pound.

Such, then, are the conditions prevailing in London today—conditions that aggravate the difficulties which confront the passenger transport enterprises.

District company alone. One or two "foreign" services are still worked over the District track, being hauled on this section of their journey by electric locomotives.

As an illustration of the facilities accruing from physical connections between the underground and the trunk railroads it may be mentioned that the Midland Railway, with which the District lines connect at their eastern extremity, operates trains from Southend (situated on the Thames estuary) to Ealing, a distance of about 50 miles, the last 10 miles or so being over the District track in the London area. When the District was electrified, the various sections of the "foreign" lines over which the District trains ran were electrified also, so that the through-running facilities that had been brought about by the physical connections were preserved.

Here it may be as well to point out that the original

underground railways of London—the Metropolitan and the District—are of the “cut and cover” type and consequently similar in general type to the subways of New York. The tunnel sections are sufficiently large to permit the passage of rolling stock of standard dimensions. On the other hand, the underground railways of later origin are in deep-level tunnels bored out by the Greathead shield system. These tunnels—or tubes, as they are popularly called—are of relatively small diameter, 11 ft. 8½ in., increasing to 12 ft. 6 in. at the curves, and can therefore accommodate rolling stock of corresponding proportions only.

SOME RECENT PHYSICAL CONNECTIONS

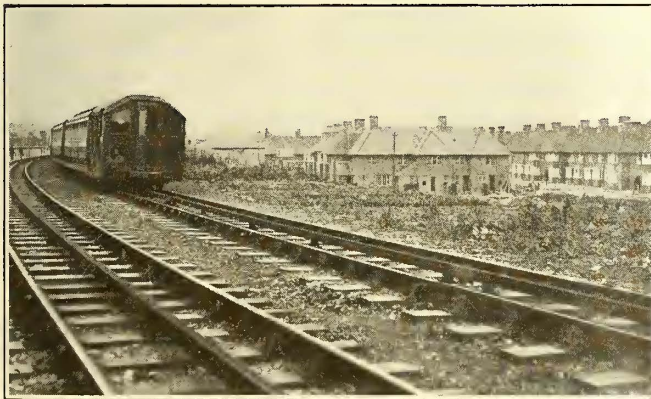
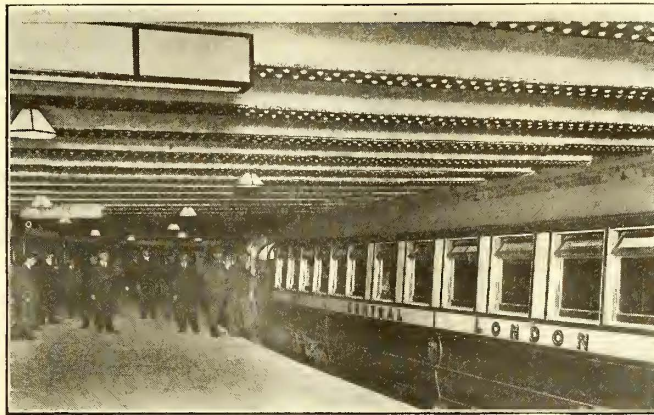
The first physical connection between a deep-level underground line and a trunk railway was opened in 1917, in which year the trains of the Bakerloo section of the Underground began running over the North Western Company's track to Watford.

From the time that it was opened for traffic in 1905 the Bakerloo has been extended on three occasions in a northwesterly direction, the third extension bringing the line up to the surface and effecting the physical junction with the trunk railway above mentioned. From

in the expansion of London, opening up as they do new areas suitable for development on both residential and industrial lines.

The linking up of the Bakerloo with the North Western Railway was the first physical connection of the kind that has taken place since Lord Ashfield assumed the direction of the London Underground Railways. It was one of several such schemes that had been projected prior to the war, but the majority of them are now held up indefinitely through the unsettled outlook in railroad operation and the greatly increased cost of carrying them out. One such scheme of connection, however, had progressed so far prior to the war that its completion after the cessation of hostilities was not retarded by the foregoing considerations. This was the extension of the services of the Central London section of the Underground to Ealing, to which, in view of the many features of interest that are presented, we propose to devote a special notice.

Although it was not actually the first deep-level electric line constructed in London (the City & South London Railway, opened in 1890, has this distinction), the Central London Railway may be regarded as the prototype of the latter-day underground railway.



At left, Central Underground train in newly developed residential suburb. Above, same train in tunnel station. At right, District Underground train on South Western Trunk Railway line

the Bakerloo terminus at the Elephant and Castle in southeast London to the Watford Station of the North Western company is a distance of nearly 21 miles. The Bakerloo line itself is but 6 miles in length; this physical connection with the North Western Railway has therefore more than trebled the extent of route served by the Bakerloo trains. Between the Elephant and Castle terminus of the Bakerloo line in southeast London and Watford, which is in Hertfordshire, a fifteen minutes' service is maintained in each direction, the journey being accomplished in an hour, exceedingly good speed when it is borne in mind that the Bakerloo trains halt *en route* at twenty-two stations during the run, eleven belonging to the Bakerloo Railway and eleven to the North Western. Building operations follow the railway, and this and other long-distance extensions of the Underground into rural territory will play an important part

Opened for traffic in 1900, the Central London Railway, through the introduction of various features that were modeled upon American railroad practice, marked a new departure in urban transit in the British metropolis and determined in a large measure the form and policy to be adopted by deep-level railway undertakings opened subsequently. One interesting innovation was the uniform fare of twopence charged for any distance, an essentially American idea and one that proved exceedingly popular in London while it prevailed. This uniform fare was abandoned in 1907.

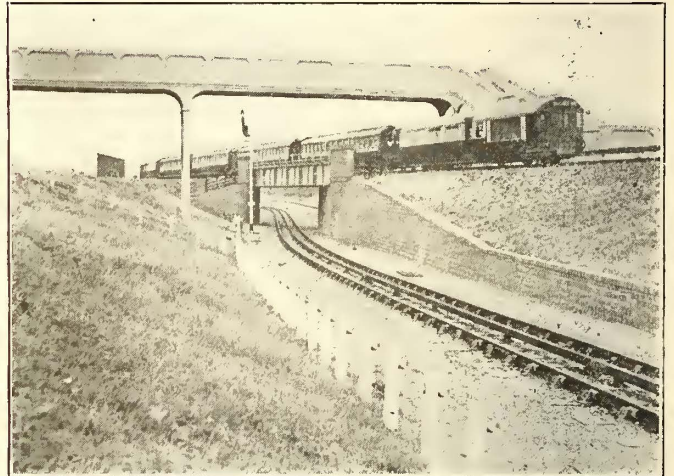
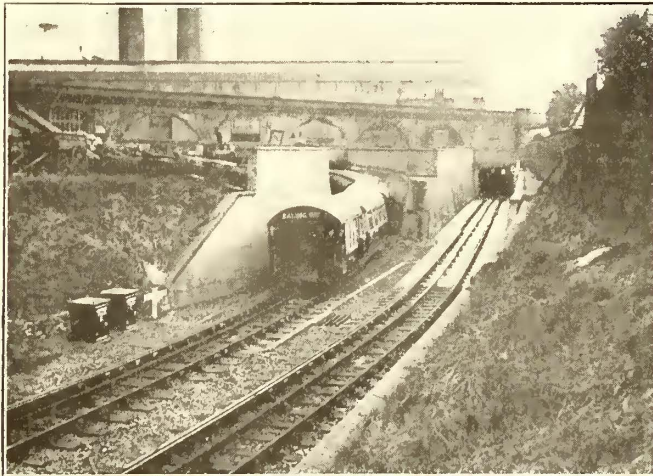
The Central London cars, which were the first in England of the American vestibule pattern, were hauled originally by locomotives, a method of traction that caused considerable vibration to the houses above the tunnels. This trouble was overcome by superseding locomotive traction by the multiple-unit system, an

improvement which had also the further advantage of speeding up the trains. The drawbacks of locomotive haulage experienced on the Central London Railway led to the general adoption of the multiple-unit system of traction on the District Railway, as well as on all four of the new deep-level electric railways that were opened for traffic a year or two later, without these lines having first to "buy" their experience as the Central Railway had done.

Contiguous throughout its length to one of the two western trunk highways leading out of London, the Central London Railway affords a very good illustration of Euclid's definition of a straight line, as it takes the shortest route between its City terminal at Liverpool Street and its original western terminal at Shepherd's Bush, a distance of about 6 miles. At the latter point the line ended on the threshold of a patch of rural territory very sparsely populated but presenting good scope for development, assuming that it was traversed by a railway providing direct connection with the central area of London. The first development in the district in question was the laying out of the Shepherd's Bush

a main-line railway had become an accomplished fact. Meanwhile, the development of the district served by the new line had been very rapid, from both an industrial and a housing point of view, with the result that besides the interchange facilities afforded to passengers using the Great Western and Central London lines the Underground trains have a new field of traffic opened up to them. Another good result is the relief of the congestion of traffic on the District line of the Underground to Ealing, this line, hitherto the only direct route between Ealing and the City, running to Ealing by a somewhat circuitous course south of the Central London line.

Unlike the other lines of the Underground, which are constructed on the four-rail principle, or with one rail for a return, the Central London Railway has the three-rail principle, with central positive conductor-rail and running-rail return, a system that has been adhered to on the extension. The construction work of the extension reflects in many respects the latest ideas in railroad engineering, one especially interesting feature being the signaling installation, which is of the Mac-



At left, Central London Underground train emerging from tunnel at Wood Lane. At right, the physical connection between the Central London Underground and the Great Western Trunk Railroad

Exhibition, which was opened in 1908 and will doubtless be recalled by many readers of this paper through its being the venue of the Olympic Games of that year. A short extension brought the Central London Railway right to the main entrance gates of the exhibition, where a new station, called Wood Lane, was erected. This extension carried the line, which was only a few feet below ground at Shepherd's Bush, up to the surface.

Four miles west of Wood Lane was an important station, Ealing, on the main line of the Great Western Railway, the chief trunk railroad serving the western counties of England, and with its London terminal, Paddington, situated outside the central area. The construction of a line linking up the Central London Railway with the Great Western was an obvious necessity in the interests of both undertakings. First projected in 1905, the work of construction was begun by the Great Western Company some few years later and had made such progress prior to the war that it was practicable to work special goods freights over the line during the period of hostilities. After the war work of electrification proceeded apace, and on Aug. 3, 1920, the Central London trains began working direct from the City to Ealing. The second physical connection of the Underground with

kenzie-Holland three-position, all electric type, and is the longest stretch of this design that has thus far been installed on any British railroad. All the signals are worked in the upper quadrant and are controlled by alternating current track circuits, the following indications being given: Horizontal (red light)—danger; forty-five degrees (yellow light)—proceed with caution; vertical (green light)—proceed at normal speed. The signals are put to "danger" on the passing of a train and do not change position until the train has cleared the track circuit of the section ahead, when the signal arm works automatically to the 45-deg. position, assuming the vertical on the train clearing the second section. For foggy weather repeating-light signals are provided throughout the new line at a distance of 200 yd. from the signals. These are lighted when necessary by means of switches. On the underground system generally the two-position type of signaling is in force; the operation of the new installation on the Ealing extension is therefore being regarded with considerable interest.

Among other schemes of improvement that are now perforce in abeyance on the Underground in London are physical connection between the (1) Central London

line and the South Western Railway; (2) the Piccadilly line of the Underground and the District and South Western lines to Hounslow and Richmond, and (3) another between two Underground lines, the Hampstead and the City & South London.

The first-mentioned scheme entails the construction of only a short connecting line at Shepherd's Bush, where the tracks of the two railways concerned are within a quarter of a mile of each other. This extension would enable the Central London trains to work through direct to Richmond, Twickenham and other Thames Valley towns and would form a very considerable addition to the mileage of route served by that railway.

The present western terminal of the Piccadilly line is at Hammersmith, where this line shares a station with the District Railway. A physical connection between the two lines would mean the linking up of the south-western suburbs of London with those in the north, where the other Piccadilly line terminal is situated.

The third scheme of physical connection—that between the Hampstead and City & South London lines of the Underground—would enable through trains to be worked direct between south London and north London and would greatly improve the existing means of communication between these districts. This project involves the enlargement of a considerable portion of the tunnels of the City & South London Railway. This line, as has already been stated, was opened so long ago as 1890, and the tunnels of the section then constructed have a diameter of only 10 ft. 2 in. which debars the use of the modern type of Underground rolling stock. One of the initial improvements needed to bring the City & South London Railway into line with the present requirements of traffic is the provision of the standard type of car in place of the primitive pattern at present in use. Hence the necessity to enlarge the tunnels, an undertaking of a very protracted nature, seeing that the work has to be done segment by segment and can be carried out only at night during the short intervals be-



A deep-level Underground station, King's Cross on the Piccadilly line

tween the close and commencement of traffic.

While it is manifest that the policy of linking up the underground physically with the surface railways must affect a material improvement in the facilities for travel in London, it is also obvious that this improvement will in itself tend in the future to make general on the system a difficulty that is at present in evidence on one section only—the District. The whole of the underground railways of London are alike in having two sets of running rail only, a limita-

tion that is bound to affect adversely the smooth working of more than the one service of trains for which each line was originally intended. The convergence of two or more services onto the sections of the Underground system in the central area of the metropolis will, if the passenger traffic of London maintains its existing rate of increase, lead in time to congestion on these sections during the busy hours. The frequency with which trains can be worked through to the terminals on the branch lines is circumscribed by the train-running capacity of the line from which they diverge.

The bottle-neck of the District Railway between the eastern and western bifurcations of its lines at Mansion House and South Kensington respectively is already taxed to its utmost capacity during the peak hours of traffic. As many as forty-three trains in each direction—eighty-six in all—are worked in the hour over this section. This is train-working extraordinary—perhaps a world's record. Nevertheless, the present requirements of traffic on this railway demand greater capacity. This might be supplied by a third track, although the cost of such an improvement now would be very great. Other possibilities are cars with greater capacities, better facilities for loading and unloading, and an increase in the number of cars to a train. Cars embodying the advantages mentioned are already on order for the District and other lines. These will have, besides additional seating accommodation, four doors on each side, arranged so that one will be readily accessible to passengers, no matter where they may be seated.

Rail-less Trolley Operation

RAIL-LESS trolley operation has been used for several years in Europe as an adjunct to street railways. The operating figures for the Bradford Corporation Tramways for the eleven months ended March 2, 1920, are given in an article by R. H. Wilkinson in the July issue of *Tramway and Railway World*. The rail-less trolley, the street railway and the rail-less battery bus are operated by this company and comparative figures are as shown in the table.

On the basis of results obtained in practice Mr. Wilkison compares a rail-less trolley system for a new project using sixty and fifty-one as the respective seating capacities. He finds that the rail-less trolley is more economical on a single-track line up to a five-minute service and on a double-track line up to a three-

minute service. He points out that the rail-less trolley is not so comfortable to ride in as the street car, is on a par as regards accidents and is not so reliable,

	Street Railway	Rail-less Trolley	Battery Bus
Traffic expenses per car-mile	17 97	16 24	25 82
General expenses per car-mile	3 32	2 04	2 07
Repairs and maintenance	12 66	11 11	6 29
Power expenses	6 5	2 49	3 26
Overhead expenses	5 93	5 2	7 57
Total (cents)	46 38	37 08	45 01
Mileage	4,807,328	350,221	8,959
Receipts per car-mile	51 77	23 31	29
Seats (cents)	60	29	29

but thinks it can be made so. He states it causes less obstruction to traffic when a breakdown occurs and can draw closer to the curb in loading and unloading.

The Place of the Bus Defined at Edinburgh

Through Runs to Adjacent Cities and Steady-Traffic Local Lines to Be Electrified—Motor Buses for Light Traffic

WHEN the municipality of Edinburgh took over the Edinburgh & District Tramways, June 30, 1919, it came into possession of a cable system which was not only badly run down but also undertracked. The intention of the city was to electrify and enlarge the system, as set forth in the *ELECTRIC RAILWAY JOURNAL* for May 3, 1919. However, several conditions arose that made immediate and extensive electrification impracticable. One factor was the terrific advance in the cost of track and a second was the impossibility of securing quick deliveries either of track or power equipment. Another complication was the desire of many people, for æsthetic reasons, to see Princes Street (the show thoroughfare) electrified on the top-cost conduit system, while the rest of the city was to have overhead trolley.

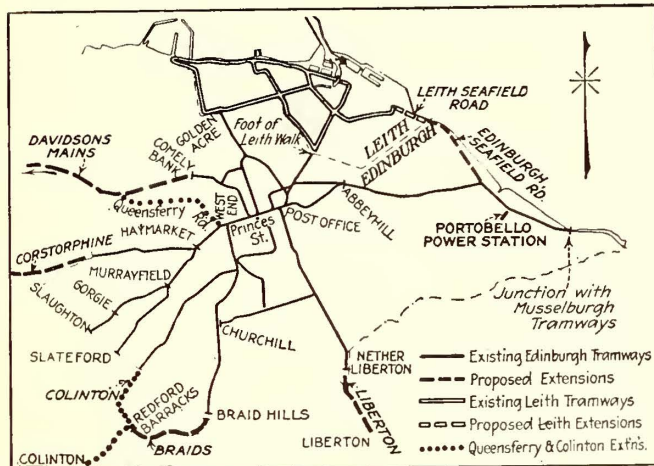
These several circumstances, plus the need for some immediate additional means of transportation, strongly favored the introduction of the motor omnibus. As

would be decreasing as the electric debt increased. Since the estimated assets of the cable system convertible to electric traction were valued at £804,163, that sum would be virtually thrown away if motor buses were adopted instead. Furthermore, the cost of reconstructing the streets would have to be placed either upon the motor buses or upon the community taxes. The permanent way, as regarded renewals and repairs, really was in substantially the same position as the electric railways throughout the United Kingdom, hence the relative financial considerations as to car versus tram were not unique to Edinburgh.

One special condition was connection with the adjacent city of Leith, which, to please the public, would have to be either all bus or all car, since bodily transfer was intolerable. Leith already had a tramway system which was more economical than bus operation, so it appeared that the Leith-Edinburgh route, which includes the Pilrig-Liberton stretch, should be electrified. The Portobello section ought also to be electrified to allow through running with the Musselburgh Tramways.

Comparing the two methods for the cable routes of the city, Mr. Pilcher presents the following:

System	Capital Cost	Interest and Sinking Fund Charges per Annum	Interest and Sinking Fund Charges per Mile Run in Pence (2c.)
Converting cable to overhead system	£695,700	£56,014	2.334
Cost of providing same number of buses	456,640	64,131	2.672
Cost of providing enough buses to equal car seats	729,900	103,155	2.886



PRESENT AND PROPOSED ROUTES AT EDINBURGH

the question was whether it would pay to convert to electric power or go to the motor omnibus entirely, the decision of the management as set forth to the Council on July 17, 1920, by R. Stuart Pilcher, tramways manager, and as supplemented by recent operating data, should be of interest to urban electric railways throughout the world.

Mr. Pilcher says that not even the first section, Pilrig-Nether Liberton (to Leith), could be operated electrically before the spring of 1922 because of lack of power. Following the Council's recommendations, he had started motor buses between Easter Road and Ardmillan Terrace and placed orders for more. The fact that the motor buses were being operated profitably and that they were being used to close down some of the northern cable routes (at least temporarily) had led many people to wonder if they were permanently to displace the electric car so far as Edinburgh was concerned. He would therefore venture to discuss the pros and cons.

The outstanding debt on the cable system May 15, 1920, was £462,761. The electrification was estimated to cost £695,700, spread over three or four years, but the fixed charges should not increase, as the cable debt

As car-seating capacity is fifty-two, against bus capacity of thirty-two, the buses must number 63 per cent more. The fifty-two-seat electric car could be operated at 18.12d. (36.24 cents) per mile, while the present thirty-two-seat buses cost 21.41d. (42.82 cents) per mile. The buses, however, would not have to give 63 per cent more mileage, because maximum capacity is required only during the rush hours. As the average speed of the bus would also be greater during the rush hours, Mr. Pilcher believes that the bus would be able to earn sufficient extra revenue to meet the extra cost of operation caused by its lower seating capacity. The total costs on this basis would be 20.33d. (40.66 cents) per car-mile, or 23.29d. (46.58 cents) per bus-mile.

After listing the merits and demerits of each type of vehicle and stressing the need of meeting rush-hour conditions, Mr. Pilcher concludes that: "It would appear for main lines of traffic, where the passenger traffic is assured and where it is dense, the electric car will be used, but where an infrequent service is sufficient, such as on a suburban route, or where the traffic is not fully developed, the motor bus will be used. I do not consider that the two systems are necessarily competitive, but rather supplementary."

On the four routes named in the report for July 1, 1919—May 15, 1920, the longest run is practically 3 miles and the fare 3d. (6 cents). The lowest fare, as on the tramways, is 1.5d. (3 cents) for a maximum length of 1.2 miles. There is no workmen's rate, but children between four and twelve years are carried at half rates with 1d. (2 cents) minimum. Several score buses are already in operation on these and other routes with earnings as high as 26d. (52 cents) a mile. The municipality also runs *char-à-bancs* (open touring cars), which are extremely popular with the visitors to this beautiful city.

Association News

ATLANTIC CITY CONVENTION, OCT. 11 TO 15

Changes in the Convention Programs

SECRETARY BURRITT has announced a few changes in the programs of meetings to be held in connection with the Atlantic City convention, as printed in the issue of this paper for Sept. 25, pages 607 and 608. These are summarized below.

American Association

The committee reports which will be read after Mr. McAuliffe's address on Tuesday morning will be that of the Aera advisory committee and that on company membership. This session will close with the discussion of the Federal Electric Railways Commission's report, led by Philip H. Gadsden, vice-president United Gas Improvement Company, Philadelphia, Pa.

On Wednesday the session will open with reports of the committees on fare systems and publicity and of the Committee of One Hundred.

Accountants' Association

On Monday afternoon the joint meeting with the T. & T. Association will be held in the Greek Temple from 3 to 4.

On Tuesday afternoon the paper on "Accounting for Material Received and Used, Including Inventories," by R. A. Weston, will precede that on "Cost-of-Service Accounting," by H. J. Davies.

Claims Association

On Monday afternoon the joint meeting with the T. & T. Association will be held in the Greek Temple from 4 to 5:30.

On Thursday afternoon, from 2:30 to 5, there will be a free-for-all discussion on these topics: (1) "The Increased Cost of Claims and Some of the Reasons Contributing Thereto." (2) "Prosecution of Claims for Damage to Company's property." (3) "How Best to Safeguard Releases from Attack." (4) "Value of Signed Statements." (5) "The Best Method of Keeping in Touch with Witnesses." (6) "Value of Secret Service." (7) "Handling Blind and Fraudulent Cases." This discussion will be followed by general business and the election of officers.

Engineering Association

On Tuesday afternoon the reports to be considered will be those of the committees on way matters and on buildings and structures. The Tuesday afternoon program as revised is as follows:

2:30 to 4:30 p.m. (Greek Temple). Joint meeting with T. & T. Association. Report of committee on safety car operation.

4:30 to 5:30 p.m. (Engineers' Hall). Papers on "Standardization and its Effect on Stores."

A. H. Armstrong's paper on "Railroad Electrification" has been transferred from Tuesday to Thursday afternoon, when it will be read after the discussion of technical reports.

The title of W. S. Murray's paper to be read on Wednesday afternoon has been changed to read: "Our Proposed National Power Policy."

On Thursday the reports of the committees on equipment and heavy electric traction will be discussed.

Transportation & Traffic Association

On Monday afternoon, from 3 to 4, the T. & T. Association will meet with the Accountants' Association in the Greek Temple for the discussion of the report of the committee on the collection and registration of fares, and from 4 to 5:30 in the same place with the Claims Association for discussion of the report of the committee on a code of traffic principles and to hear a paper by C. M. Talbert on "Automobile Hazards."

How the Delegates Will Be Entertained

THE convention entertainment will be under the direction of the following committee: Martin Schreiber, chairman; F. R. Coates, N. R. Garland, R. M. Campbell, R. C. Cram, George R. Lyman, Ross F. Hayes, C. H. Beck, L. E. Gould, Harold Hegeman, Thomas Cooper, J. A. Queenie, Charles C. Peirce, J. P. Barnes, J. C. Thirlwall and A. F. Walker.

The committee announces this as the program:

MONDAY, OCT. 11

Morning concert, Convention Pier, 11 o'clock, Strickland Orchestra.

Afternoon concert, Convention Pier, 3 o'clock, Strickland Orchestra, informal dancing.

Annual reception, ball room, Convention Pier, 9 p.m., in honor of the officers and ladies of the American, Accountants', Engineering, Claims and Traffic & Transportation Associations.

The reception will be followed by informal dancing.

TUESDAY, OCT. 12

Morning concert, 11 o'clock.

Ladies' bridge tournament, Convention Pier, 2:30 to 4 p.m. Play to start promptly at 2:30 p.m. Tournament open only to ladies wearing badges. Prizes will be awarded. Ladies are requested to arrange tables of four if possible. In cases where tables have not been arranged, the committee will gladly see that such arrangements are made prior to play. All visiting ladies are urged to enter the tournament. Mrs. W. F. Ham, hostess.

Afternoon concert, 4 o'clock.

Informal dancing, Convention Pier, 9 p.m.

WEDNESDAY, OCT. 13

Morning concert, 11 o'clock.

Ladies' obstacle tournament, Marlborough-Blenheim lawn, 2:30 to 4:30 p.m. Play starts promptly at 2:30 o'clock. Tournament open only to ladies wearing badges. Prizes will be awarded. All visiting ladies are urged to enter the tournament.

Afternoon concert, 4 o'clock. Violin solo, Abraham Ruvinsky, soloist, leader of Rail-Light Orchestra, Company Section No. 11 of the Toledo Railways & Light Company, Toledo, Ohio.

County Fair, ball room, Convention Pier, 9 p.m.

THURSDAY, OCT. 14

Morning concert, 11 o'clock.

Tea, Convention Pier, 4 p.m., Mrs. John H. Pardee, hostess, and concert, Strickland Orchestra.

Annual ball, Convention Pier, 9 p.m., music by Strickland Orchestra.

FRIDAY, OCT. 15

Morning concert, 11 o'clock.

Recent Happenings in Great Britain

Increased Fares for London Underground Sanctioned by Parliament —Larger London Buses—Labor Restless Again

From Our Special Correspondent

The London underground railway companies' bill to authorize them to charge higher fares passed through Parliament and received royal assent before the recess began in August. That was immediately followed by the companies issuing a statement to the effect that the revised scale of fares was being prepared but that it would not come into operation till the end of September. The newly authorized maximum fares are at the rate of 1½d. per mile or part of a mile, with a minimum of 2d. "Workmen's" tickets will be issued up to 7:30 a.m. and will be available for the return journey at any time during the day. The charge will not exceed the ordinary single fare for the double journey, with a minimum of 3d. (return). The companies do not propose to charge the maximum fares unless further emergency arises. They will continue their policy of giving preferential treatment to the longer-distance passengers, so the fare per mile in these cases will still be low though somewhat higher than before.

BY WAY, no doubt, of making it abundantly clear to the public that the increased fares are necessary, the companies have put up posters at their stations quoting the low dividends and in some cases the fact that there are no dividends at all on the ordinary stocks, and pointing out that to secure such meager results so many millions of passengers have been carried. Another form of this publicity work states that in the first six months of this year the associated companies carried 601,000,000 passengers; that each passenger on the average paid 2.02d., that on the average he cost 1.97d.; that the companies had left 0.05d., that this nearly broke the companies, and that only because of the Government subsidy and miscellaneous earnings were the companies able to maintain their solvency.

40 PER CENT INCREASE IN FARES

In the latter part of August, Lord Ashfield, chairman of the underground railways, in an interview stated that the companies did not intend to put into operation a greater average increase than 40 per cent over the pre-war fares, bringing the charge up to a little over a penny per mile. The fares on the steam railways of Britain, it may be mentioned, are now in many cases as high as 1½d. per mile. Lord Ashfield also pointed out that there are still millions of passengers on the underground railways who pay only a penny each, while the terminal charges per passenger (printing, issue and collection of tickets, running of elevators, etc.) amount to about three farthings per passenger. If there is no further increase in working expenses the increase in fares of 40 per cent will allow of a dividend of 5 per cent on ordinary capital.

In connection with the fare question in London, there was a fluttering of certain doves during August over a proposal, which was defeated by a majority of only one vote in the London County Council, to abolish the 2d. all-the-way mid-day fare on the Council's tramways—started three or four months ago to encourage traffic during the slack hours of the day. The proposal was made by the highways committee of the County Council as one

outcome of negotiations which have been going on between representatives of the Council and of the underground railways and the omnibus companies. The recommendation submitted to the Council was that subject to the omnibus companies agreeing that the fare for one section of about 0.6 of a mile should not exceed 1d. (this being the same as the new proposed Council's tramway fare) the charging of a 2d. maximum fare on the Council's tramways during certain hours of the day should be suspended. W. J. Squires, the chairman of the highways committee, in moving the proposal at a special meeting of the London County Council on Aug. 24, said it was the Council's desire to come to some understanding as to traffic on London tramways, omnibuses and underground railways. There should be a spirit of give and take, and he regarded the experimental 2d. fare as a direct cut against the omnibus company.

UNDUE COMPETITION UNDESIRABLE

G. H. Hume, who represented the Council before the Ministry of Transport and the omnibus companies, stated that the negotiations would not be taken up seriously till October, and undue competition was undesirable in the meantime. The omnibus undertaking proposed to do away with 1d. fares and to charge a minimum of 1½d.; they objected to the 2d., all-the-way mid-day fare, and it was proposed to meet them in this. Other councillors (including Labor men) contended that the 2d. fare had been successful and should be continued, and that the Council was not there to consider the interests of the shareholders of the companies.

The proposal was defeated by thirty-six votes to thirty-five. The decision is a fresh example of the difficulties arising from part of London passenger transportation being conducted by a municipality and part of it by companies. The jealousy of the former is always marked.

LARGER BUSES FOR LONDON

The size and the seating capacity of motor omnibuses in London are still increasing. The standard bus until recently seated thirty-four passengers.

The next type, by means of a somewhat larger body and a modification in design, provides a seating accommodation for forty-six people. A number of this sort are now on the streets. In the end of August the Commissioner of Metropolitan Police agreed as an experiment to license a limited number of a new type, each of which will seat fifty-seven passengers. All the omnibuses mentioned are double-deckers, and the last type rivals a four-wheeled tramcar in capacity. It is said that the new vehicle keeps within the existing limit of weight, namely, 3½ tons unladen. At the time of writing no sample of it had begun operation.

It is expected that the London General Omnibus Company, which is in the underground "combine," will put up its fares at the same time the railways do. For this it does not need any Parliamentary powers. The company has resumed two all-night services of buses which were stopped owing to scarcity of men, vehicles and petrol during the war. These services are between the city and some northwestern suburbs. The buses run at intervals of about an hour between midnight and morning.

STRIKES CONTINUE

A truly remarkable record has been set up by the Great Eastern Railway by putting into effect a two-minute service of trains during the rush hours on certain of their suburban routes out of Liverpool Street Station in the city of London. This is said to be the most frequent service of steam trains in the world. The project for electrifying the company's suburban lines is still under consideration, but costs of everything are excessively high and it is not easy for the railways at present to raise additional capital.

Despite all the "settlements" that have been arrived at, sporadic strikes, often of the "lightning" variety, continue to take place on various tramway undertakings in England. They arise out of local grievances or disputes, and the Joint Industrial Council seems to be unable to prevent them. Tramway employees, like many other employees in this country, now go out on strike on the most trivial matters. Then in Scotland there was a twenty-four hour stoppage of some of the most important tramways, this being part of a one-day strike among various industries as a protest against a new act of Parliament allowing landlords to increase house rents—a thing prohibited during the last two or three years of the war. Glasgow tramwaymen threaten to strike because the Town Council will not recognize one of their trade unions. Another of these unions is already recognized. The Council evidently thinks that one union is enough.

It is announced that the government of New Zealand has accepted a tender of the English Electric Company for the electrification of the Arthur's Pass section of the main line railways. The route includes a tunnel 5½ miles long through the mountains. The gradients range up to one in thirty.

News of the Electric Railways

FINANCIAL AND CORPORATE • TRAFFIC AND TRANSPORTATION

PERSONAL MENTION

Budget Reduced \$379,000

Cincinnati Street Railway Director Orders Cut in Supplementary Budget—Total \$554,000

The Cincinnati (Ohio) Traction Company has filed an application for supplementary allowances for 1920 as follows:

Way and structures.....	\$ 72,818
Equipment	170,384
Power	277,540
Conducting transportation...	380,626
General and miscellaneous...	21,720

Total \$923,090

The explanation of the company may be summarized under these general heads.

The failure of the O'Brien law in the Supreme Court dislocated the financial plans for track construction upon which the budget of 1920 was based, necessitating a larger expenditure for this purpose. The outlaw switchmen's strike interrupted the company's regular supply of coal from the mines and made it necessary to purchase coal in the open market at almost double contract prices.

The decision of the Wage Board of Arbitration added 18 per cent to the scale for members of the union and thereby required adjustments affecting every department of the company. The latter is the larger and more important item.

STREET RAILWAY DIRECTOR SATISFIED

William C. Culkins, Street Railway Director, after reading the report of the arbitrators said that he was impressed with the justice of their conclusions in the matter affecting wages. Mr. Culkins reiterated the recommendation of Chairman Tuttle of the wage board urging the railway to introduce every economy possible. Mr. Culkins said:

A general survey of the system by this department shows that during the middle of the day, and in the late evening on many lines, cars are running almost empty. The change of a few minutes in headways during the middle of the day would produce an appreciable inconvenience but would materially reduce operating expenses on the whole system and benefit the car riding public, who will, I am sure, cooperate cheerfully in working out of any economy which does not reduce service below the standard established.

One-man car operation, through rerouting, crosstown connections and other matters have been previously called to your attention, as the need of conservation is greater now than at any other time.

The total supplementary allowances requested would increase the total operating expenses for the year 1920 from \$5,449,346 to \$6,373,434 and require a total, including taxes, rentals and other deductions, of \$9,628,000. The total receipts for the first eight months of this year were \$5,809,471.

It seems reasonable, however, to expect an increase in traffic, but the number of revenue passengers for the last four months of 1920 will probably not exceed 42,500,000, or 2,500,000 more than in 1919. This would

produce at an 8-cent fare approximately \$3,440,000, or a total for the year of \$9,249,000, which would be \$379,000 less than the total allowance under the supplementary budget as requested.

However, I am of the opinion that with economies suggested the company will be able to pay the new wage scale and still materially reduce expenses so that it will be possible to avoid increasing the present rate of fare.

It is evident that the improvement of Eastern Avenue, Central Avenue and possibly Freeman and Hamilton Avenues will not be completed this year and the total estimated for this purpose will not be required before next year.

The efficiencies suggested will reduce the consumption of power, and since the total excess over the budget for the first months of 1920 is \$112,000 the amount requested, \$277,000, seems excessive, especially in view of the improved railroad freight conditions which should assure a supply of high-grade coal.

The greatest effects of the schedule readjustment and the greatest savings should be shown in "conducting transportation." Of the \$21,720 requested for "general and miscellaneous," a satisfactory reduction in the injuries and damages accounts promises to offset increased costs of supplies coming under this heading.

It is therefore ordered that the supplementary budget required by the company be not granted and that in lieu thereof the following supplementary allowances be and the same are hereby granted:

Way and structures.....	\$ 30,000
Equipment	150,000
Power	200,000
Conducting transportation...	150,000
General and miscellaneous...	14,000

Total \$544,000
Reduction 379,000

City Representatives to Meet at Atlantic City

William C. Culkins, Street Railroad Director at Cincinnati, Ohio, and secretary of the American Association of City Representatives of Electric Railways, announced that on Oct. 13 at 2 p.m., during the convention of the American Electric Railway Association at Atlantic City, the Association of City Representatives of Electric Railways will convene at the Hotel Traymore. Mr. Culkins has requested each member to prepare a paper on local conditions to be read before the assembly.

Among those who have signified their intention of attending the meeting are: Thomas Murphine, former Superintendent of Utilities, Seattle, Wash.; M. M. O'Shaughnessy, City Engineer, San Francisco, Cal.; William C. Culkins, Director of Street Railroads, Cincinnati, Ohio; Fielder Sanders, City Street Railroad Commissioner, Cleveland, Ohio; Lynn B. Milam, Director of Public Utilities, Dallas, Tex.; William L. Sause, Street Railroad Commissioner, Youngstown, Ohio; C. R. Barnes, Street Railroad Commissioner, Rochester, N. Y.; R. F. Kelker, Jr., Chicago, Ill.; John W. Everman, Dallas, Tex.; D. W. Henderson, Seattle, Wash.; Colonel E. M. Stayton, Kansas City, Mo.; and W. S. Twirling, Philadelphia.

New Orleans Report Public

Special Masters Acting for Court Recommend Service-at-Cost Plan and an Eight-Cent Fare

The report of the three special masters arbitrating the differences between the trainmen and the New Orleans Railway & Light Company was filed with Judge Foster on Sept. 20. The document, which is signed by Charles J. Theard, George H. Terriberry and P. J. O'Leary, recommends:

That the citizens of New Orleans pay a fare of 8 cents.

That the company be allowed interest on its investment at the rate of 7 per cent. The valuation placed at \$41,500,000.

That the company immediately adopt the service-at-cost plan.

That the men be paid 40 cents for the first six months in service, 52 cents the next six months and 55 cents thereafter. The men now are getting 38, 40 and 42 cents an hour.

That the local union and its affiliation with the Amalgamated be recognized.

That the company sign the contract of 1918 with certain reservations. These reservations in some instances are those requested by the company, one of which is the abolishment of the five-minute layover. The company also has the right to say how it shall run its cars.

That school children pay not more than 5 cents with transfers.

EASY TO ADOPT NEW GRANT

The special masters agree with counsel for the New Orleans Railway & Light Company that the adoption of a service-at-cost plan in the city of New Orleans should not involve serious difficulties nor protracted negotiations. They express the opinion that it would appear to be improbable that difficulties will arise in selecting from these various plans such parts as are appropriate and adaptable to local conditions and incorporating them into a fair and workable cost of service plan.

Federal Judge Foster rendered a decision on Sept. 30 on the report of the special masters in which he granted the wages awarded to the motormen and conductors, holding that until such time as the service-at-cost plan was adopted an 8-cent fare was necessary to meet the wage increase and enable the receivers to give adequate service. He held further that since the city made no objection to the masters' recommendation of an 8-cent fare, he took it for granted that the city would not oppose the increase. He recognized the Amalgamated, but held that the men would have to abide by the masters' recommendation regarding working conditions. He disapproved and set aside the masters' valuation of \$41,500,000 for the property in deference to the representatives of the stockholders, who objected to the valuation. The report now goes to the Commission Council, which will meet on Oct. 5 for final action.

Employment Control Upheld

District Court Says Employees Have Right to Organize, but Employers May Fix Employment Conditions

The Supreme Court of the District of Columbia has denied the application for an injunction sought by the Brotherhood of Railroad Trainmen to restrain the officers of the Washington & Old Dominion Railway from discharging any of the plaintiffs from the employ of the railway by reason of their affiliation with the brotherhood or for any cause not the result of the fault or misconduct of the plaintiff.

ROAD A COMMON CARRIER

The conclusion of the court as noted briefly in the *ELECTRIC RAILWAY JOURNAL* for Sept. 11 is that the defendant railway is such a carrier by railroad as comes within the purview of Title 3 of the transportation act of 1920. The court says that the company's right to dismiss its employees for becoming members of the labor union is supported by the judgment of the highest judicial tribunal in the country and that this judgment, in cases within the jurisdiction of the court, the court must recognize and enforce.

It was sought to have the injunction continued pending a decision of the so-called labor board created by the act of Congress, known as the transportation act of 1920. The bill also prayed that pending the decision of the labor board referred to the defendants be required to reinstate such of its employees as had been discharged because of their affiliation with the railway brotherhood.

The Washington & Old Dominion Railway insisted that it was an interurban or suburban electric railway not operating as a part of the general steam railroad system of transportation and was excepted from the provisions of section 300 and sections following in the transportation act. The railway admitted that some of the plaintiffs and other employees of the company had been dismissed from its employ and that those still in its employ at the time of the filing of the bill were threatened with dismissal because of their union affiliations. The railway contended that there was no equity presented by the bill and that the court did not have the authority to grant the relief that is sought.

EMPLOYERS HAVE RIGHTS, TOO

The court found that both the declared purpose of the company, the business contracted by the railway and the character of the territory through which the line ran, removed it from the category of either an interurban or suburban electric railway. On the issue of the matter of the policy of the road to prevent its employees from joining labor unions, the court said that Mr. Davis, the manager, very frankly stated the reason which influenced this policy.

The court also said that the right to labor was a social right which inhered in the individual and as a corollary to that the right not to work must equally be recognized. With the recognition of the right to belong to organizations of labor unions, so called, was another right which belonged to the employer. That right was to impose conditions upon those who sought employment from a given employer, be that employer an individual or a corporation. In this connection the court said:

It may be asked what becomes of the right of employees to organize themselves into a union, or to become members of a union already in existence, if, as a consequence of doing so, the employer may exercise his right as recognized by the Supreme Court in the cases cited? The answer may not be easy to formulate, but this Court is not called upon to answer the question. Its duty is to give effect to the authoritative opinions and decisions of the Supreme tribunal. These, it would seem, give to the defendant railway company the right to dismiss its employees if they join a labor union.

It may be urged that to so hold is to render vain the right which the plaintiffs claim is given them under the transportation act of 1920. But without stopping to inquire whether they are given rights under that act of the character claimed in the bill, it is enough to say that if that act undertakes to restrain the power of employers to discharge their employees for joining a labor union, the act would then appear to come within the denunciation of such legislation in the opinion of the Supreme Court to which attention has been called.

It might be appropriate to point out that the provisions of the transportation act relied upon by the plaintiff contemplate, apparently, action by the labor board where application by an existing labor organization is made to it, or made by unorganized employees to the number of 100 or the labor board's own motion. It is alleged in the bill that there are not 100 unorganized employees of the defendant railway to sign the petition to the labor board, contemplated. But even so, the labor board may on its own motion, "if it is of the opinion that the dispute is likely substantially to interrupt commerce" . . . decide such disputes as it is by the act given jurisdiction to hear and determine.

It is not for this court to discuss the policy which from the evidence submitted is the one adopted by the defendant railway employer with respect to its refusing employees becoming members of a local union. But it is well to keep in mind the evident policy of the National Legislature, which impliedly, at least, recognizes the right of employees to be members of a labor union.

Service Resumed Pending Inquiry

At a hearing before the Public Service Commission for the First District of New York on Sept. 16 Commissioner Barrett, acting for the commission, read a letter which he had just sent to Frueauff, Robinson & Sloane, attorneys for the receivers of the Manhattan & Queens Traction Corporation, pointing out the franchise obligations of the company and directing it to resume service at a 5-cent fare, pending the continuation by the commission of the investigation of the company's affairs made necessary by its application for increased fares. The attorneys for the receivers complied with the commission's request in a letter to Commissioner Barrett. In this letter they said that with many statements of the commissioner they were in accord, but that they have already shown that service cannot be rendered with the fare at 5 cents.

Bus Competition Protested

Pacific Electric Railway Opposes Direct Stage Competition—Increase in Fares Hurt Railway

The Pacific Electric Railway, Los Angeles, Cal., has instituted a fight before the California State Railroad Commission against direct auto stage competition on all parts of its system. A petition filed by the interurban system on Sept. 24 with the Railroad Commission protests and asks that wherever such competition is authorized or permitted to exist, the Pacific Electric be allowed to cancel all of its interurban commutation fares.

BLOW TO COMMUTERS

This drastic proposal as now made would be a serious blow to thousands of interurban commuters. It is made as the result of an application recently filed with the commission for the granting of an autobus franchise between the cities of Los Angeles and Alhambra.

An application of similar nature has since been filed with the commission in anticipation of autobus competition being sanctioned between Los Angeles and Pasadena. Similar action will be taken by the company to cancel the commutation fares between Los Angeles and Pasadena and to eliminate free transfer privileges now in effect in Pasadena from local lines to interurban lines on through business between Los Angeles and Pasadena.

The applicants for the competitive bus line between Los Angeles and Alhambra contend that unsatisfactory service on the interurban line and the unjust burden resulting from recent increased rates make the granting of a bus line franchise an absolute public necessity.

The bus line proposes to charge the same fare in effect on the electric line before the recent 20 per cent increase. There is nothing definite in the bus line proposal as to a commutation fare. All bus lines avoid this issue, always going after the one-way and round-trip business.

RAILWAY DENIES NECESSITY

In its protest to the commission the Pacific Electric Railway denies any public convenience or necessity for the proposed auto stage line. The electric line claims it is now furnishing sufficient and adequate service and would suffer material loss in patronage should the stage line be permitted to operate. In conclusion the company said:

In the event your honorable body should see fit to grant the application of the bus line, the Pacific Electric Railway hereby makes application for authority to cancel all commutation tickets, and retain in effect only one-way and round-trip tickets.

It is cited that the electric line pays out 30 per cent of its revenue for taxes and maintenance of right of way, while the auto stage lines pay out only 2 per cent of their gross revenue in state taxes and the public maintains the right of way free.

Government Ownership Planned

Program of Mexican Government for Taking Over Electric Utilities Causes Surprise

Foreign investment interests in Mexico express much surprise at the authoritative announcement which has just come from the capital to the effect that the Mexican government plans to purchase the extensive holdings of the Mexican Light & Power Company and the Mexican Tramways, Ltd., including the hydro-electric plant at Necaxa. It is stated that an inventory of these properties has just been made and that the proposed purchase price has been practically agreed upon by the interests involved.

The making public of the government's plans to acquire these holdings was all the more of a surprise, coming, as it did, upon the heels of an authentic statement that the Mexican Tramways, Ltd., had under consideration plans for resuming construction work upon its two proposed interurban electric lines, one to run from the city of Mexico to Puebla, 130 miles, and the other from the city of Mexico to Toluca, a distance of 45 miles.

A \$12,000,000 INVESTMENT

More than \$12,000,000 gold was expended in the building of dams for the storage of water in the mountains, the installation of a hydro-electric plant of 200,000 hp. and the construction of transmission lines from Necaxa to the city of Mexico, Puebla and El Oro. How much money in addition to this was invested in the lighting system and electric railways of the capital and Puebla is not publicly known. The Mexican Light & Power Company and the Mexican Tramways, Ltd., are owned by a British syndicate.

It is the purpose of the Mexican Government to finance these pending transactions by issuing bonds, which will be retired from the profits of the companies. The details of how this financing is to be accomplished are lacking, however, in the preliminary announcement of pending negotiations.

Valuation Proceedings Begun

The valuation proceedings in connection with the appeal of the Philadelphia (Pa.) Rapid Transit Company for additional revenue started on Sept. 23. Commissioners Benn and Clement sat to hear the testimony regarding the company's holdings. A mass of evidence tending to show the length of mileage owned and operated by the company was introduced. In order to expedite matters with the city the commission postponed the hearing until Sept. 30 so as to give the city an opportunity to select its experts.

The company was ordered by the commission to throw open its books and give all data relating to the valuation as well as the actual property to the city's experts, so that the latter will

have every opportunity to check up the figures that will be submitted to the commission in the valuation hearings.

The hearing opened with the reading of a paper by Coleman J. Joyce, counsel for the company, in which he explained that the company would be unable to submit anything but the inventory of the various equipment that makes up the system. The actual pricing of the items submitted, he said, would be made as the hearings progress. In explanation of the inability of the company to present the valuation as ordered by the commission. Mr. Joyce said that the failure of the company to get the higher fares it sought in June had made necessary certain economies that precluded the employment of the pricing experts required to expedite the valuation.

He also delivered a plea for the granting of a higher fare by the commission, pointing out that a higher fare had been allowed in Pittsburgh, and in Philadelphia, in the case of the Philadelphia Electric Company, higher rates were permitted while valuation proceedings were in progress. Mr. Joyce said that the work of compiling the valuation had started in November, 1918. At various times as high as 250 men had been employed on the valuation.

Employees Desire to Run Road

Trainmen in the employ of the Eastern Massachusetts Street Railway believe the Chelsea division, now run at a loss, can be made to yield a good profit, and desire an opportunity to operate it in their own way, expressing a willingness to make good any losses entailed by such management.

In an open letter to the public, signed by President James M. O'Brien, the Chelsea union declares it feels as though it could reduce the fare, give more frequent service and resume operation of lines which have been discontinued. The letter follows:

To the public: The employees of the Bay State System, in the Chelsea division, who are members of the Amalgamated Association, desire to inform you that we did not raise the fare from 10 cents to 15 cents, and that we did not approve of it at the time it was done.

The company alone is responsible for the advance and the only thing we can do is to collect whatever rate the company charges. We believe the company has made a mistake in trying to get additional revenue in this manner.

Raising the rate of fares certainly drives away riders, and that of course results in fewer cars being run, and causes more of our men to be laid off. We are inclined to believe that someone in charge of running the Bay State system either does not understand how to run the property or has some idea in mind other than giving the public service.

We believe that the Chelsea division is a good paying proposition and would welcome the opportunity of trying to run it in our own way. We feel as though we could reduce the fare, give more frequent service, and resume operation of lines that have been discontinued. We are willing to share in the losses, if there be any.

According to its own statements, the present management must be convinced that it is a failure. Why do the officers stand in the way of letting others try it; why don't they stop before they put the entire property in the junk pile?

The proposal from the men is to be put up to the trustees of the Eastern Massachusetts Street Railway by the employees.

\$175,000,000 Program Suggested

Greater New York's Transit Needs for Twenty-five Years Planned For by Commission's Engineers

General plans and studies for enlargement and extension of the city-owned rapid transit system in all of the boroughs of Great New York have been announced by Transit Construction Commissioner John H. Delaney and the engineering forces of the department. The plans have been prepared by Daniel L. Turner, chief engineer of the commission. The scheme as worked out has been issued in pamphlet form for consideration for the purpose of evoking suggestion and criticism from the operating companies, engineers and civic organizations generally.

As laid down in general terms the program for transit development is intended completely to take care of the city's needs as long as it is confined within its present boundaries. A definite program is suggested for the next twenty-five years, as such needs can now be forecast. Studies have been made in order that municipal growth may not be retarded in any direction and for the prevention of abnormal and congested conditions in certain sections of the city and strangulation of growth in other areas.

830 MILES OF LINE PROPOSED

In the proposed routes for the complete program provision is made for adding 830 single track miles to the present rapid transit facilities of the city, which now aggregate approximately 616 miles of single track elevated and subway lines. Projected lines and extensions to the existing lines, wherever they may originate in outlying boroughs, are laid out to enter and traverse the heart of the city, which from the transit viewpoint is 8 square miles in the section of Manhattan south of Central Park between Second and Tenth Avenues. The plan contemplates the addition of forty-two single track river crossings to the thirty-four single track river crossings provided in the existing dual transit system. All of the proposed crossings will be by means of tunnels. In the new project will be twenty-one additional two track tunnels connecting the boroughs of Manhattan, the Bronx, Queens, Brooklyn and Richmond.

No close estimate of the cost of construction of the enlarged transit system is possible at present, and it is not intended that the comprehensive scheme as laid out in its entirety will be undertaken at once, but that it should be preceded with gradually and continuously. At pre-war prices it is estimated that the lines contemplated in the suggested program would cost approximately \$175,000,000. At present prices, however, it is estimated that this cost would amount to \$350,000,000 exclusive of equipment, interest during construction, engineering and superintendence.

Wages Vary with Net

Elgin & Belvidere Men Sign Contract with Wage Scale Under Which They Share in Earnings

Bion J. Arnold, sole owner and operator of the Elgin & Belvidere Electric Railway, Elgin, Ill., has entered into a new contract with his trainmen who are organized as Division 507 of the Amalgamated Association, which embodies a new principle in the matter of wage determination. A "basic rate" of pay of 31 cents, 32 cents and 33 cents, respectively, for first year, second year and senior men is provided, and to this is to be added an "increased pay" of an amount sufficient to make up the rate of pay contained in a table in the contract and varying upward with increasing net income.

PLAN SIMPLE IN OPERATION

For example, if the difference between gross receipts and operating expenses for the current month is between \$3,500 and \$3,000, the total rate of pay for that month is to be 43 cents, 44 cents and 45 cents an hour. If, during the next month, the net revenue should be between \$4,000 and \$3,500, the rate per hour would be 46 cents, 47 cents and 48 cents for that month.

The rate of pay is determined each month for the current month. At the end of the first fifteen days of any month, the net revenue is computed and multiplied by two to indicate the monthly net, and the men then paid for this first fifteen days, accordingly. The sliding scale thus determined varies for senior men from the basic rate of 33 cents an hour for a net earning of less than \$2,250 per month to a maximum of 63 cents an hour for a net income of \$6,000 or over.

The contract specifies that the operating expenses of the company shall be kept in accord with the Interstate Commerce Commission standard classification of accounts and shall include the actual cost of all labor and all other expenses incidental to the operation of the road, it being understood that 25 per cent of the gross receipts may be expended for maintenance and renewals, and 4 per cent expended or reserved for injuries.

CAPABLE OF WIDER APPLICATION

The rate of pay for the last half of the month is determined by taking the actual gross earnings for the month. Provision is made that checks drawn for the pay of the men shall be accepted by the men temporarily with the understanding that adjustments will be made within sixty days from the close of every month, and additional checks sent to cover the amount due the men, or deductions made from subsequent amounts to them if the amount paid was at a rate in excess of what was actually earned, according to the sliding scale.

While this plan has been worked out on a small property, Mr. Arnold considers it fundamental and capable of

general application, provided that the companies are willing to accept a reasonable rate of return upon the actual cash invested in the property or upon a fair valuation. In the case of the Elgin & Belvidere Railway, which has never been profitable, the company will earn about 3.5 per cent on the actual cash (not stocks and bonds) invested in the property when the men are receiving 45 cents an hour and 5.5 per cent when the men are receiving 60 cents an hour. The whole plan is based on the theory that both the company and the employees prosper in good times and suffer in bad times, in proper proportion, the limit of the burden borne by the men and the extent to which they prosper being fixed by the wage scale tabulated in the contract. Mr. Arnold states:

In our case we will probably never reach the 63-cent limit, although if we could I would be glad to see the men get the wage provided, but the probability is that the wages will run from 33 cents to 54 cents an hour, the 33 cents applying probably only during January and February of each year.

Another interesting clause of the contract is that the union employees of the Elgin & Belvidere Railway have agreed to maintain good relations with the union employees of the Aurora, Elgin & Chicago Railroad, which connects with it at Elgin, and co-operate with the non-union employees of the Rockford & Interurban Railway, connecting with it at Belvidere, in the establishment and maintenance of various through service to the end that the volume of business done by the respective companies may be increased.

Back pay has been paid the men from July 15, the date of expiration of the old contract. For the last half of July the men received 51 cents an hour and they will probably receive 51 cents for August, although the exact figures have not yet been determined. They will probably receive between 48 cents and 51 cents for September. The men have thus apparently received a raise of pay of from 8 cents to 11 cents an hour under the new contract.

Newspaper Reviews Railway Situation

In order to acquaint the residents of Cleveland with the present situation of its street railway system a series of articles about the Cleveland Railway is being published in the Cleveland *Plain Dealer*. Two installments have already appeared written by two members of the staff of that newspaper. The object of the articles is to present to the people of Cleveland the real situation with respect to its railway, discussing its present needs and future improvements. It is hoped that the digesting of these accounts will move people to help and not hinder the railway in giving its best service to the city. In the articles so far published it has been shown the system undoubtedly needs new equipment to maintain efficiency in transportation. The ways and means of acquiring this capital will be discussed in subsequent articles.

Council Repasses Measures

Toledo Body Clears Way for Railway Settlement at the November Election

The City Council at Toledo, Ohio, started the Milner service-at-cost ordinance and the twin bond ordinances providing for an issue of \$7,000,000 of bonds to acquire and construct a municipally owned railway system on the way to the voters when it finally approved them at the meeting of the Council on Sept. 27, without a dissenting vote. It had been previously agreed that they would be passed without opposition.

PREPARING FOR CAMPAIGN

It is expected that Chairman W. L. Milner, of the service-at-cost commission, will lead in the campaign before the people for the adoption of the ordinance. No organized opposition to the Milner plan has been brought out except that voiced in the Scripps afternoon newspaper, the *News-Bee*. This paper is also supporting the municipal ownership plan as it did in the previous campaign. During the negotiations on the franchise the paper always supported the Milner commission as opposed to Henry L. Doherty and the company interests. Now it is turning against Milner in an effort to defeat the franchise after it has been approved by Council twice.

The campaign against the ordinance so far has been in general terms against the Tayler plan. The *News-Bee* has said that it is like "signing a blank check" to give the railway such a working plan. It is also extensively advertising the Wilcox statements regarding the Tayler plan.

It will be remembered, however, by many that while Mr. Doherty and the commissioners were trying to reach an agreement, Mr. Doherty objected to the Toledo plan largely because it differed from the Tayler plan as in force in Cleveland.

With the twin bond ordinances the taxpayers of Toledo will hand over to the Council \$7,000,000 to spend *carte blanche*, except that it shall be for a transportation system. Radicals are opposing the measure because it does not provide for buses alone and others are opposing it because it does not provide for taking over the present system of transportation.

The service-at-cost plan at Toledo does not mean death to municipal ownership. It provides for municipal ownership in a series of small payments to be made one each year of the twenty-five years of the grant, or ownership or lease on short notice at any time in the twenty-five years.

It is expected the campaign for the Milner ordinance will open very shortly. Municipal ownership advocates have announced no plan as yet. W. L. Milner, chairman of the commission, will lead the business interests in favor of the service-at-cost and permanent settlement of the railway difficulties of Toledo.

Formal Appeal Made for Wage Rehearing

The Public Service Commission of Missouri has been petitioned by the attorney for the employees of the United Railways, St. Louis, Mo., to set aside its recent order denying the men a rehearing of their application for increased wages. The order of the commission sitting as a board of arbitration was for an advance of 5 cents an hour in the wages of the men. Most motormen and conductors are paid at present 60 cents an hour. The motormen and conductors recently voted to accept this award.

The attorney for the men issued a statement saying that one reason for the men's petition was that the order denying a rehearing was not issued by the same board of arbitration which granted the advance of 5 cents an hour, as after that action Commissioner Blair resigned from the commission and was replaced by Commissioner Kennish, who cast the deciding vote on which a rehearing was denied. The men ask that Mr. Blair be permitted to assume his old place as one of the arbitrators and that he vote on a rehearing.

Worcester and Springfield Wages Adjusted

Employees of the Worcester (Mass.) Consolidated Street Railway must accept the wage compromise of the company though they defeated the proposition by a vote of 504 to 420. The agreement which exists between the Springfield and Worcester unions is that each must abide by the total vote of both cities and the men of Springfield gave a sweeping "yes" to the proposal. The compromise carries with it an increase of 7 cents an hour for the second six months of this year, an additional 1 cent an hour for the first six months of next year and 3 cents an hour more after June 1 next.

Last spring the members of the Worcester division of the Amalgamated Association made demands on the company for an increase to 95 cents an hour. The question was to be referred to a board of three arbitrators, two of whom were Bentley W. Warren, Boston, for the company, and James H. Vahey for the employees. The third arbitrator was to be selected by these two men.

A time limit has been imposed for the selection of a third arbitrator and on the date of expiration the company announced that it had an offer to make to the men. The proposition from the company to the men which was voted on and accepted is as follows:

From June 1, 1920, to Dec. 31, 1920, 7 cents an hour, or 63 cents more a day.
 From Jan. 1, 1921, to June 1, 1921, 8 cents an hour, 72 cents a day.
 From June 1, 1921, to Dec. 31, 1921, 11 cents an hour, 99 cents a day.
 Worcester rate on hourly basis same as present.
 Springfield rate figured on daily basis.
 Operators of one-man cars 13 cents an hour over rate paid on two-man cars.
 All other conditions to remain the same.
 Miscellaneous employees to receive the same rate per hour as uniform men.

News Notes

Big Plan Dies.—The plan of a proposed tunnel under East Fifty-fifth Street, Cleveland, known as the Barber project, has practically become extinct. On Sept. 24 a plot of land considered essential to carrying out the project passed into the hands of a realty corporation. At the time the plan was first advanced people of Cleveland were led to believe that the completion of this tunnel meant an ocean port for Cleveland. This now seems remote.

Bus Legislation Fails.—At the special session of the Legislature of New York, called to consider the housing situation, an effort failed to enact legislation fostered by Mayor Hylan of New York to permit the city to own and operate motor buses. The courts have already ruled against the operation of such vehicles in competition with the railways and have stayed the hand of the city in its effort to expend \$1,000,000 for motor vehicles. The bus proposal was opposed by counsel for the New York Railways, the Interborough Rapid Transit Company and the Brooklyn Rapid Transit Company.

Wage Increase in Charlotte.—Z. V. Taylor, president of the Southern Public Utilities Company, Charlotte, N. C., has announced a new wage scale for the employees of his company. The men had submitted a contract which called for so great an increase that the company in view of its limited revenue was unable to meet the request. However, at a meeting where company officials and representatives of the men were present, a compromise was reached and the men of Charlotte, Winston-Salem and Greenville signed an agreement for the next twelve months which will give them an increase of 5 cents an hour. The new scale is as follows: For the first six months, 43 cents; second six months, 44 cents; second year, 45 cents; third year and after, 47½ cents. Operators of one-man cars will receive 5 cents an hour above the scale.

Interurban Franchise Case Heard.—The Wisconsin Supreme Court heard final arguments on Sept. 25 in the Milwaukee interurban franchise case. A decision is expected within a few weeks. The controversy resulted from the demand of the city of Milwaukee that the Milwaukee Electric Railway & Light Company obtain an interurban franchise over its city lines. This the company refused to do. The city thereupon obtained a restraining order. When the company prepared to obey this order by stopping all its interurban cars at the city limits and compelling passengers to get off and get on the cars again

after the cars had crossed the city boundary line, the state intervened and the execution of the injunction was delayed pending a hearing by the State Supreme Court. The case was reported in *ELECTRIC RAILWAY JOURNAL* of May 22, 1920, page 1076.

East St. Louis Arbitrators Selected.—After conferences between Maurice V. Joyce and C. E. Pope, attorneys representing the East St. Louis & Suburban Railway, East St. Louis, Ill., and the men employed on the interurban lines of the company, Edward J. Coffey, East St. Louis agent for the Southern Railroad, was selected chairman of the board to arbitrate the wage demands of the men. David M. Walsh and C. E. Smith are the other members. The men are receiving from 48 to 53 cents an hour. Last April they presented a demand for an increase to 95 cents an hour. Whatever increase is granted them will be retroactive to May 1. Three weeks ago the Alton, Granite City & St. Louis Traction Company, controlled by the East St. Louis & Suburban Company, was placed in the hands of receivers and the line is now being operated under the supervision of the Federal court. Shortly afterward the receivers agreed to an increase of 6 cents an hour to men employed on the city divisions of the system and 7 cents to men employed on the interurban cars. The men have not voted on the proposition to accept the increase.

Program of Meeting

Public Utilities Association of West Virginia

The Public Utilities Association of West Virginia will meet at Charleston, W. Va., on Oct. 5, for the election of officers and the transaction of other business.

Joint Meeting in Providence

New England Street Railway Club Invites Rhode Island Company Section to Join in Meeting

The next meeting of the New England Street Railway Club will be held on Oct. 7 in Providence, R. I., at the Narragansett Hotel. The Rhode Island Company Section No. 12, A. E. R. A., will be guests, in what thus becomes a joint meeting. Elaborate plans are being made for this novel meeting, according to I. A. May, president of the club. At least 250 are expected to attend. There will be an afternoon session, a dinner and an evening session. The meeting will be addressed by Fred A. Cummings, publicity agent of the Eastern Massachusetts Street Railway, and the ensuing discussion is expected to be lively and instructive. At the evening session, two addresses are planned, one of which will be by William C. Bliss, chairman of the Public Utilities Commission of Rhode Island; the other speaker will be Joseph F. Berry, attorney for the Connecticut Company in Hartford.

Financial and Corporate

Norfolk Valuation Submitted

Taylor-Cooke Report \$8,750,000—Company Seeks Valuation of \$11,000,000 at 1920 Prices

The report of A. Merritt Taylor and his associate, Charles B. Cooke, Jr., on the Norfolk street railway problem has been made public. Mr. Taylor finds the value of the property to be \$8,750,000 and suggests a return thereon at 8 per cent. He would retain the 6-cent fare within the city limits, establish additional fare zones on certain county lines and eliminate ultimately the 2-cent transfer charge.

It is the idea of Mr. Taylor to revise the franchise and relieve the company from street paving and from making a return to the city of moneys secured from the 2-cent transfers. He would continue the use of safety cars and eliminate jitney competition. A rehabilitation program of calling for the expenditure of \$830,572 and a construction program calling for work to the total of \$1,269,395 are suggested. Re-routing plans are described in detail. The report was made at the instance of the city. Its purpose is to develop and define the respective rights and obligations of the city and the Virginia Railway & Power Company and find solutions of the traction situation which will result in good transit facilities.

REPORT DISCUSSED BEFORE COMMISSION

The report was submitted and discussed at a hearing held recently before the Norfolk Public Utilities Commission. At the hearing Thomas S. Wheelwright, the president of the company, said that he agreed with all the recommendations in the report except as to the valuation of \$8,750,000. Over this matter of valuation there was a discussion between Mr. Taylor and Mr. Blood of Stone & Webster, whose reproduction value of \$11,000,000 was checked and accepted with slight modifications in the Taylor-Cooke report. The \$11,000,000 valuation is based on present prices. Mr. Blood and representatives of the company contended that this was the proper basis of valuation. Mr. Taylor's figure was about midway between the reproduction cost at 1914 and 1920 prices.

President Wheelwright for the company said that he was greatly impressed with the recommendations in the report and with the thoroughness of the document, but that he was disappointed with Mr. Taylor's revaluation figures. These figures, he said, were lower than the company had hoped for, for "rate-making" purposes, and lower by nearly \$3,000,000 than the estimate by Mr. Blood, which he considered fair. He expressed concern about the ability of the company to raise \$1,600,000 sug-

gested by Mr. Taylor to be spent within the next fifteen months.

All of the recommendations of the Norfolk Public Utilities Commission must be addressed to the City Council. The commission has within its power the right to accept the Taylor-Cooke findings and figures on those of Stone & Webster or to submit a report of its own to the Council.

The principles upon which Mr. Taylor's valuation was based were stated in writing by him prior to his undertaking the responsibility of acting for the city. He acted on the expressed

Interurban Surplus Increased

Boston & Worcester Railway Has Net Income for 1919 Three Times That of 1918

The income statement of the Boston & Worcester Railway for the year ended Dec. 31 shows that the total operating revenue increased from \$882,666 in 1918 to 948,936 in 1919. This was an increase of \$66,270, or 7.3 per cent. At the same time the operating expenses increased to \$732,842 as compared with \$689,174 in 1918, an increase of \$43,668, or 6.3 per cent. The net revenue from railway operations increased 11.7 per cent, changing from 193,492 in 1918 to 216,094 in 1919. The expense due to taxes was considerably reduced.

In 1918, the taxes were \$58,087, but decreased to \$46,601 in 1919. This was

INCOME STATEMENT BOSTON & WORCESTER RAILWAY

Year Ended Dec. 31:	1919	1918	Percentage Change Over 1918
Operating revenues:			
Revenue from transportation.....	\$934,996	\$869,566	+ 7.5
Other railway operations.....	13,940	13,100	+ 6.4
Total operating revenue.....	\$948,936	\$882,666	+ 7.3
Operating expenses:			
Conducting transportation.....	\$438,902	\$387,486	+13.3
Maintenance.....	198,379	206,785	- 4.1
General expenses.....	95,561	94,902	+ 0.7
Total operating expenses.....	\$732,842	\$689,174	+ 6.3
Net revenue railway operations.....	\$216,094	\$193,492	+11.7
Taxes assignable to railway operations.....	46,601	58,087	-19.8
Gross income.....	\$169,493	\$135,405	+25.2
Interest on funded and floating debt.....	140,005	128,474	+ 9.0
Net income transferred to profit and loss.....	\$29,488	\$6,931	+325.0

STATISTICAL INFORMATION BOSTON & WORCESTER RAILWAY

Year Ended Dec. 31:	1919	1918	Percentage Change Over 1918
Total revenue car-miles.....	1,835,974	1,929,616	- 4.3
Total revenue car-hours.....	138,040	134,357	+ 2.7
Ratio C.M. to C.H. (speed m.p.h.).....	13.3	14.3	- 7.0
Operating ratio (per cent).....	77.2	78.2	- 1.3
Statistics per car-mile:			
Operating revenue (cents).....	51.7	45.8	+12.9
Operating expenses (cents).....	39.9	35.7	+11.8
Revenue from transportation (cents).....	50.8	45.1	+12.6
Net income (cents).....	1.6	0.36	+345.0
Statistics per car-hour:			
Operating revenue.....	\$6.87	\$6.57	+ 4.6
Operating expenses.....	\$5.31	\$5.13	+ 3.5
Revenue from transportation.....	6.77	6.47	+ 4.6
Net income (cents).....	21.4	5.16	+315.3

understanding that he would appear in a judicial capacity and not as an advocate.

"Saturday Night" Reviews Federal Report

The Detroit *Saturday Night* of Sept. 4 contained a very interesting page summarizing the report of the Federal Electric Railway Commission. In the center of the page under the title "Sanity on Street Railway Problem" the editor explains what the problem was before the commission, who were the members and the witnesses. The rest of the page under such captions as "M O Is No Panacea for Street Railway Ills, U. S. Commission Finds," "How the Trolley Lines Can Be Put on a Sound and Efficient Footing," "Why Railways Can't Get Money" and "What Has Happened to Fares" tells the plight of the electric railways as outlined by the President's commission.

a reduction of \$11,486, or nearly 20 per cent over 1918. As a result of the increase in net revenue and a decrease in taxes, the gross income increased 25 per cent, or \$34,088 over 1918. The net income transferred to profit and loss changed from \$6,931 in 1918 to \$29,488 in 1919. The operating ratio decreased 1 per cent. Total car-miles for 1919 amounted to 1,835,974, while the total car-hours were 138,040. The company owns more than 83 miles of track between Boston and Worcester. A reserve of \$12,000 for depreciation was deducted from the yearly surplus.

Receivership Hearing Postponed

The hearing set to be held before the Federal Court in Kansas City, Mo., on Sept. 30, on the matter of the appointment of a permanent receiver for the Kansas City Railways was postponed to Oct. 14. Frank C. Niles was appointed temporary receiver on Sept. 9.

Reorganization Without Foreclosure Planned

The situation with respect to the Washington, Alexandria & Mount Vernon Railway and the affiliated Washington, Arlington & Falls Church Railway is explained in letters addressed to the holders of the \$2,370,000 of outstanding first mortgage bonds of the former company, and the \$1,000,000 first mortgage and \$250,000 second mortgage bonds of the latter company. On account of the accumulation of floating debt which the company has been unable to finance without aid, the property requires about \$250,000 to meet its overdue interest and maturities. A protective committee has agreed to advance the necessary funds subject to an audit now being made and when the stock of the company is deposited under an agreement giving the committee control of the management.

It is hoped to avoid foreclosure and to readjust the company's finances without the expense, delay and legalities which would be required by receivership. Following the bonds there is an issue of \$2,000,000 of secured gold notes. These notes are held by banks, trust companies and other strong financial institutions. The protective committee of noteholders is headed by Howard S. Graham of Graham, Parsons & Company, as chairman. It is proposed that Mr. Graham shall succeed Norman Grey as president, the latter to become vice-president, and that the committee shall also name a secretary and treasurer and other officers.

The committee stipulates that 90 per cent of the outstanding stock shall be deposited before Sept. 24 with the Guarantee Trust & Safe Deposit Company, Philadelphia, under the terms of an option agreement under which the committee will have the right within two years from the date of the agreement to purchase the entire deposited stock at the rate of \$10 per share for the preferred stock and \$2.50 a share for the common stock. The agreement also provides that the depository shall vote the deposited stock from time to time as the committee may direct.

Illinois Utilities Use Large Display Space

An advertisement of the Illinois Committee on Public Utility Information, used in half-page and quarter-page size, is now running in the Chicago newspapers and some of the larger papers in northern Illinois. It has been placed and is being paid for by some of the Chicago companies. The object is to stimulate public interest in the securities of the utilities of the State by calling attention to the tremendous number of persons who hold such securities. This effort is regarded as quite important, as the wider the circulation of this information the greater the good to the industry as a whole.

Financial News Notes

Certificate of Capital Increase Filed.—The Manila Electric Railroad & Light Company has filed a certificate with the Secretary of State at Trenton, N. J., increasing its capital from \$3,000,000 to \$5,000,000. The company operates an electric railway system and furnishes power and light in Manila and other parts of the Philippine Islands.

Milwaukee Issues Equipment Trusts.—The Milwaukee Electric Railway & Light Company, Milwaukee, Wis., has sold an issue of \$1,090,000 ten-year 8 per cent sinking fund equipment trust gold certificates at par and interest through W. A. Read & Company. The notes are dated Oct. 1, 1920, and are issued under the Philadelphia plan against 139 new standard steel cars.

Receiver for Pennsylvania-Ohio Road.—The Cleveland & Erie Railway, Girard, Pa., operating between Conneaut, Ohio, and Erie, Pa., has been placed in the hands of a receiver, following proceedings in equity brought by George Bullock, receiver of the Buffalo & Lake Erie Traction Company. Failure to pay interest on bonds due on July 1 and \$2,489,230 alleged to be due the local traction company for the use of its lines in the city of Erie are charged in the bill of equity.

Toledo Company Reimbursed.—From the Craig fund, authorized by federal court to provide for improvements to service of the Toledo Railways & Light Company, Toledo, Ohio, Judge Killits ordered \$14,377 to be paid over to the company to reimburse it for repairs to tracks and equipment. This sum was additional to amount being expended in double tracking a part of Stickney Avenue and a part of it is being used to remodel cars and paint them. The fund is formed by payment of 6 per cent of the net earnings of the company weekly into the hands of an officer of Federal court. It was created to take care of a fraction of a cent raise in fare at a railway settlement several years ago.

Interurban Entrance Agreement Reached.—The City Council of Reno, Nev., has accepted the terms under which the Nevada Interurban Company has asked to be allowed to operate cars over the line of the Reno Traction Company from Reno Avenue to Second Street. Under this proposal the Nevada Interurban Company will pay \$1,200 to the city, which will cover the cost of construction and repair work from California Avenue to Second Street. The Reno Traction Company will maintain the track from California Avenue to Reno Avenue, the city to do the paving on each side. Estimates furnished the City Council by City En-

gineer Chism would appear that it will cost the city near \$20,000 for the reconstruction work.

Shuttle Service on Staten Island.—On the afternoon of Sept. 18 the receiver of the Richmond Light & Railroad Company commenced operating cars on the tracks of the Staten Island Midland Railway, which had been idle since last January. The operation was directed on Sept. 16 by the United States District Court, having jurisdiction in the matter of the receiverships, and is being carried on under contract arrangements between the receiver of the Midland company and the receiver of the Richmond company pursuant to instructions of the court. A shuttle car service is provided on different parts of the lines, each to be operated for a 5-cent fare. Through operation for a 5-cent fare to or from St. George, the focus of the main transportation routes of the Borough of Richmond, is discontinued by the court.

Oil Earnings Diverted to Utilities.—So far as the St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., is concerned that property will be left to its own financial resources, according to F. C. Hamilton, testifying for the Doherty interests, which control the property, at the hearing before the Missouri Public Service Commission for an increase in fare from 7 cents to 10 cents. Mr. Hamilton is quoted as follows: "The public utilities could not get along unless they were helped from the oil earnings of the Doherty interests. The investment in the utilities is 35 to 40 per cent more than in oil, but the earnings of the public utilities are about one-sixteenth of the earnings of the oil business. The Dohertys have lost so much on their utilities that, in the future, unless they change their mind, they will decline to finance the utilities out of the oil earnings, and the utilities will have to stand on their own feet."

Cash Used to Take Up Certificates.—An order permitting Receiver Rolla Wells of the United Railways, St. Louis, Mo., to use \$2,300,000 of the general funds of the company in order to retire the first issue of receiver's certificates has been issued by Judge Faris in the United States District Court at St. Louis. The issue of certificates was made Sept. 2, 1919, and bore 6 per cent interest. It was the original plan to sell a second issue of \$4,200,000 of certificates and with the proceeds pay off the first issue and take care of some underlying bonds. Bids on the second issue, however, were all so low that none could be advantageously accepted. These certificates bear 7 per cent interest and run for three years. The stipulation in the issuance of the first certificates that if they were not paid at maturity they were to bear 8 per cent interest caused Receiver Wells to seek the court order. A representative of the company said that no effort would be made to market the second issue of certificates until the money market became more favorable.

Traffic and Transportation

States' Power at Issue

Utilities Commissions Take Action to Preserve Their Authority Over Intrastate Rates

The Public Service Commissions of a number of States have taken steps to prevent steam roads and electric interurbans from establishing for intrastate traffic the percentages of increase in freight and passenger rates recently allowed by the Interstate Commerce Commission. The National Association of Railway and Utilities Commissioners at a meeting in Chicago on Sept. 11 appointed a committee to follow all litigation in which carriers attempt to secure an interpretation of the Esch-Cummins act, "which will diminish the powers of the States to control intrastate rates and regulations of carriers."

WOULD SAFEGUARD RIGHTS

The commissions which have refused to allow the roads to install either in whole or in part the rates authorized by the Federal commission take the stand that if the efforts of the carriers are successful in the proceedings that have been instituted before the Interstate Commerce Commission they will have succeeded in stripping the state commissioners of all effective powers over state rates. Their position is outlined in a letter recently addressed by the association's committee to all state commissions. This communication reads in part as follows:

The situation is serious. The state commissions generally have allowed freight rate advances upon intrastate traffic corresponding to the advances allowed upon interstate traffic by the Federal commission. The Illinois commission has, however, allowed 33½ per cent, the Texas commission the same per cent and the Nebraska commission 25 per cent. Several commissions have restricted the advances on particular commodities. In states where passenger fares are limited by statutes they have refused to sanction the proposed passenger advance.

At the hearing in Chicago before the Federal commission in the Illinois Shreveport case no other evidence of discrimination was offered by the carriers than that the Illinois commission had allowed a less percentage of increase than the Federal commission. The carriers have chosen to rest upon the proposition that whatever action the Federal commission takes as to interstate rates must be also taken by every state as to intrastate rates, without consideration of the question of the reasonableness of the same as to state traffic, and even though it may be destructive to such traffic.

Upon this proposition it was the unanimous opinion of the conference that we have no alternative but to fight. If the transportation act is correctly interpreted it does not strip the state commissions of all power over state rates, but carefully preserves the same. We owe it to the people of our respective states to defend our present powers against destruction by any such misconception of the transportation act as carriers are now attempting to give. We should do this first before the Federal commission, and then in court, if need be.

Sixteen state commissions have so far made authorizations in general accord with the Federal commission. The

states where this action has been taken are California, Colorado, Florida, Georgia, Maryland, Massachusetts, Michigan, Missouri, New Hampshire, New Jersey, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia and Wyoming. The Idaho and Washington state commissions have authorized the freight and passenger advances, with the stipulation that no passenger fare as increased shall exceed 3.6 cents per mile.

Commissions which have allowed the full freight increase but have denied or postponed action on passenger rates under statutory limitations include Indiana, Iowa, Minnesota, Montana, New York, Ohio, South Carolina, West Virginia, and Wisconsin. The South Dakota commission allowed increases corresponding to those of the Federal commission, with the exception of advances in commodity rates. The commission of Illinois and Texas authorized freight advances of 33½ per cent, but denied the passenger increases under state laws.

Regulation of Jitneys Urged

According to an opinion of the State Department of Public Utilities, a continuation of jitney service in competition with the street railways of Massachusetts cannot long exist without disaster to one or both. The department's opinion is that, with the elimination of jitney competition, there "is every reason to believe" that the street railways alone would be able to render cheaper and better service than the railways and jitneys now furnish together.

The theory is advanced that the failure of Massachusetts to keep pace with the rest of the country in subjecting jitneys to reasonable and proper regulations is responsible for the jitney problem in that State assuming a more acute phase, perhaps, than in any other part of the country.

It is significant that practically all of the states and cities where the volume of jitney business has been largest in the past have found it necessary to adopt stringent regulations which have resulted in decreasing the number of jitneys to a point where their operation no longer constitutes a serious menace to existing transportation agencies or to the public. The 1918 statute represents an attempt, in part at least, to bring the Massachusetts policy into line with legislative precedents in other states.

The commission finds that a candid investigation of the conditions of jitney operation wherever it has been tried is bound to lead to the conclusion that while jitney service may supplement or destroy the street railway, it cannot take its place.

Railway Rests Its Case

Los Angeles Company Presents Reasons for Asking a Rate Increase at Commission Hearing

The application of the Los Angeles (Cal.) Railway for an increase in its rate of fare was presented to the California Railroad Commission at a hearing on Sept. 20. The City Attorney of Los Angeles was granted three weeks in which to examine statistics submitted by the corporation and to file a brief. The decision of the commission will be made without another hearing.

G. J. Kuhrts, general manager of the Los Angeles Railway, testified that \$5,000,000 would be needed for investment in 1921. He declared that \$1,393,000 would be needed for new cars, seventy of the standard type and sixty-two of the one-man safety type. The present valuation of the company was given as \$41,083,864. The deficit on June 30, 1920, was stated to be \$893,083.

A 27 per cent advance in power costs and wage increases amounting to \$990,000 a year were given as the chief items of increase in operating costs experienced by the railway.

The possibility of jitney competition reappearing in Los Angeles after being stopped by a city ordinance was injected into the hearing by Jesse Stephens, Assistant City Attorney. Mr. Kuhrts said that he believed the public would resist any such move owing to the present traffic situation.

SPECIFIC RATE NOT ASKED

Mr. Kuhrts contended that an increase of from 20 to 30 per cent in fare would be necessary for the Los Angeles lines. No specific rate was mentioned. The Los Angeles Railway now charges a 5-cent fare. The Pacific Electric Railway was recently granted a 6-cent fare for local travel as a temporary measure.

Patrons of the company questioned Richard Sachse, chief engineer of the commission, on the practicability of one-man car operation and the advisability of extending this service. Mr. Sachse spoke emphatically in favor of the safety car and advocated extension of the local service, as recommended in his report following the survey which led up to the recent rerouting of the Los Angeles Railway system.

Whether the Los Angeles Railway would receive 20 per cent more in revenue through a 20 per cent fare increase was discussed extensively. Bruce Campbell, assistant engineer of the commission, estimated that such a rate advance would produce a 17½ per cent increase in revenue and predicted a 5 per cent increase from additional traffic resulting from the expected growth in population.

One of the witnesses urged the adoption of a co-operative plan whereby non-rush-hour riders should be given rebate slips to be redeemed by local merchants. This scheme, he contended, would benefit trade as well as stimulate traffic.

50 per Cent More Riders

Co-operation Between Railway Management and Public Accomplishes Tangible Results in Fall River

Everybody is smiling in Fall River, Mass., these days. Everybody, that is, who comes in contact with the local electric railway system. The men who run the cars are happy because they have been given an increase in wages of 11 cents an hour. The people who ride the cars are pleased because theirs is the only community served by the Eastern Massachusetts Street Railway to escape the recent increase in fare. But the "joyfullest" person of all is A. J. Boardman, manager of the Fall River Division of the Bay State system. The reason why Mr. Boardman is especially gleeful and, incidentally, why there is so much smiling in Fall River just now is this: During the past twelve months traffic on the local electric railway lines has increased by 50 per cent.

IN JULY, 1919, there were 800,000 riders on the lines of the Fall River Division. In July, 1920, there were 1,200,000, an increase of 400,000 passengers. Last July the Fall River district netted a profit of \$29,715. During the same period all the other divisions failed even to earn their cost of service. Because of this showing, the public trustees of the system announced that Fall River alone would be exempted from the recent advance in rates.

CO-OPERATION RESPONSIBLE

Co-operation between the railway management and the public has been mainly responsible for this growth in riding. Fall River, to a man, woman and child, "boosts" for the trolleys. The members of the Chamber of Commerce, the American Legion and the Ladies' Aid Society of the First Methodist Church are trolley "fans." James Tansley, president of the Fall River Textile Council and chairman of the home rule committee of the Fall River Division, has this to say of the situation:

A street-car line must have passengers to make any profit. If the riders get a grudge and walk, or use other means of transportation, the street railway has simply got to run at a loss. The reason we are making a profit is because we have the confidence of the citizens, and by that means have got them to use the trolley in increasing numbers. The credit for accomplishing this belongs to all concerned. The Chamber of Commerce took the initiative in promoting co-operation; the home rule committee gave faithful service; the newspapers urged the people to "boost, not knock," and the Eastern Massachusetts trustees have kept faith in every particular.

It all began about a year ago. At that time the fare was 10 cents straight. Sidewalk and jitney competition was increasing by leaps and bounds. Car riding had been reduced to a "must" proposition—one "must" pay 10 cents only if one "must" ride. Then of a sudden there came a change. The Chamber of Commerce launched an educational campaign. It showed the people that they could not get along without trolley service. The public was quick to respond. "Take the trolley" became the city's slogan.

"HOME RULE" POLICY WINS

The railway management met the people half way. In September, 1919, the trustees made Fall River a separate operating district under the control of a home rule committee, nominated by the Mayor and appointed by the trustees. This committee has complete supervision of the territory, except for

the setting of fare rates. At the same time the trustees established a workmen's ticket giving fifty rides for \$3. Later the rate was further reduced by the introduction of a ticket giving sixteen rides for \$1. The people have forgotten that the cash fare is still 10 cents. Every one uses tickets.

Charles J. Leary, managing editor of the *Fall River Daily Globe*, stated recently that whereas complaints against the railway used to pour into his office each day, he had not received a complaint now for months. Said Mr. Leary:

We used to "knock" as hard as anybody. But now that the public and the company are working for each other there is no need for it. Though we helped out in the co-operative campaign, we don't intend to suppress complaints. The reason we don't print them is because we don't have them, strange as it may seem.

Among the most ardent workers for the railway is Charles M. Ketchum, secretary of the Chamber of Commerce. Mr. Ketchum summed up the situation as follows:

The whole thing started with the movement for better streets. We needed road improvement, but also needed the financial help of the Bay State on the streets where it had lines. As it was only just managing to cover expenses and could spare no money the question boiled down to making the street cars pay.

Increased revenue has enabled the Bay State to provide new cars and better service. It has helped the city in its street improvements and is planning more, which have been temporarily held up by the recent wage award.

The Bay State got its money; we got our road improvements, and now the people have got exemption from the most recent fare rise. It is a clear illustration that it is increase in number of passengers which makes a road pay, and it is because the people feel that the road is really run for them that they ride in ever-increasing numbers.

Ask Aid for Hartford Trolleys

Indorsing the report of its special transportation committee, the board of directors of the Chamber of Commerce of Hartford, Conn., on Sept. 28 appealed to the city authorities to suppress jitney competition with the local lines of the Connecticut Company. The committee's report, in addition to urging stringent regulation of the buses, suggested that the Chamber of Commerce petition the State Public Utilities Commission to grant the company an adequate rate of fare. The report follows:

Based upon the investigation and findings of the Public Utilities Commission, the special legislative committee, the Federal Electric Railways Commission, as well as from local observation, and reports from other cities, also conference with representative

of the jitney association and conference with representative of the Connecticut Company, your committee finds, and calls attention to, the following facts:

1. Under the present condition of operation the revenues of the Connecticut Company do not equal the expenses of operation.

2. Service has been maintained to date by the omission of payment of taxes and other lawful charges imposed by the state and city, and by omitting and postponing all but the most urgent maintenance work.

3. Such financial condition unless remedied must inevitably result in bankruptcy and cessation of service.

4. Under present conditions it is probable that with the increased expense of winter operation a general suspension of service on many suburban lines must occur, possibly extending as well to the poorest paying city lines.

5. Under present conditions the possibility of total abandonment of service must be faced in the near future.

6. Under present conditions trolley transportation cannot be self-supporting in competition with individual and unregulated bus competition of a material magnitude.

7. The continued operation of trolley transportation is of vital importance to the city, as the transportation of the public cannot at present be handled by any other means now available.

8. The city would be greatly benefited by systematic bus transportation in those territories not now served by trolley lines.

9. The present bus service is popular as shown by the patronage, and is more rapid than can be furnished by trolley service.

In view of the above facts your committee recommends:

1. That the Chamber of Commerce urge the city authorities to make such suitable regulations as will eliminate the present bus competition in the sections of the city served by the trolley. Such regulations should not, however, discourage the operation of suitably regulated and responsible bus service lines in sections not now served by the trolley.

2. That the Chamber of Commerce urge that the Connecticut Company should obtain the necessary permission from the Public Utilities Commission for such rate of fare as will give sufficient revenue to rehabilitate its credit, and enable it to give an improved and proper service to which the community is entitled.

Advertise for Traffic

In an effort to assist the Cincinnati (Ohio) Traction Company in increasing business and getting people into the car riding habit, William C. Culkins, City Street Railway Director, on Sept. 14 suggested several ways of increasing traffic. Some of the suggestions offered by Mr. Culkins, which are already being put into practice by the railway, follow:

Induce passengers and their friends using the railroad depots to use street cars by adopting schedules closely adapted to the arrival of trains.

Operate a better type of car to the Central Union Depot.

Place a representative of the company at the station and use advertising matter and signs judiciously.

Advertise the baseball games attractively and legibly, and reclaim for the street cars many persons who now use taxicabs.

Remodel cars with longitudinal seats to cars with cross seats.

Mr. Culkins further suggests that advertising matter in hotels and newspapers explaining the possibilities of attractive scenery would be money well spent in the interest of the car rider. He commented on what appears to have been the policy of the company in recent years to discourage the use of chartered cars. He added that co-operation with the convention and publicity bureau of the Chamber of Commerce could be had

and special routes laid out in accordance with the particular interests of the convention to be served.

In Cincinnati some factories are "trucking" employees direct between their homes and the factory. Mr. Culkins holds that this traffic could be better served by the use of the street cars in instances where the patronage would warrant.

May Reopen Portland Case

The Oregon Public Service Commission is justified in reopening the case of the Portland Railway, Light & Power Company, Portland, with a view to relieving the company of heavy franchise charges, according to a ruling recently issued by the State Attorney General. A group of Portland citizens some time ago petitioned the commission for a hearing on the question of reducing these charges, which they contended made necessary the recent increase in fare by the company from 6 cents to 8 cents. The commission asked the Attorney General for an opinion on the case.

On March 27 last the commission found that the provisions of the franchise relating to taxes, car licenses, free transportation of city employees, paving assessments and bridge assessments were unreasonable and amounted to double taxation. The commission recommended that the city of Portland eliminate these alleged unjust burdens. On May 21 the proposal was referred to the voters at a referendum election and was defeated. The commission then authorized the company to raise its fare.

Connecticut Freight Rates Up

The Connecticut Public Utilities Commission on Sept. 29 authorized the Connecticut Company, New Haven, to increase its freight rates 40 per cent. The matter came before the commission on Aug. 23 in the form of a petition from the company. The commission held a hearing on the petition on Sept. 16. The order of the commission follows in part:

The wage scale for the employees of the company engaged directly in the freight and express department shows the following increases over wages paid when the present rates were established in September, 1918: Motormen, 56.81 per cent; messengers, 46.66 per cent; freight handlers, 42.85 per cent, or an average wage increase of 48.77 per cent.

The petitioner asks for an increase of 40 per cent over its present rates. In a recent decision by the Interstate Commerce Commission granting a 40 per cent increase in the freight rates of the New York, New Haven & Hartford R.R. and other steam railroads it stated relative to electric lines that the operating costs of these lines have on the whole increased approximately in the same ratio as those of steam railroads. In some instances there is competition between the electric lines and the steam railroads. We conclude that the freight rates of the electric lines may be increased by the same percentages as are approved herein by the trunk lines in the same territory.

It is problematical as to whether a 25 per cent increase would produce more revenue than the proposed 40 per cent on the assumption that the latter increase on account of substantially higher rates would drive away business. Even with the retention of the present volume of business, a 40 per cent increase would not produce sufficient revenue to pay a 6 per cent return on the capital directly invested in and allocated to the freight and express business.

Riders Back P. R. T.

400,000 Philadelphians Express Their Approval of Mitten Fare Plans— Mayor Outlines City's Attitude

Patrons of the Philadelphia Rapid Transit Company to the number of 476,027 have given their written indorsement of the work accomplished by the Mitten management in the interest of efficient service. Announcement to this effect was made on Sept. 27 at a

meeting the company to install a straight 5-cent fare. He placed responsibility for any alteration of the 1907 agreement between the city and the P. R. T. squarely on the shoulders of the Councilmen.

Mayor Moore declared that even if the company were wiped out by bankruptcy the fare problem would remain. In outlining his position he said:

The statement given to the board of directors for the eight months ended Aug. 31 last shows the amount by which the gross revenues of the company are insufficient to provide for operating expenses, taxes, fixed charges and the 5 per cent return upon P. R. T. stock to be \$1,151,628.77. It is freely stated—stated I think at your last meeting by one more qualified to speak of its affairs than myself—that the company must have more revenue before December, or face failure.

It is admitted that the company has no credit. It cannot borrow money. It cannot make extensions, so it is represented to the Mayor—and he has asked for many which the city desires—because it has not the funds with which to make extensions. It has retained the good will, however, of its thousands of employees by increasing or keeping wages up to meet the increasing cost of living, and it is unthinkable that faith should not be kept with those employees, particularly while the high cost of living continues.

As to rentals paid to the underlying companies, or an increase in fares for services rendered to the public, either or both of these questions must await the determination of the Public Service Commission, based on a valuation of the property of the Philadelphia Rapid Transit and the underlying companies.

Therefore, whatever the Council may do with respect to the pending ordinance will be in the nature of a temporary recourse, to apply only and until the Public Service Commission, with the valuation of the property in hand, shall decide what is a just and compensatory rate of fare and what is a just and reasonable rental.

Business Men Ask Lower Fares

L. D. Pellissier, president of the Holyoke (Mass.) Street Railway, has received from the president of the local Chamber of Commerce a letter asking that the railway take immediate steps to improve service and possibly to reduce its fare. The letter states that the Holyoke business men feel that the carmen should not receive a further increase in wages which would lead to a still higher rate. The company is also asked to abolish the zone fare system under which it is now operating. Under the present plan the city of Holyoke is divided into two districts, in each of which a 6-cent fare is charged, the fare for a ride across the city being 12 cents. The company's employees, who are now receiving 55 cents an hour, are demanding a further increase in wages.

The railway has not been on a profitable basis since it stopped paying dividends three years ago. An attempt to recover the loss by adopting a zone system failed of its purpose and a modification with a 7-cent fare was next made. Under the 7-cent fare the company was able to accumulate a surplus of \$33,000. The men then demanded higher wages and secured retroactive concessions that not only wiped out the \$33,000 surplus, but resulted in a considerable deficit. The company then adjusted the present fare plan. The men now demand \$7 for an eight-hour day, with one day off in fifteen with pay.

CO-OPERATIVE EFFORT

TO THE CAR RIDDER:

Up to 1911 street-car strikes in Philadelphia greatly disturbed the car-rider, and caused enormous loss to the community.

Co-operation, under present management, has put a stop to all this, and every car-rider should be deeply interested in helping to prevent a return to bad street railway conditions, as they used to be in Philadelphia, and still are in other cities.

Instead of having strikes and interrupted car service during the war, co-operation, between the Men and Management of P. R. T., secured such settled conditions made it possible for Philadelphia to get more than its share of war contracts. The contracts provided plenty of employment at high wages, made money plentiful and benefited everybody—except P. R. T.

Pittsburgh is now permitted to charge a 10-cent fare, and this would have been necessary here, except for the good work of this Management and its Men.

P. R. T. was refused permission to make a general 3-cent charge for transfers last July, so that P. R. T. is growing daily deeper in debt.

P. R. T. must have more money now—immediately—to pay its wages and other increased costs, and provide better service for the coming winter.

A straight 5-cent fare, without transfers or exchanges, will save the Management at this time, but if permission is not granted now, an 8-cent flat fare at least will be later required to keep the cars running.

The Men and Management believe that they have earned your confidence and consideration, and appeal to you, in a spirit of fair play, to express yourself as being now willing to pay the straight 5-cent fare, which is necessary to a continuation of the present Management.

T. E. MITTEN, *President.*

PLEASE DETACH HERE,

SIGN AND HAND TO CONDUCTOR

P. R. T.'s Men and Management ask YOUR endorsement of the work they have done, by signing your name hereon, requesting that the Mayor, City Council and Public Service Commission consent to P. R. T. now collecting a straight 5-cent fare, without transfers or exchanges. (This is a temporary measure, pending completion of valuation.)

(Sign here)
(Address)
SEPT., 1920.

REFERENDUM CARD USED BY P. R. T.

hearing before the transportation committee of the City Council, when the company made public the results of a canvass on the question of the abolition of transfers. As tangible evidence of the public's attitude, a delegation of P. R. T. employees produced fourteen wash hampers heaped with signed referendum cards.

Mayor J. Hampton Moore, principal witness at the hearing, declared that unless the company obtained an increase in revenue it would face bankruptcy. The Mayor refused to take a definite stand on the question of per-

Ten Cents in New London

Lucius S. Storrs, president of the Connecticut Company, New Haven, Conn., announced on Sept. 29 that a 10-cent cash fare would be placed in effect on the New London city lines on Oct. 15. The New London Division, formerly a part of the Shore Line Electric Railway, is now being operated by the Connecticut Company.

The announcement that a 10-cent fare will be charged in New London is taken by many persons in Connecticut to indicate that the company plans to apply for a 10-cent fare throughout its system. The State Public Utilities Commission, at the time of granting the railway temporary increase in fare to 7 cents, announced that it would later hold a hearing for the purpose of fixing a permanent rate. This hearing before the commission was scheduled to take place on Oct. 1.

Transportation News Notes

Six-Cent Fare in Marion.—The City Council of Marion, Ohio, has passed an ordinance granting the Columbus, Delaware & Marion Electric Company, Columbus, a 6-cent cash fare with five tickets for 25 cents on its lines in Marion. The fare has been 5 cents.

Zone Fares 7 Cents.—The Chester & Derry Railroad, Chester, N. H., has raised its fare in each zone to 7 cents. The increase was authorized by the State Public Service Commission and became effective on Aug. 16. The company operates a line 8 miles long between Chester and Derry.

Fare Raised in Lima.—A 7-cent cash fare went into effect on Sept. 3 on the Lima, Ohio, lines of the Ohio Electric Railway. The fare was formerly 5 cents. Nine tickets are sold for 50 cents in place of six for 25 cents. Children are carried for 4 cents or two for one adult fare.

Seven Cents in Bangor.—The Maine Public Utilities Commission has issued an order authorizing the Bangor Railway & Electric Company, Bangor, to put into effect on one day's notice a new schedule of fares with a basic rate of 7 cents. The fare has been 6 cents. The company some time ago applied to the commission for authority to charge an 8-cent fare.

Ten-Cent Fare in Marshall.—The Marshall (Texas) Traction Company on Sept. 20 installed a 10-cent fare on its lines in Marshall. The company was recently granted authority to increase its fares from 5 cents to 7 cents. It now asserts that increased cost of operation makes the 7-cent fare entirely too low, and that it cannot operate longer on that basis.

Towns Ask Fare Cut.—At a conference of the city and town officials of Beverly, Salem, Peabody, Marblehead, Danvers, Wenham and Hamilton, Mass., on Sept. 25, it was voted to appoint a committee to confer with the trustees of the Eastern Massachusetts Street Railway with a view to the elimination of double fares within a single city or town. The restoration of the transfer privilege is also to be asked for by the municipalities.

Ten Cents Asked in Missoula.—The Missoula, (Mont.) Street Railway has filed with the Montana Public Service Commission a petition for authority to charge a 10-cent cash fare on its city lines. The company proposes to sell four tickets for 30 cents. The fare was raised from 5 cents to 6 cents two years ago. It is proposed to continue the issuance of free transfers. The railway also seeks to raise the rate on its suburban lines.

Fares Raised on Interurban.—Passenger fares on the line of the Lackawanna & Wyoming Valley Railroad, Scranton, Pa., have been raised 20 per cent. The company has raised its commutation rates 10 per cent. Freight rates have been advanced 40 per cent, as recommended by the Interstate Commerce Commission. The company's passenger fares are now on the basis of 3 cents a mile, mileage books on one of 2½ cents a mile and commutation books on one of 1½ cents a mile.

Lower Fares for Brockton.—At the request of Mayor William L. Gleason of Brockton, Mass., the public trustees of the Eastern Massachusetts Street Railway have promised to reduce the present fare rates in that city by introducing a limited \$4 commutation ticket good for three zone rides, to be used within two weeks. The purpose will be to aid those who live outside Brockton, particularly working people, to get into the city and home again at reduced rates.

Needs More in Sacramento.—The Pacific Gas & Electric Company, Sacramento, Cal., has notified the Sacramento City Commission of its intention to apply to the State Railroad Commission for authority to raise its fare. The company asks that the city take no action looking to the revoking of jitney restrictions pending action on its application. The company's local lines earned only 2.5 per cent, or \$56,742, for the year ended June 30, 1920. The company recently curtailed its service owing to a shortage of power.

Ten-Cent Fare Asked on Suburban Lines.—The Connecticut Public Utilities Commission on Sept. 21 held a hearing on an application of the Waterbury & Milldale Tramway, Waterbury, for permission to raise its fare to 10 cents. John H. Cassidy, general manager of the company, stated that even at a 10-cent fare the company would not make ends meet. Daily expenses are \$355, while the receipts approximate \$283. The company has paid no dividends in some time. It owes \$15,000 interest on its bonds.

City Fights Higher Fares.—The city of Winnepeg, Man., has begun an action in the provincial court looking to a reversal of the order of the Manitoba Public Utilities Commission granting the Winnipeg Electric Railway permission to charge a 7-cent fare. Under the order of the commission the company raised its rate from 6 cents to 7 cents on Sept. 1. In attacking the commission's action, the city alleges that the former has no power to interfere with a contract between a utility and a municipality.

Asks More in Alton.—W. H. Sawyer and F. E. Allen, receivers for the Alton, Granite & St. Louis Traction Company, Alton, Ill., have applied to the Illinois Public Utilities Commission for an increase in the company's fare to 10 cents. The petition asked that the new rate be made effective on Sept. 30. The present fare in Alton is 8 cents with two for 15 cents and seven for 50 cents. The receiver recently replied to a demand for a wage increase from the carmen that they would be willing to pay 6 cents an hour more if a higher fare was granted.

Motor Stages Opposed.—Protest has been filed with the Utah Public Utilities Commission by the Bamberger Electric Railroad, Salt Lake City, against the granting of a permit for a motor passenger and freight line between Farmington and Salt Lake City. The company states in its protest that it has been giving the public a daily service for the last ten years, that one of its taxable holdings is a franchise, assessed to be worth \$75,000, which will be injured if the stage line is permitted to run, and that the auto stage will use the state highway, a cement road, which the taxes paid by the Bamberger line have helped to make and to keep in a state of repair.

Eight Cents Cash in Durham.—Cash fares on the city lines of the Durham (N. C.) Traction Company were raised from 7 cents to 8 cents on Sept. 5. The price of tickets in strips of four was advanced on the same date from 25 cents to 30 cents. The increases were made by authority of the State Corporation Commission. The company had applied to the commission for a 10-cent fare, asserting that during the past year it operated its railway department at a loss of more than \$61,000. Granting of the company's petition was opposed by the city, which contended that the company was operating its other departments at a profit.

Auditors Justify Fare Increase.—After an examination of the books of the Cedar Rapids & Marion City Railway, Cedar Rapids, Iowa, the firm of Billings, Prouty & Tompkins, auditors, has announced that the company was justified in raising its fare from 6 cents to 8 cents. The railway installed the new rate about a month ago, contending that it could no longer continue to operate at a 6-cent fare. The auditors find that an 8-cent fare will produce revenue in excess of the company's operating costs, including depreciation,

without making allowance, however, for the reduction by the imposition of Federal income taxes.

Seven-Cent Fare Approved.—The City Council of Texarkana, Texas, has passed an ordinance granting the local electric railway an increase in fare from 5 cents to 7 cents for adults and from 3 cents to 4 cents for children under twelve years of age. This action was taken after a petition had been presented by the Southwestern Gas & Electric Company, which operates the local traction system, and after the City Council of Texarkana, Ark., had granted the increase. Neither ordinance embodied the full requests of the traction company, and the company has not indicated whether it will accept the franchises.

Ten Cents in Paducah.—Alfred Nichols, manager of the Paducah (Ky.) Railway, recently notified the Board of City Commissioners that the company would raise its fare to 10 cents on Oct. 1. Mr. Nichols announced that in case the city opposed the rate increase the company would take the case to the Federal courts for judgment. The company has been operating under a service-at-cost franchise and at a 6-cent fare. In notifying the commissioners of the intention to raise fares Mr. Nichols stated that since Jan. 1, the railway had sustained a loss of \$70,000. The City Commission has passed an ordinance forbidding the company to raise its rates until the need for an increase has been investigated.

Commission's Power Questioned.—The Delta Light & Traction Company, Greenville, Miss., has brought suit in the Circuit Court against the Mississippi Railroad Commission to determine whether the commission has the power to forbid the company to abandon operation of its railway lines. Several months ago the company applied to the commission for permission to abandon its lines, comprising approximately 7 miles of track. The commission refused this request, but authorized the company to charge a fare of 10 cents. The company contends that it can abandon service at will without incurring any penalty other than forfeiture of the railway portion of its franchise and that its electric lighting franchise remains intact.

Skip-Stop for Golden Gate.—Shortage of hydro-electric power throughout northern and central California has caused the skip-stop system to be revived on the electric railways of San Francisco. H. S. Butler, State Power Administrator, recently issued an order calling for the curtailment of power consumption by public utilities as well as by private corporations. Under the terms of this order both the United Railroads and the Municipal Railway of San Francisco installed the skip stop on Sept. 20. It is estimated that the saving in power under the new arrangement will approximate 8 per cent. Several other traction companies in the northern part of the state have adopted similar measures. The Pacific Gas &

Electric Company, Sacramento, recently reduced its service approximately 20 per cent.

Fare Increase Alternative to Shut-down.—Fares on the local electric railway in Attleboro, Mass., have been raised from 5 cents to 6 cents by authority of the State Department of Public Utilities. The Interstate Consolidated Street Railway, operating the Attleboro lines, recently applied for permission to raise its fare, stating that unless the rate was increased it would have to abandon operation. Service is now being furnished at a loss estimated at \$3,000 a month. A year ago the company's line was divided into zones and the fare was raised to 7 cents. Two months ago the zones were shortened and the fare was reduced to 5 cents. Traffic has fallen off during the summer, owing to the fact that the company abandoned the use of open cars, thus losing the patronage of many riders.

City to Operate Lines.—The Board of Estimate and Apportionment of New York City has revoked the franchises of the Richmond Light & Railroad, operating electric railway lines in Richmond Borough, because of the failure of the company to operate its lines continuously. The railway is now operating cars on all of its lines at an 8-cent fare and will continue to do so under a court injunction, prohibiting interference with it. The city is expected to ask the court to withdraw the injunction so that it can prepare for the operation of municipal lines. Grover A. Whalen, commissioner of Plant and Structures, is completing arrangements for taking over on behalf of the city the lines of the Staten Island Midland Railway, also serving Richmond Borough. The company, which is in the hands of a receiver, suspended service last January on the plea that it could not pay expenses on a 5-cent fare. It recently resumed operation over a part of its lines.

Ten Cents on Penn Line.—The Public Service Commission of Pennsylvania has granted the application of the Waverly, Sayre & Athens Traction Company, Waverly, N. Y., for an increase in the cash fare on its lines in Pennsylvania to 10 cents. The company is required to sell thirty tickets for \$2.40. The company is also given the right to abandon such parts of its line as are unremunerative. The Frankford, Tacony & Holmesburg Street Railway, Philadelphia, has filed with the commission a rate schedule under which it proposes to divide its lines into two zones, charging a 6-cent fare in each zone. The Southern Pennsylvania Traction Company, Chester, announced that beginning Sept. 19, the rates within the city limits and in each fare zone on all suburban lines would be increased from 7 cents to 8 cents. The Steubenville, East Liverpool & Beaver Valley Traction Company, East Liverpool, Ohio, has filed notice with the Pennsylvania Commission of an increase of fare from 5 to 10 cents between stations.

New Publications

Proceedings of Public Ownership Conference

Published by the Public Ownership League of America, Chicago, Ill.

This is the full report of the conference held in Chicago Nov. 15-17, 1919, the second conference of the kind. Among other subjects the report contains one on "The Street Car Problem and Its Solution," with contributions by Delos F. Wilcox, M. M. O'Shaughnessy, Hon. A. M. Todd, Thomas Murphy and Frank Ayers.

Calculating Diagrams for Design of Reinforced-Concrete Sections

By James Williamson, Constable & Company, Ltd., London, England.

Mr. Williamson's book is a collection of diagrams with examples to show their application, for use in the design of slabs, beams and columns under tension, compression and bending stresses. His purpose in publishing the book was to provide a convenient and quick means for calculation, eliminating danger of arithmetical error and complication of elaborate mathematical formulas.

Safe Storage of Coal

By H. H. Stock. Technical Paper No. 235, United States Bureau of Mines, Washington, D. C.

In view of the importance of its subject to electric railways this little pamphlet, which can be obtained free by addressing the bureau, should be in the hands of all railway men who are in any way responsible for continuity of coal supply. It is in the form of a catechism, is practical and contains a good bibliography of coal storage.

Personnel Administration

By Ordway Tead and Henry C. Metcalf. 53 pages, cloth, 5 x 9 in., McGraw-Hill Book Company, New York, N. Y.

This book is written to that newly developed field of personnel administration and is useful both as a text in colleges and for other types of classes studying this question, as well as to men engaged in personnel administration or other phases of management of men, as reference to suggest new ideas.

Included in the book are admirable discussions of reasons for and functions of a personnel department, employment methods and provisions for both safety and training of workers and employees of all sorts. There are also suggested lines of study upon which improvement can be made, rewards to men and the larger problem of administrative relations and joint relations between the administration and the employees.

It is a book which should appeal to all those interested in the problem of handling men whether in large or small groups.

Personal Mention

M. J. Loftus, general superintendent of the Texas Electric Railway, Dallas, Tex., has been given the duties of superintendent of maintenance of way.

W. Clapper, general manager of the Inter-Urban Railway, Des Moines, Iowa, has resigned. Mr. Clapper became general manager last May. He was formerly traffic manager of the company.

F. C. Chambers has succeeded W. Clapper as general manager of the Inter-Urban Railway, Des Moines, Iowa. Mr. Chambers will continue to act as general manager of the Des Moines City Railway.

Hon. William B. McKinley, president of the Illinois Traction system, Peoria, Ill., and Congressman from the Nineteenth Illinois District, has won the Republican nomination for United States Senator in the recent state primary election.

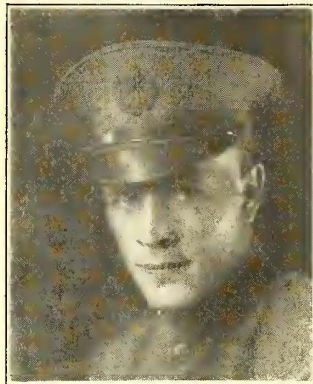
H. L. Treeman has tendered his resignation as superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. Mr. Treeman was graduated from the Oklahoma Agricultural and Mechanical College in 1909 with the degree of Bachelor of Science, having specialized in mechanical and electrical engineering. For several years thereafter he was employed by the Edison Electric Illuminating Company, Brooklyn, N. Y. as power engineer. In 1915 he left the service of that company to accept the position of electrical engineer of the Eastern Pennsylvania Railways.

Prof. Charles F. Scott, chairman of the Department of Engineering of Yale University, returned on the *Finland*, on Sept. 25, from a three months' stay in Italy. Professor Scott has been representing the Western Electric Company on the problem of communication cable location, his associate being L. P. Ferris, formerly assistant engineer on the California inductive interference studies. The object of their trip was to determine the practicability of running a cable as projected between Milan, Genoa and Turin without interference from railroad and transmission lines, and to determine what precautions should be taken by the telegraph administration and railroad administration or the former alone to prevent inductive interference. Part of the railway is already being operated by electricity and the rest soon will be. As a result of the summer's work a considerable amount of interesting information was collected with reference to inductive interference and three-phase lines under the peculiar conditions that surround this installation. A modified route was suggested for the cable free from disturbance with certain precautions.

W. I. Brown Promoted

Made Assistant to President Denman of the Tri-City Railway & Light Company

Walter I. Brown, for several years past secretary to B. J. Denman, president of the Tri-City Railway & Light Company, Davenport, Iowa, has been promoted to be assistant to President Denman. Mr. Brown assumed his new duties on Sept. 1. As right-hand man to Mr. Denman, Mr. Brown will occupy a post of great responsibility with one of the largest electric railway systems in the Middle West. The Tri-City Railway & Light Company, in addition to controlling the Tri-City Railway of Iowa and the Tri-City Railway of Illinois, owns the city lines in Muscatine,



W. I. BROWN

Rock Island, Moline, East Moline and other cities and towns in Illinois and Iowa. It also operates a number of interurban lines. The work of integrating the activities of this great network of lines will fall to no small extent upon the shoulders of Mr. Brown.

Mr. Brown was born in Nevada, Mo., on Aug. 31, 1893. Seven years later he removed with his family to Davenport, Iowa. There he attended the public schools, graduating from the Davenport High School in 1911. In the following year he entered the employ of the Tri-City Railway & Light Company as a stenographer for J. M. Porter, then president of the company. After serving in this position for two years he was made secretary to Mr. Denman, then vice-president.

After serving as secretary to Mr. Denman for three years, Mr. Brown entered the United States Army in November, 1917. He was honorably discharged from military service in April, 1919, with the commission of

Second Lieutenant and the rating of Assistant Camp Finance Officer, Camp Wadsworth, S. C. Immediately following his discharge he resumed his duties as secretary to President Denman, continuing in that capacity until his recent promotion.

G. M. Spidell, purchasing agent of the New York, Westchester & Boston Railway, has resigned.

Reid McManus has been elected secretary of the Hydro-Electric Power Commission of New Brunswick.

D. C. Bridges has been appointed superintendent of buildings of the Texas Electric Railway, Dallas, Tex.

J. F. Simerlee has been appointed superintendent of roadway of the Texas Electric Railway, Dallas, Tex.

C. W. Robinson has been elected chairman of the Hydro-Electric Power Commission of New Brunswick.

J. E. Gallaher has resigned as master mechanic of the Eastern Texas Electric Company, Beaumont, Texas.

C. O. Foss, a member of the Hydro-Electric Power Commission of New Brunswick, has been made chief engineer of the commission.

C. J. Crampton has been appointed superintendent of the safety and efficiency department of the Dallas (Tex.) Railway.

Charles Johns has succeeded J. F. Daugherty as manager of the St. Thomas Ontario Municipal Street Railway.

H. G. Crampton has been elected secretary and treasurer of the Capital Traction Company, Washington, D. C., succeeding the late R. D. Simms.

G. W. Carver has succeeded G. M. Spidell as purchasing agent of the New York, Westchester & Boston Railway, New York, N. Y.

J. W. Anderson has been appointed terminal freight agent of the Pacific Electric Railway, Los Angeles, Cal., to succeed T. H. Mann, resigned. Mr. Anderson was formerly local freight agent for the railway at Long Beach, Cal.

Robert W. Hewins, treasurer and general manager of the Norton, Taunton & Attleboro Street Railway, Norton, Mass., has resigned. Mr. Hewins has been connected with the railway for the past twenty-five years. The company's line was taken over for municipal operation by the towns of Norton, Taunton and Attleboro several months ago.

Chester B. Lawson has been appointed superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. He succeeds H. L. Treeman, resigned. Mr. Lawson was graduated from the Pottsville High School in 1905. After completing a course in electrical engineering at Lehigh University he was employed for a time in Boston, Mass. He has been connected with the Eastern Pennsylvania Railways for the past six years.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER,

SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES

BUSINESS ANNOUNCEMENTS

Price Trend of Iron and Steel Market Uncertain

Consumers Delay Buying in Hope of Lower Prices—Producers Discount Possibility of Reduction

In view of the direct bearing of the iron and steel market upon the buying of electric traction companies in many lines, such as car trucks and wheels, brake shoes, rails, and other track supplies, tools, etc., current discussion regarding the possible price trend of iron and steel is interesting. At present there seems to be two widely divergent views of the situation. Consumers are very generally holding off ordering with the expectation of lower prices developing. Producers, on the other hand, say there can be no immediate reductions, but that even higher prices on iron and steel may develop. This view is apparently based on the grounds that the general steel market is still largely under-supplied, that labor is high and transportation costs are much greater.

At present the market is rather quiet. Transportation has improved to such an extent that unfilled tonnages have been reduced by two-thirds, it is stated. Railroads as yet have not ordered heavily and many cancellations have been received from automobile, oil and other industries. Export demand is said to be extremely light just now. Furthermore the price of coke is showing signs of softening. These factors would seem to justify hopes of lower prices, and, in fact, slightly weaker quotations on the part of independent producers are noted in one or two lines. The average price of eight principal iron and steel products as quoted by *Iron Age* shows no change during the last four weeks, however.

DEMAND LIGHT AT PRESENT

On the other hand, this is normally the slack season in the iron and steel industry. In spite of this, cancellations from automobile manufacturers and others seem to have been readily absorbed. To compensate for this loss demand for structural steel is apparently reawakening. Orders booked during August were 72,200 tons, or 40 per cent of the total month's capacity, it is stated. A very large market is also expected to develop the steam railroads. Thus far orders in that quarter have for the most part been confined to small items such as spikes, bolts and tie plates. In 1921, however, a large portion of their program of expenditures, amounting close to \$1,000,000,000, it is estimated, is expected to be placed. At present the United States Steel Cor-

poration is said to be booked ahead with orders for about nine months, while independent producers have sufficient business on hand to carry them through the winter. These conditions, producers hold, substantiate their position that prices will not drop materially.

In analyzing the probable trend of prices it must be noted that there are two price levels. The price scale of the United States Steel Corporation averages \$21 per ton below the independent level. In many quarters the view is held that the independents' prices must come down to approximately the level of the United States

Steel Corporation before buying will be resumed on a large scale. If one considers the latter's quotations as the market level, however, these same opinions hold that no general reduction can be made. Opinions differ whether the United States Steel Corporation will be able to absorb the increase in freight costs, which is estimated to total approximately \$50,000,000 annually on the raw and intermediate material used by the corporation. A more definite trend to the market is expected to be evident in the next month or so. At the present time the situation is one of "watchful waiting."

Active Demand for Window Glass

Stocks Are Low, but Manufacturing Conditions and Deliveries Are Improving—Prices Show Great Steadiness

Manufacturers of window glass report a very active demand for their product at present. One large producer has been so far behind on filling orders this year that no new business was sought for a period of four months. Orders are being received from electric railways in good volume and a still heavier buying movement seems to be expected from that source as traction companies continue to change over from summer to winter equipment. Demand for glass for building construction has not been as heavy as in other seasons, it is stated, but this market is expected to develop large orders in the not far distant future.

Raw material difficulties seem to have been the chief obstacle retarding output. Sand, chemicals, coal, gas and lumber for boxing have been both scarce and high in price, it is reported. The production of one representative producer is only 60 per cent of normal at present. Conditions in general are improving, however. Manufacturers are now fairly well caught up on orders and deliveries can be made in better time. Delivery quotations cover a wide range of from about two to eight weeks. Labor conditions are also beginning to ease up. Stocks while fair on some types of window glass, on the whole are low. This is especially true of the double-strength glass usually placed in car windows. According to one producer the production of this type of glass is proportionately slower than ever before. The receipt of orders which should have arrived months ago is said to have somewhat relieved the present situation. Some quantities of window glass are arriving from abroad, notably Antwerp, but these receipts are

but a drop in the bucket. The field is apparently too well covered by domestic producers to encourage foreign competition.

Producers see no reason for any immediate change in prices. The consensus of opinion seems to be that no fluctuation will take place within the next few months. One reason may be the fact that manufacturers have contracted ahead for raw material supplies.

Carbon Brush Deliveries Fairly Prompt

From Two to Three Weeks Is Generally Quoted—Heavy Demand and Good Supply of Raw Material

There is no shortage of carbon brushes, according to representative manufacturers. Deliveries are being made in good shape and are improving somewhat under the influence of better conditions of production. In general, orders are filled in about two weeks, ranging up to three weeks in many cases. So far as could be learned but one producer is unable to make such prompt shipments and from four to eight weeks is quoted in this case. Deliveries of railway type brushes are made in slightly better time in some cases and about within the same limits in others.

Heavy orders are generally reported by producers. Railway brushes are even in stronger demand than usual. In some quarters this demand is said to have slackened recently, but a larger buying movement seems to be looked for soon. Traction companies are said to have pretty well anticipated their needs for brushes and their reserve supplies are consequently fairly heavy.

Factory stocks of unfinished carbon are in good condition, so that raw material is not seriously affecting the supply of carbon brushes. Improved transportation is also aiding the situation. As a result, production, except in one or two instances, is proceeding at a normal pace. One of the large manufacturers reports an increase in output last year of 33 per cent. The present season is expected to show an even larger output due to plant additions. Labor conditions in the industry are much better and no trouble from this source is now being experienced. An entire absence of cancellations is also noted.

Prices have been holding steady. Most manufacturers say they anticipate no increase soon, though the exception is provided by one large company which looks for higher prices to materialize.

Production of Turnstiles Is Improving

Raw Material Has Been Showing Deliveries—Demand Is Normal, with Prices Holding Steady

Manufacturers of turnstiles report a demand for their product during the past year that compares favorably with other seasons. Orders from electric railways have not been extraordinarily large because the construction of new terminals, etc., has been somewhat curtailed. On the other hand, the buying of turnstiles by such interests as athletic and amusement parks has been unusually large, it is reported. Producers are extremely optimistic over the outlook for next year's business.

Construction work in many lines which requires the use of turnstiles is expected to go forward in increased vol-

ume. One of the large manufacturers is also looking for a big field to open up in the use of these machines on street cars to register automatically the number of passengers. A turnstile for this purpose has been developed and successfully experimented with on several lines, it is stated.

At the present time factories are endeavoring to accumulate surplus stocks in anticipation of the expected spring buying. Production during the winter closely follows the estimated future requirements of all interests, however. For this reason manufacturers state that traction companies should now start to figure their needs for 1921 in this line, with a view to ordering supplies three months in advance for shipment next spring. In this producers can accurately gage the number of turnstiles that will be needed next year. By governing production accordingly delays in making shipments may be avoided, it is said.

The labor situation at factories is reported satisfactory. Raw material has been retarding production in the past, however. This condition is now considerably relieved as a result of better transportation and quicker shipments from steel mills. Orders in some cases have been running behind and stocks of the finished goods have been correspondingly low. With the dull season at hand, however, this is expected to be remedied.

A few cancellations have been made as a result of long deliveries, but the number, it is stated, is not alarming. Prices have remained steady for some months and the outlook seems to be for the present level to hold firm until the first of next year at least. After that date the tendency of prices may be upward, manufacturers think.

Rolling Stock

Birmingham (Ala.) Railway, Light & Power Company is reconstructing many of its old cars and installing new motors.

Interstate Public Service Company, Indianapolis, Ind., has purchased fifteen new freight cars that are scheduled for delivery in December, it is reported. The eight all-steel 62-ft. passenger cars ordered some time ago are expected to be placed in operation in November, it is stated.

Track and Roadway

Danbury & Bethel Street Railway, Danbury, Conn.—The Danbury & Bethel Street Railway has begun the construction of a line on West Street. This connecting line joining the present tracks on West Street opposite Orchard Street will run alongside the park at the junction of West and Division Streets and will not go into the center of the street until after it leaves Division Street.

Central Texas Electric Railway, Waco, Tex.—O. A. Ryfle, president and general manager of the Central Texas Electric Railway, with headquarters at Waco, has been advised that 100 tons of steel rails for the Waco-Temple Interurban are now en route to Waco. Other material is on the ground and the laying of the track of the first 6 miles of this line, extending from Waco to Robinson, will begin in a few days.

Richmond - Fairfield Railway, Richmond, Va.—The Richmond - Fairfield Railway, a recent incorporation, is making real progress according to its presi-

NEW YORK METAL MARKET PRICES

	August 3, 1920	October 1, 1920
Copper ingots, cents per lb.	19.00	18.50 to 18.75
Copper wire base, cents per lb.	22.50 to 23.00	21.50 to 22.00
Lead, cents per lb.	8.50	7.75
Nickel, cents per lb.	43.00	43.00
Zinc, cents per lb.	8.02½	7.70 to 7.80
Tin, cents per lb.	48.25	42.75
Aluminum, 98 to 99 per cent, cents per lb.	33.00	35.10

OLD METAL PRICES—NEW YORK

	Aug. 3, 1920	Oct. 1, 1920
Heavy copper, cents per lb.	15.50 to 16.00	15.25 to 15.50
Light copper, cents per lb.	13.50 to 13.75	13.00 to 13.25
Heavy brass, cents per lb.	9.25 to 9.50	8.50 to 9.00
Zinc, cents per lb.	5.50 to 5.75	4.50 to 5.00
Yellow brass, cents per lb.	7.25 to 7.75	6.50 to 7.00
Lead, heavy, cents per lb.	7.25 to 7.50	6.50 to 6.75
Steel car axles, Chicago, per net ton.	33.50 to 34.50	33.00 to 34.00
Old carwheels, Chicago, per gross ton.	36.00 to 36.50	37.00 to 38.00
Steel rails (scrap) Chicago, per gross ton.	28.00 to 28.50	27.50 to 28.00
Steel rails (relaying), Chicago, gross ton.	35.00 to 36.00	37.50 to 38.50
Machine shop turnings, Chicago, net ton.	9.50 to 10.00	9.00 to 9.50

ELECTRIC RAILWAY MATERIAL PRICES

	August 3, 1920	October 1, 1920
Rubber-covered wire base, New York, cents per lb.	28.00	28.00
Weatherproof wire, (100 lb. lots), cents per lb.	29.00	29.00
Standard Bessemer Steel Rails, per gross ton.	45.00 to 63.00	45.00 to 63.00
Standard open hearth rails, per gross ton.	47.00 to 65.00	47.00 to 65.00
T-rail, high (Shanghai), cents per lb.	3.00	
Rails, girder (grooved), cents per lb.	3.00	
Wire nails, Pittsburgh, cents per lb.	3.25 to 4.50	4.25
Railroad spikes, drive, Pittsburgh base cents per lb.	4.00 to 5.75	4.50 to 6.00
Railroad spikes, screw, Pittsburgh base, cents per lb.		4.00
Tie plates (flat type), cents per lb.	4.00	4.00
Tie plates, (brace type), cents per lb.	4.00	4.00
Tie rods, Pittsburgh base, cents per lb.	7.00	7.00
Fish plates, cents per lb.	3.75 to 4.75	4.00 to 5.00
Angle bars, cents per lb.	3.75 to 4.75	4.00 to 5.00
Rail bolts and nuts, Pittsburgh base, cents per lb.	6.00 to 7.50	6.00 to 7.00
Steel bars, Pittsburgh, cents per lb.	2.35 to 4.00	2.35 to 4.00
Sheet iron, black (24 gage), Pittsburgh, cents per lb.	4.20 to 7.85	4.20 to 7.35
Sheet iron, galvanized (24 gage), Pittsburgh, cents per lb.	5.25 to 8.55	5.25 to 8.30
Galvanized barbed wire, Pittsburgh, cents per lb.	4.45	4.45

	August 3, 1920	October 1, 1920
Galvanized wire, ordinary, Pittsburgh, cents per lb.	4.20	3.70 to 4.70
Car window glass (single strength), first three brackets, A quality, New York, discount*	77%	77%
Car window glass (single strength), first three brackets, B quality, New York, discount.	77%	77%
Car window glass (double strength, all sizes, AA quality) New York, discount	79%	79%
Waste, wool (according to grade), cents per lb.	17 to 23	17 to 23
Waste, cotton (100 lb. bale), cents per lb.	15 to 17½	15 to 17½
Asphalt, hot (150 tons minimum), per ton delivered.	38.00	40.00
Asphalt, cold (150 tons minimum, pkgs. weighed in), per ton.	42.50	42.50
Asphalt, filler, per ton.	45.00	40.00
Cement, New York, per bbl.	5.10	5.10
Linseed oil (raw, 5 bbl lots), New York, per gal.	1.58	1.22
Linseed oil (boiled, 5 bbl lots), New York, per gal.	1.605	1.24
White lead (100 lb. keg), New York, cents per lb.	15½	15½
Turpentine (bbl. lots), New York, cents per gal.	1.65	1.46

*These prices are f.o.b. works, with boxing charges extra.

dent. The relaying of track and the installing of new overhead wires have already been started.

Toronto (Ont.) Civic Railway.—Commissioner R. C. Harris has recommended the construction of a permanent double-track line on Bloor Street from Runnymede Road to Jane Street. It will cost approximately \$104,245.

Pacific Electric Railway, Los Angeles, Cal.—The Pacific Electric Railway has recently announced in detail its program of reconstruction work delayed by the late war. The greater portion of this improvement work in Southern California became necessary principally through franchise and legal obligation. The improvement plans referred to are now under way.

Hydro-Electric Power Commission, Ont.—The double-tracking of London Street, West, has been started, and the proposed improvements to the local street railway system, now operated by the Hydro-Electric Commission of Ontario will be rushed to completion. In the June 26 issue of the *ELECTRIC RAILWAY JOURNAL*, reference to this improvement on London Street was made.

Chicago North Shore & Milwaukee Railroad, Highwood, Ill.—The Chicago, North Shore & Milwaukee Railroad operating in Waukegon will extend its line from North Avenue to Greenwood Avenue, then east to the Chicago & Northwestern Railroad's tracks. A survey of these streets has just been made and the work of estimating the cost is well under way. The extension will be approximately 2 miles and is practically assured.

Connecticut Valley Street Railway, Greenfield, Mass.—The Connecticut Valley Street Railway has petitioned the Selectmen of Greenfield to relocate the tracks in Deerfield Street and to add a spur track from the main line.

Brockton & Plymouth Street Railway, Plymouth, Mass.—The Brockton & Plymouth Street Railway has laid new track from the carhouse to Jaboz Corner and from Hotel Pilgrim to Hornblower's estate.

Trenton & Mercer County Traction Corporation, Trenton, N. J.—The State Highway Commission has approved of the application of the Trenton & Mercer County Traction Corporation for the removal of a spur on its Slackwood branch along the Brunswick pike.

New York, Westchester & Boston Railway, N. Y.—The New York, Westchester & Boston Railway expects to build 1.5 miles of standard double-track railroad, an extension of the present line from a point $\frac{1}{4}$ mile east of New Rochelle to Chatsworth Avenue, Larchmont.

Brockton & Plymouth Street Railway, Plymouth, Mass.—The Brockton & Plymouth Street Railway has installed two miles of copper trolley wire and plans for additional wire have been made. Nearly 200 new 35-ft. poles have been set replacing old equipment. The wooden poles upon the West side of

Main Street will soon be removed and permission has been secured of all the property owners to string the trolley wire to the buildings.

St. Paul City Railway, Minneapolis, Minn.—The St. Paul City Railway will extend its lines in the suburb 3 miles just as soon as earnings will permit.

St. Joseph Railway, Light Heat & Power Company, St. Joseph, Mo.—Residents of St. Joseph have petitioned the City Council for an extension of the Prospect Avenue line to Third Street and Hamburg Avenue. The St. Joseph Railway, Light, Heat & Power Company is not in favor of this movement on the ground that it would not be a profitable undertaking.

West Virginia Traction & Electric Company, Wheeling, W. Va.—The West Virginia Traction & Electric Company will start at once the laying of the new tracks that will enable the re-routing of its cars up Eoff to Twelfth, to Chapline and South to Sixteenth on the outbound trip. The new routing will dispense with the Market Street tracks and traffic to Elm Grove down that thoroughfare. It will relieve traffic congestion along upper Chapline Street, Eleventh and Market between Eleventh and Sixteenth.

Power Houses, Shops and Buildings

Three Rivers (Que.) Traction Company.—The Three Rivers Traction Company has purchased a site on St. Maurice Street and contemplate erecting a station and waiting room.

New York, Westchester & Boston Railway, N. Y.—The New York, Westchester & Boston Railway expects to build one 16-ft. I beam and concrete slab bridge and two frame temporary stations with standard high platforms. One will be located about midway at Potter Avenue and one at Chatsworth Avenue at the Larchmont end.

Havana Electric Railway, Light & Power Company, Havana, Cuba.—The Havana Electric Railway, Light & Power Company is planning an extension and reconstruction of its shops for the maintenance of rolling stock.

Havana Electric Railway, Light & Power Company, Havana, Cuba.—The Havana Electric Railway, Light & Power Company has recently contracted for 50,000 k.w. generating apparatus to install in the present power plant. There will be additions to the piping system, and a distilling equipment for boiler feed water, new feed pumps and economizers is being considered. The company will also build a reinforced concrete wharf on the harbor frontage of the gas works property at Rincon de Melones, which will be provided with movable coaling crane to receive coal from ships and barges and to load cars—about 100 tons per hour capacity. Another improvement will be the construction of a steel building, 50 ft. x 150 ft. for company automobile trucks.

Trade Notes

The General Electric Company, Schenectady, N. Y., is having plans prepared for a five-story factory addition, 70 ft. x 400 ft., to its Pittsfield Works.

The Marion Insulated Wire & Rubber Company, Marion, Ind., has awarded contract for a three-story-and-base-ment, 35-ft. x 60-ft. extension.

The Consolidated Wire and Machinery Corporation, 519-527 West Van Buren Street, Chicago, is issuing a loose-leaf price list of new and second-hand motors, Kuhlman transformers and miscellaneous materials.

The Monroe-Louisiana Carbon Company, Monroe, recently organized, contemplates the construction of a large carbon plant at Hancock, near Monroe, to cost, including equipment, about \$1,000,000. Barney Oakland of Monroe is superintendent.

Roller-Smith Company, 233 Broadway, New York City, announces the appointment of the Mountain States Machinery Company, 1710 Glenarm Street, Denver, Col., as its agent for the states of Colorado, Wyoming and New Mexico. The Mountain States Machinery Company will, in addition, handle the products of Crocker-Wheeler Company, Maloney Electric Company, Cutler-Hammer Manufacturing Company, Terry Steam Turbine Company and others.

New Advertising Literature

Panel Supports.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 47,703-A, to supersede No. 47,003. It describes standardized fittings and such accessories.

Combustion Control.—The Engineer Company, 17 Battery Place, New York, has just printed a booklet on "Modern Practice in Combustion Control," of interest to all steam-station engineers.

Insulator Testing.—T. F. Johnson, Jr., Atlanta, Ga., is distributing five booklets describing his insulator-testing methods and methods of working on live lines.

Melting Pots.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a two-page leaflet, entitled "Metal Melting Pots," describing the C-H melting pots, both portable and bench types.

Switchboard Panels.—General Electric Company, Schenectady, N. Y., has issued bulletin 47001-A, superseding No. 47001, on standard unit switchboard panels for both direct current and alternating current in large and small capacity plants.

Water Softeners, Filters, Etc.—The Permutit Company, 440 Fourth Avenue, New York City, has issued bulletin No. 101, entitled "Permutit Water Rectification Systems," in which it describes and illustrates its products, including water softeners, filters, manganese removal equipment, etc.