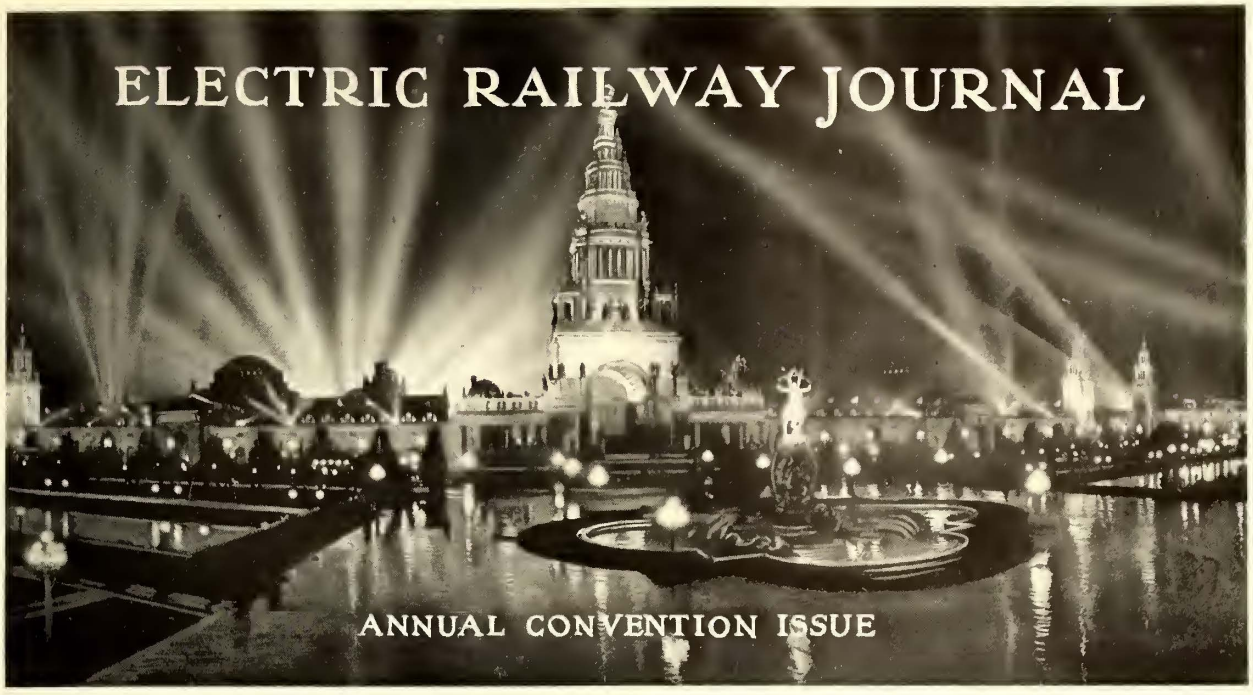


From San Diego to Vancouver

WHEN a plan for the Pacific Coast convention issue was considered, it was obvious that descriptions of Pacific Coast properties would be expected by the readers. Nevertheless, the ELECTRIC RAILWAY JOURNAL has covered these properties so thoroughly in the past that any general descriptions would have meant the unnecessary duplication of much material, and, at best, an issue of unwieldly size.

A second plan would have been an attempt to compare the standards of different companies as regards track, line, power and rolling stock. This, too, would have proved impracticable because the properties are comparatively few for the great extent of territory traversed, and they represent an enormous range of conditions from the cable lines of Seattle, Tacoma and San Francisco to the 1200-volt and 1500-volt heavy traction lines of the Bay Cities and Portland.

A third plan was still available. This was to present articles on whatever matters were of the greatest importance to the properties affected and of probably the greatest interest to the stop-over convention visitor. This plan was adopted with the further improvement that this information was obtained in the form of contributions from the men who have been closest to the questions treated. Furthermore, in this form, the ELECTRIC RAILWAY JOURNAL convention issue is a collective invitation from the men of the Coast to their brethren of the rest of the United States and Canada. This is a fitting place to express the strongest gratitude to the contributors whose co-operation made so personal an issue possible.

The table of contents will reveal discussion of topics in almost every branch of electric railroading. Perhaps the articles of most vital interest are those of Messrs. Lewis, Dunne, Black and Hild on the jitney from the respective standpoints of birth, growth and decline, legal status, financial status and public sentiment. After playing the part of a seven-year locust the jitney seems doomed to a grave unmourned, unhonored and unsung save by the trader in used automobiles. Yet the jitney will leave more than a scar on electric railway finance and operation. Above all, it has shown that all public transportation, car and bus together, should be under one control.

Another set of articles that fall under a common heading are those relating to heavy electric railroading. It will warm the cockles of the electric railway man's heart and warm the cold feet of many a steam railroader to see the Southern Pacific Company operate trains at 1200 volts and 1500 volts direct current as an every-day matter, whether it be on the near-city headways of Los Angeles and the Bay Cities or on the electric passenger and steam freight combination of the Portland divi-

sion. The articles of Messrs. Sears, Hewitt, Johansen, Nichols and Clough indicate emphatically that high-tension d.c. equipment is making good.

That the most advanced ideas in scientific management also find a haven on the Pacific Coast is proved by Mr. Maize's article on work planning at Portland, and Messrs. Sliter's and Cooper's dissertations on schedules. Progressiveness in other branches of the industry is apparent from the remarks of Messrs. Jones and Cashin on front-end fare collection, of Mr. Hinshaw on helping the farmer, of Mr. Schluss on real comparisons of maintenance costs and of Messrs. Alberger and Murrin on the true worth of motormen's checking devices. The three articles on a.c. track-circuit signal practice contributed by Messrs. Vanatta, Miller and Cunningham bring out the ever-increasing reliability of this apparatus; nor does the foregoing enumeration exhaust the list of good things which will be found in this issue.

Finally, a word is in order concerning the two fairs which are responsible for bringing the American Electric Railway Association to the Pacific Coast. At San Diego the visitor will find what has been most truthfully called a Spanish "dream city." It is doubtful, indeed, whether Spain knew greater beauty even at the height of the Moorish power than has been recreated by the modern American. The area of the fair grounds is also small enough to permit everything to be seen in a couple of days provided the visitor does not linger too long and lovingly over the ravishing displays of California products. The chief railway exhibit at San Diego is by the San Diego Electric Railway, and it's a very good one indeed.

At San Francisco the visitor will find an exposition which will not only attract him at once, but hold him in an ever-increasing thraldom as acquaintance is made with each of its beauties. And, like all others, he will leave with regret that this wonderful art should have been created for less than a year.

Of the technical exhibits, electric railway apparatus forms an important part. It is a pity that all transportation exhibits could not have been placed in one building, for this would have encouraged the exhibit of more detail parts. As it is, the exhibits as described in the ELECTRIC RAILWAY JOURNAL for March 13, 1915, are divided between the Palace of Machinery and the Palace of Transportation. Of course, the displays have been made with the view of attracting the general public, but the spatial conditions are so liberal that the technical man will be able to study details even better than at the usual railway convention. Like the regular exhibits of the American Electric Railway Manufacturers' Association, only the latest developments are shown. Unlike preceding world's fairs, the Panama-Pacific International Exposition commemorates an achievement of to-day, and it is therefore consistent that the exhibits should have been planned in the same spirit.

Part of the San Diego Exposition—United States Marine Force on the Puente Cabrillo

San Fernando Mission

An Electric Railway Paradise

Where Nature's Beauties, an Equable Climate and Rich Soil Are Made Accessible by an Electric Railway Service Which Combines the High Speed of Interurban Operation with a Headway that Approaches City Schedules

By PAUL SHOUP
President Pacific Electric Railway

THE populous section of four southern California counties is served by the Pacific Electric Railway. This garden-like territory, walled in on the north and east by the San Gabriel and San Bernardino mountain ranges, forest-clad on their heights, and rimmed westward and southward with one broad, almost continuous, sandy beach along the Pacific Ocean, has great diversity of attractions for the visitor.

The Pacific Electric Railway, operating 611 road miles and more than 1000 single-track miles, reaches practically every section of this territory. More than a dozen of its interurban lines radiate from Los Angeles. In this section there is not a seaside resort where its lines do not go down the principal aisles of amusement and distribute passengers directly along the sandy beaches.

The forested canyon of Alpine Tavern, with Mount Lowe above, is the mountain terminus of the Pacific Electric Railway, 5000 ft. above the sea.

There is no great citrus fruit growing district in all this section through which the service of the Pacific Electric does not pulsate. Every county seat is connected with every other county seat by its lines, and every populous section has a direct route to Los Angeles and usually to the local business center nearer by. Our lines serve some thirty-five municipalities, and in a third of them we give local in addition to our interurban service.

The private rights-of-way of this railway reach well up into the heart of Los Angeles with the result that the service is not only very frequent but is expeditious.

The great citrus fruit growing districts of south-

ern California lie chiefly along the foothills and in the narrower valleys, though this statement is not wholly comprehensive. From Pasadena eastward, including Sierra Madre, Monrovia, Azusa, Covina, Glendora, San Dimas, Lordsburg, Pomona, Ontario, Uplands, Alta Loma, Etiwanda, Fontana, Rialto, San Bernardino, Highland and Redlands, is a broad belt of almost continuous orange groves, interspersed here and there with lemon groves and vineyards. The valley of Riverside is almost one great orange grove. Southward, the Corona lemon and orange groves have spread from the railway tracks up through the foothills.

In Orange County, the lower mountains wall the beautiful valleys, and here, with Santa Ana and Orange as business centers, are great orchards of citrus fruit and of walnuts.

If vistors should be interested in a citrus fruit valley in the making, there is no journey more educational than that over the Pacific Electric Railway's La Habra line. Here, where a few years ago were the bare plains and foothills, are now several thousand acres of oranges and lemons, all young, and only a small percentage in bearing. What this country will be like may be seen from the Whittier district, a thrifty and prosperous section passed on the way, necessitating only a short side trip.

These territories traversed by the Pacific Electric produce more than 30,000 carloads of oranges and lemons per annum, and this output is steadily increasing.

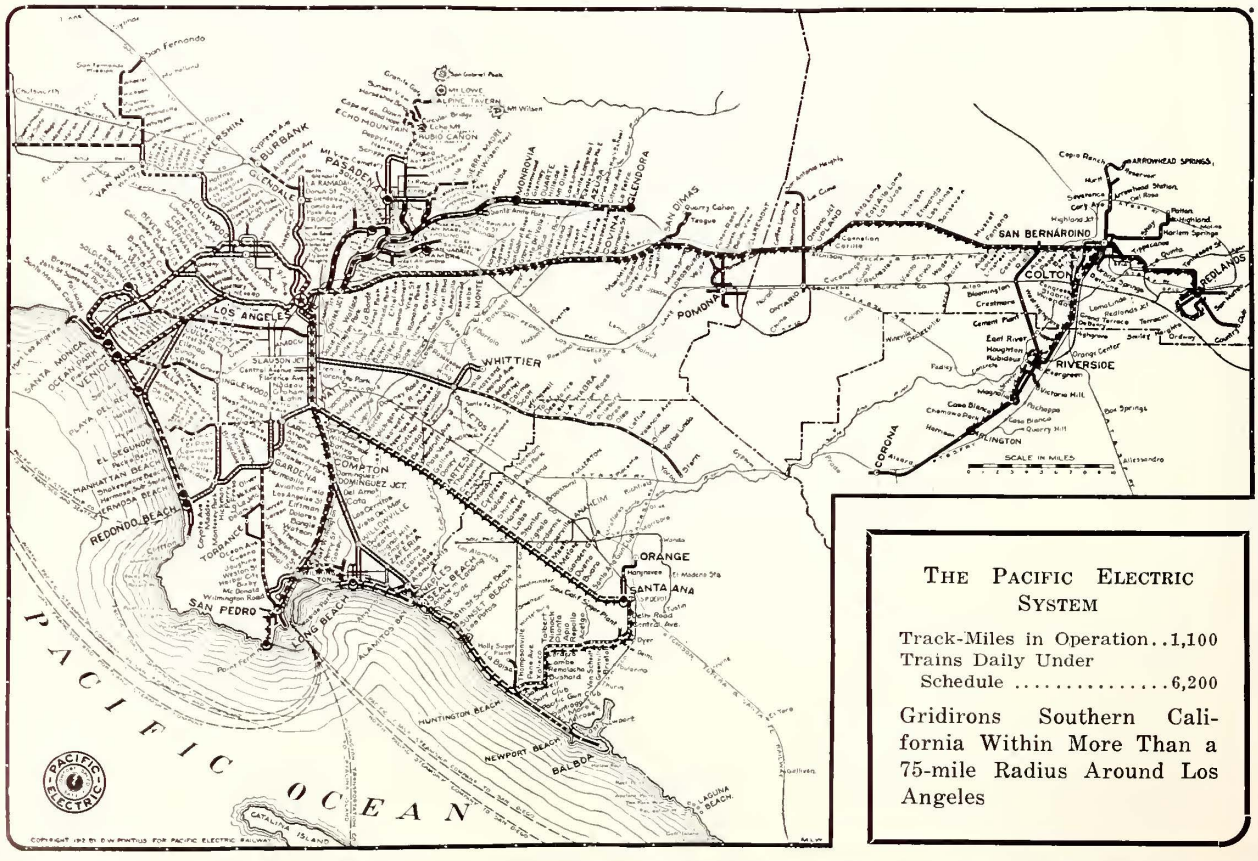
West and south of Santa Ana and Orange is the greatest of sugar beet growing districts, last year's crop being some 250,000 tons. In this comparatively small district are three large beet sugar factories on Pacific Electric lines.

Northward from Los Angeles and separated from the city proper by the Santa Monica mountains is the San Fernando Valley where a grain field of three years ago has been metamorphosed into four thriving towns, a great area of 10, 20 and 40 acres of orchards and vegetable ranches, with many miles of well-macadamized streets, electric lighted, and with every principal section served by the Pacific Electric. The advance of the San Fernando Valley is marvelous, and the towns of Van Nuys, Owensmouth, Lankershim and San Fernando are very interesting to the visitor in that they indicate how rapidly towns may be made. Van Nuys is perhaps the most remarkable example of such creation in the country.

Beach Amusement Attractions

Southern California, as I have said, offers a great diversity of attractions. Venice, as a seaside resort, has all the play attractions of Coney Island, and the beauty of beach in the fore and of green hills in the background that Coney Island cannot have.

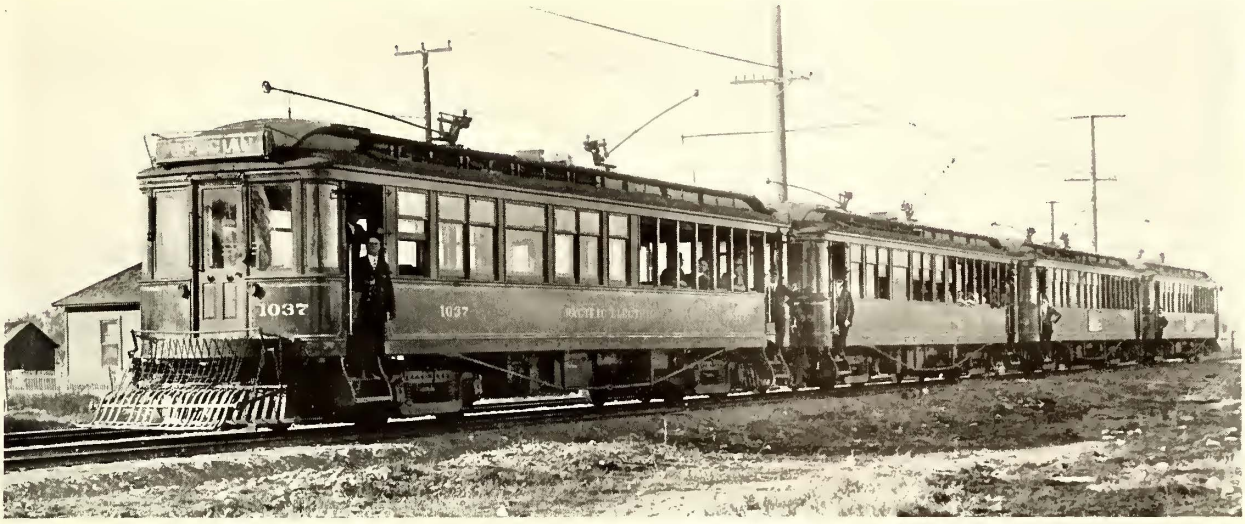
Long Beach, with a hotel unsurpassed so far as I know by any other seaside resort on either coast of the country, is built on an upland and overlooks



The Pacific Electric System

Track-Miles in Operation..1,100
Trains Daily Under Schedule 6,200

Gridirons Southern California Within More Than a 75-mile Radius Around Los Angeles



Four-Car Passenger Train

the sea. It is claimed that within the due course of time all of Iowa's farming population is planning to retire to Long Beach and enjoy life, and at a meeting of the Iowa State Society in that town you would think this to be true, but the Iowans have no monopoly; there are a great many thousands of other people who know what Long Beach is worth.

What is true of Long Beach and of Venice as to their improvements and their attractions is true likewise of Santa Monica, noted for its upland residences, Redondo Beach, Hermosa Beach, Naples, Alamitos Bay, Seal Beach, Sunset Beach, Huntington Beach, Newport Beach and Balboa. This whole beach country, from Santa Monica on the north to Balboa on the south, is one great playground all summer long. There are no rains and no storms. The weather is invariably pleasant and the bathing unexcelled. At such places as Redondo Beach there is good fishing practically all the time. Every one of these resorts has its merry-go-round attractions, with pleasure piers, and, in nearly every one there are places where good things to eat can be had.

These beach towns are made a part of Los Angeles by a service of trains from fifteen minutes to an hour apart, depending on the distance from Los Angeles. At such points as Venice, Redondo Beach and Long Beach, people hardly consult the timetables, knowing that in any event they will have not long to wait for a train.

As a Winter Resort

The foothill cities of South Pasadena, Pasadena and Alhambra, Sierra Madre, Monrovia, the Hollywood section of Los Angeles, Beverly Hills and other near-by places, are thronged with winter visitors. Here are some of the very best winter resort hotels in America. They are also charming in summer, the green foliage and the white blossoms of the orange trees, the views of the smiling valleys on the one hand and the snow-capped mountains on the other, and the even temperature of the California winters, giving them their greatest lure when the thermometer in the East is frozen down to its boots.

As a Summer Resort

Southern California is as much of a summer resort as a winter resort; indeed, I think perhaps more so, and what is said of southern California is likewise true of California as a whole. The mountains, outside of resorts such as Mount Lowe, are not easily accessible in the winter time, but in the summer there are between thirty and forty beautiful mountain canyons, nearly every one with a running stream, readily accessible from the lines of the Pacific Electric Railway. In these canyons are groves of sycamore and oaks, and in their upper stretches and along the hillsides forests of pine and cedar. On the mountain tops themselves and spreading down the northern slopes are large pine forests, now practically all timber reserves. There are public camps and pine log lodges which comfortably entertain visitors, while camping out during the stormless summer season is a favorite vacation experience.

Transportation Service

The visitor may go from Los Angeles to San Bernardino in the morning via the Pacific Electric, have luncheon at the latter city, take the connecting automobile stage and dine on the top of the San Bernardino range in a pine forest within a few miles of a mountain lake 6000 ft. above the sea. The next day he may ride among the groves over a road looking down into the San Bernardino and Riverside valleys on the one hand and out upon the desert on the other, from an average height of some 7000 ft., and spend the next afternoon and evening by the side of another mountain lake in the

Flowers and Snow at Smiley Heights, Redlands

Orange Grove, Near Riverside

Bear Valley. Such trips as these are not well known to our visitors, but as time goes on they will increase this lure of southern California.

Perhaps the greatest attraction that southern California has is the near association of wilderness and town, of mountain and sea, of all the advantages that come with conventional and man-made improvements and all the advantage that goes with unspoiled nature in canyon and mountain wall, in islands, such as Santa Catalina, and long unbroken stretches of sea beaches. The Pacific Electric Railway makes these contrasts the more vivid in that through the service rendered by it all points are brought close together.

On the main streets of San Bernardino or Riverside or Santa Ana you may take cars at reasonable intervals during the day for Los Angeles, and, on the main streets of Los Angeles, or, from the business center of the city, you may take cars and return to these same points. There is no city in which it does not have up-town facilities.

The business building which is owned by the Pacific Electric and occupied by it as a terminal in Los Angeles is perhaps the largest business building in the city, and its location is near the business center.

All of these conditions create a situation with respect to city and country development and tending to the unity of the two perhaps not found in quite the same fashion elsewhere. This situation accounts for the 2300 scheduled trains a day of the Pacific Electric and for the fact that it handles some 75,000,000 passengers annually in a residence population of possibly 750,000; and of these by far the greater proporton are, of course, interurban passengers, as only a small part of the railway service of Los Angeles is given by this company.

The business man may, indeed, have his business in Los Angeles and his home in Pasadena, from 11 to 15 miles distant, or in Long Beach, 21 miles away, and reach that home as quickly as if he lived in the immediate suburbs.

It has been the effort of the Pacific Electric Railway to keep up with the growth of southern California and this has necessitated a great deal of pioneering. The system as a whole is, perhaps, yet somewhat in advance of the country. Only recently the isolated sections in the San Bernardino and Riverside valleys have been connected with each other and, in turn, connected with the main system around Los Angeles. The full value of this association and interchange of electric car service over

A Flowered Irrigation Canal at Riverside

Typical Home of a Retired Capitalist

Glenwood Inn, Riverside

Lagoons at Venice

the whole territory served by this company will be fully felt only after some period of experience and development.

A Land of Opportunities

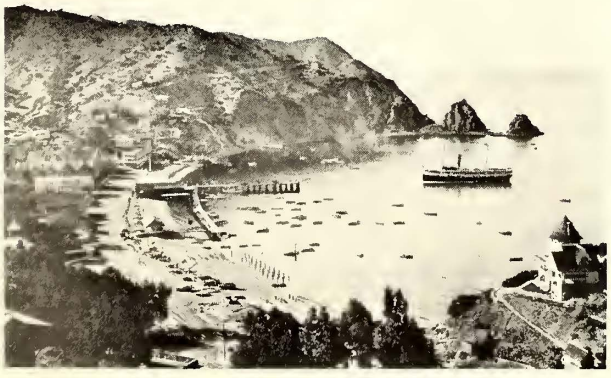
Business opportunities are all relative, and while it may appear that southern California is at this time fairly well populated, it is altogether probable that no rural section in the United States of equal area is destined to greater increase in population during the next ten years than the territory served by this company. This territory possesses attractions that are almost natural monopolies. It is becoming the playground and the resting place of the world. Income on investments elsewhere is being constantly poured into southern California for the maintenance of people who have in whole or in part retired from business activities. Another stream of wealth comes through the creation of beautiful homes from money realized through the sale of properties elsewhere or from income sources. There may be temporary checks in this development, but the past thirty years indicate that these checks can be but temporary, and they who build wisely and well in southern California need have no fear as to the value of their investments nor any fear as to dissatisfaction with the conditions that make their new home life approach the ideal.

The wealth of the world is behind this development. This country is more than the playground of the nations—it is the home place of all countries. Where once it was said that one might sit idly at Cairo and in the course of time at this cross-roads of the nations meet everyone whom he knew, it will not be long until this expression will be much more applicable to the city of Los Angeles and southern California generally.

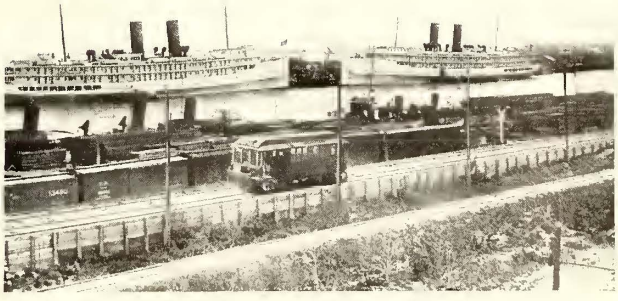
It is, however, more than a tourist land and something else than a home place, but I need say little more in that direction. Los Angeles County was, according to the United States census report recently made public, the first in the United States in the value of agricultural products.

Operating Features

The aim of the Pacific Electric Railway is to give with its red cars a service constantly abreast of the demand. We are, working within reasonable business lines, improving our operating conditions wherever new ideas make this soundly practicable. Our grade crossings with steam lines are rapidly being protected by interlocking plants. Our dense



Avalon Bay, Catalina Island



Harbor at San Pedro

traffic lines are protected by block signals and other lines will be so protected when income conditions make it possible. In connection with other Los Angeles city terminals, plans, in part carried out but deferred until business conditions are better, will enhance the advantages to the public in the private right-of-way service now given. All of our most dangerous highway crossings are protected by automatic wigwag signals invented and first manufactured in our Pacific Electric shops. All of our new interurban cars are steel underframed and all cars of recent purchase are of all-steel construction.

Our operating department organization includes a training school with practical instructors thoroughly qualified by experience, and with proper equipment, including a motion picture outfit. Employees in the operating department are required to take physical tests every three years and oral and written examination on the book of rules especially prepared after some months of study and analysis. These examinations primarily are given after a three weeks' course in the training school and on the road, and finally and comprehensively given at the end of a sixty-day term in the school. The Brown system of discipine is in effect. The same signal test system adopted by many of the steam lines is in effect and rigidly enforced, every operating officer from the general superintendent down being under the necessity of personally conducting tests, which are properly distributed as to divisions, men and rules each month.

With the great number of road crossings and the very large number of automobiles in southern California, the street traffic of various towns and cities to look after, and the many railroad crossings to be guarded against, it has been determined that only thorough qualification of employees and a rigid follow-up system will enable us to maintain our present service in the face of these increasing difficulties to the satisfaction of the public and ourselves and with "safety first" always in our mind.

We want our visitors from the East at the convention in their itineraries to allot enough time to southern California to view it thoroughly. This is a land of hospitality and they will be met with open arms. While, with our sightseeing excursions operated daily a very satisfactory view of southern California may be had in three or four days, yet, if possible, double that time should be allowed.

Magnolia Avenue, Riverside

The Railway on Mount Lowe

Businesslike Methods in Handling Freight by Electric Railroads

Freight Business, Begun by Handling Materials for Building Construction, Now Embraces Every Character of Goods—It Has Been Found Desirable to Handle Express via the Old Line Companies

By J. McMILLAN
General Manager Pacific Electric Railway

Freight Train Approaching Road Crossing

PRIMARILY, the Pacific Electric Railway, like almost all other electric railroads, was designed, constructed, and equipped not for freight handling but for the performance of rapid passenger transportation, or, in other words, for passenger traffic purposes and what might be called the by-products thereof, namely, the handling of such traffic as usually accompanies the passenger business, like United States mail, small packages and express matter.

Early Developments

After the first few years' operation it became quite apparent that the new territory into which the lines had been and were being projected could not develop to the fullest extent without the facilities for bringing into them and to the most convenient points of delivery the necessary materials and supplies for development and improvement. This, of course, meant the establishment of lumber yards, warehouses, etc., for the supplying of building material, lumber, brick, cement, sand, etc., for the building of residences, store buildings, etc., on the many sites decided upon as suitable locations for stations and towns. To accomplish this much-to-be-desired result, the Pacific Electric Railway began in a small way in the freight traffic business by purchasing a few freight cars when they were found to be necessary for the accommodation of the business strictly local to its own lines. After development of the kind mentioned had taken place, the lands improved and places of business established, it, of course, became necessary to extend the freight handling to the extent of hauling to them the merchants' stores supplies, and then, a little later, to afford transportation to the local markets

for the products of such communities and developed territory. It is plain, therefore, that the Pacific Electric Railway entered into the freight traffic business more from force of necessity, for the purpose of developing its territories and populating the same in order to create a reliable and permanent traffic, rather than from the desire or expectation of profiting from freight hauling.

Therefore, as is made plain by the foregoing, the Pacific Electric Railways freight traffic, like Topsy, "jes' growed" during the first four or five years of the company's existence until the extent of it and the question of a more satisfactory manner of handling it became an embarrassing one—embarrassing because the facilities for handling it had not been provided and had not been considered in the first place as a contingency to be very amply provided for. Fortunately, the projectors, who were the owners, had the foresight to secure, in most instances, ample rights-of-way and station ground facilities. Possibly this came more as the result of previous experience in the construction and equipment of steam railroads, therefore somewhat of a habit, than from foreseeing that the same would later be necessary for anything like a satisfactory provision for freight traffic handling. As a result of this situation, when it had become quite apparent that the Pacific Electric Railway must be a "regular" railroad for handling all kinds of traffic possible to be handled by any kind of a railroad, and many kinds possibly not handled by most railroads as freight shipments, the company began paying more attention to the freight and express features of its traffic and providing proper facilities in the way of rolling stock and power equipment and stations suitable for such traffic. Then the realization that the builders had built wisely in the securing of station and terminal grounds began to be quite apparent to the road's operating officers, and it was then they commenced to build regular station structures and to provide the necessary station and terminal trackage for the accommodation of the freight traffic.

However, like the fellow who bought the set of harness at auction, then had to buy a horse to fit the harness and then a buggy to fit the horse, and then build roads around the farm over which to use his acquisitions, the question of providing for the handling of through shipments of both freight and express matter was unsettled; that is to say, the handling of matter coming from and going to points beyond its own lines and in many instances interstate shipments. The reason was that as the communities were developed and started along the lines, and the products became more than the local markets could take care of, more distant markets were sought and in return, of course, more distant sources of supplies of merchandise sought these local markets which wanted their goods possibly as much as the more distant markets wanted the local products.

As the steam railroads had not joined in through rates and the interchange of traffic and freight equipment, it was, of course, necessary to move all through freight shipments, both carload and less than carload, by making the rates by the combination of locals; in other words, the rates of both or all the lines handling the same, and to transfer the shipments at what are now called interchange points. This same condition prevailed in the handling of express matter, as the Pacific Electric Railway for several years was operating its own express company, known as the "Pacific Electric Express." These conditions, involving the combination of the rates of two or more lines and the rehandling of through freight shipments coming from and going to the Pacific Electric Railway's local stations, placed a heavy handicap on the merchants or industries located exclusively on the electric railroad. This handicap, however, was, a little later on, made somewhat lighter as to the rehandling of through shipments by means of a limited arrangement whereby the connecting steam railroads agreed to allow their freight cars, and foreign line cars in their possession, to be loaded solidly; that is, in commodity carload lots, to go to their destinations on the Pacific Electric Railway's lines, not competitive with the steam railroads, for delivery.

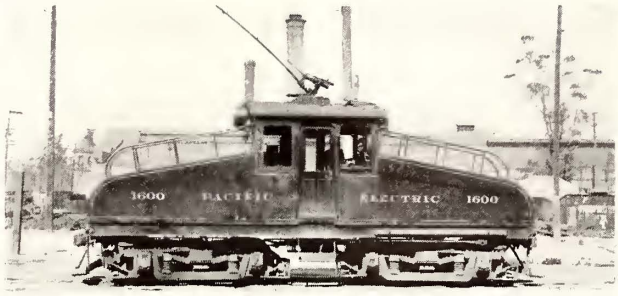
They also agreed that where back-loading was offered to accept the cars back in the same manner; namely, on the combination of local rates. The electric railroad agreed to pay demurrage charges on the steam road's equipment just as would be charged a merchant or shipper for cars delivered to industry or private service tracks. This condition prevailed up to about two years ago, the higher rates due to the combination of locals still acting as a handicap to a large extent against the electric railroad's freight traffic, and being, of course, a handicap to just that extent upon the electric railroad's shippers or the shippers located thereon having to make or receive shipments to and from points beyond the rails of the electric railroad.

Free Interchange of Traffic with Steam Railroads

All these handicaps upon the company's freight traffic and against the free interchange of traffic with steam railroads were removed about two years ago by the good old Southern Pacific coming to our relief with a liberal freight interchange arrangement and the application of through rates, both State and interstate, to and from all stations on the Pacific Electric's lines. Since then, this electric road's freight business has grown quite rapidly.

Evidence of this increase in the electric freight traffic is found in the figures which show that for the first ten months of the fiscal year 1914-1915 the freight tonnage for the system increased 22 per cent over the same period of the previous fiscal year, 1913-1914.

Notwithstanding this, the fact, and the evidence thereof, still remain that the Pacific Electric Railway was designed to serve and does serve the public as a high-class rapid-transit passenger carrying line, because its freight traffic, even after all the development described, amounts now to only 13 per cent of its gross earnings.



Pacific Electric Locomotive, Type 1600, 1000 Hp., Built Ten Years Ago and Still Doing Good Service

Freight Handling Equipment

Another evidence of wise building, or provision, is the fact that in the acquisition of freight equipment, the Pacific Electric Railway has, from practically the very beginning of its provisions for handling freight, purchased and provided standard freight equipment of the same type and equal in quality to the freight equipment of any steam railroad, and superior to that of many steam roads. At this time the company owns 223 box cars, of which ninety are of 100,000-lb. capacity, the rest varying from 80,000-lb. capacity down to 40,000-lb. capacity; 349 flat cars, of which 212 are of 100,000-lb. capacity; 454 gondola cars, of which 250 are of 100,000-lb. capacity, 100 of the latter being of steel construction throughout; thirty-one oil tank cars; ten standard 80,000-lb. capacity stock cars, or a total of 1149 freight cars that are of standard construction and are interchangeable with those of standard steam railroads; twenty-six express and express-freight cars, and eighteen combination express-passenger cars. This does not, of course include any equipment that is assigned for the exclusive use of the construction and maintenance of way departments, such as tool cars, line cars, wreckers, etc.

All freight equipment is handled over our own lines by electric locomotives, of which there are eleven 1601-class which weigh approximately 65 tons, and have a tonnage rating of approximately 1400 tons; sixteen 1550-class which weigh approximately 50 tons and have a tonnage rating of approximately 800 tons, and twelve work-train-type locomotives, which are put in freight service and switching service where necessary to help out in heavy movements. Six locomotives of class 1550 have General Electric equipment; all the other locomotives have Westinghouse equipment. In addition, the express-freight type of express car is so flexible, having a loading capacity of 40 tons of freight inside, that it can serve as a locomotive in moving carload shipments between local stations, as well as distributing carload shipments where the emergency requires it and bringing in carload shipments of perishable freight, fruits, berries, vegetables, etc. It has a train-pulling capacity of from eight to ten loaded cars.

The Freight-House Force at the Los Angeles Station of the Pacific Electric Railway

There is considerable satisfaction in the fact that when interchange with steam railroads did come about we encountered no handicap worthy of note on the freight car equipment feature of the business.

Regarding the express business: I should have explained that on account of the handicap on that business coming from and going to far-distant points because of the combination of the two rates, the lack of ample free delivery facilities, extended free delivery limits, etc., it was deemed the better policy, both for the benefit of the Pacific Electric and the public patronizing it, to make an arrangement with an old-line express company. Such an arrangement was made with Wells Fargo & Company, some eight years or more ago, by which that company operates over the entire system, even into and out of what might be called rural districts and under which through rates are applied to and from all Pacific Electric Railway points the same as to and from all steam railroad points on roads operated by regular express companies. Hence, where patrons had formerly to pay the rate to and from Los Angeles, plus the local express rate between Los Angeles and the destination or shipping point on the Pacific Electric Railway, they now pay only the one rate between the points of origin and destination, in most instances saving entirely what was formerly the electric railroad's local express rate. Notwithstanding this saving to the shipper, the electric railroad derives more net revenue from the express business than it did under its local rates and handling. In addition to handling the express business in straight express cars with messengers over lines supporting heavier express traffic, a large amount of this business is handled in connection with passenger service in the express compartment of combination express-passenger cars.

Pacific Electric Locomotive, Type 1601, Showing an Example of a Purchased and Later Design

The most difficult part of the electric railroad's freight business has been to overcome what seems to have been and is yet to some extent the opinion of shippers generally that it costs electric roads nothing to handle freight traffic. In fact, the general idea seems to have prevailed throughout the country that electric railroads are built and operated for the purpose of reducing rates. It can be said to the credit of the Pacific Electric Railway that it has never, since its beginning as a railroad, been a rate-cutter, rebater, or demoralizer in any sense of the word. It is true that its rates generally are very low, but they have been made so only to meet conditions; that is, the established rates of other lines into competitive territory as such existed at the time of the opening of the electric railroad for operation, or as the rates were made by the steam railroads at about the time this electric railroad entered the field, or since.

The company's management has tried to follow the policy that "the servant is worthy of his hire," and as its service is of the very best there is no

Express Transfer Between Pacific Electric and Southern Pacific Steam Cars at Wells Fargo Station, Los Angeles

reason why it should not receive as much compensation therefor as any other railroad receives for similar service. It has been and is still the policy of the company to give the best service possible for the compensation received. We know that some electric railroads in some parts of the country have made themselves, as well as all other electric railroads, unpopular with the established steam railroads by following unfair methods in securing and handling freight in an irregular way and by scalping the steam road's rates between competitive points by taking local shipments, packing cases, boxes, packages, etc., between such points, particularly from jobbing centers, into the country on the platforms or inside of their passenger cars and thus distributing to country and village stores along the line at almost any old rate.

On a trip east some four years ago, in riding over the electric roads, I noticed this being done by an electric interurban road in a State and from a city it is not necessary to name. Upon visiting the local manager to see at what rates his road was doing such business, and thinking from the way it was being handled his road was receiving not less, and possibly more, than the express company's rates, I was surprised to learn that such shipments were being handled at much less than the steam railroad's freight rates, which, the Lord knows, were too low even for old-established steam railroads to make any money.

Effect of Unfair Practices

To my mind it is just such practices as these on the part of some electric railroads, of which the foregoing is only one example, that have made the established steam railroads loath to recognize electric railroads as freight carriers and to enter into traffic interchange relations with them. Really, it is hard for an unprejudiced railroad officer to see how they could be expected to do so until the electric railroads shall have ceased their haphazard and what might be called disreputable practices and begin doing a freight traffic business on a business basis. My own views are and have been for some time on the same principle; that is, that we are all supposed to pay willingly for what we get. The Pacific Electric Railway or any other electric railroad performing as high-class service should receive a somewhat higher rate for its service, and particularly its freight service, which is, as a matter of fact, practically express service at freight rates. About the only difference between this and express service is the free pick-up and delivery which is performed by express companies and which we all know is, of course, quite an item of expense to freight shippers in the forwarding and receiving of freight shipments.

It might be said by those unfamiliar with the conditions that this is wrong and possibly unnecessarily extravagant handling and dispatch of freight traffic, but with the Pacific Electric Railway it is a case of necessity; for on account of the passenger train units being so frequent and fast, it is necessary when the freight leaves the terminal and gets out onto the lines to move it quickly between stations and handle it quickly at stations to keep it out of the way of passenger cars and trains. Unfamiliarity with these conditions has been the cause of much adverse criticism from some sources that the electric roads' freight service is thought to be unnecessarily extravagant, as well as unfair to old-established steam railroads. Nevertheless, it is hard to see how an electric railroad, the Pacific Electric in particular, could handle the business with any degree of satisfaction to itself as well as to the public in any other way than the way in which it is being handled. As a general proposition, this company's freight traffic is solicited, receipted for, handled, way-billed, loaded, shipped, and delivered in the same manner as such business is handled by the best regular steam railroads, with the possible exception of somewhat closer attention to details and dispatch in loading, moving over the lines and unloading at destination, due to a large extent to the nature of the business. In short, all connected with the business naturally become somewhat electric (quicker) in their habits and movements, as well as the necessities of the situation already explained. However, it is largely due to the compactness of the property and the advantage in this respect which the managing officers have in keeping their fingers on the pulse of the lines at all times.

Expeditious Service

I have been told by the manager of the Pacific Car Demurrage Bureau that the Pacific Electric Railway's records for the prompt movement of and low detention to freight cars excel those of any other member of the bureau. This fact is due, no doubt, to reasons already explained combined with the close attention to detail and alertness of the car service department; also, to its facilities for keeping in close touch by telephone with the handling of rolling equipment at every point on the system.

As far as possible, however, freight traffic moved in trains drawn by locomotives is moved at night. The reasons for this are obvious to electric railroad operating officers; first, because such trains are, of course, slower than passenger trains, the latter are fewer and farther apart at night, and the freights have more opportunity to get over the lines from station to station without delaying passenger cars and trains; and, second, the night power supply, purchased from hydroelectric companies, besides being adequate in amount for

heavy motor movements is much lower in cost. It is still questionable in my mind whether heavy freight train service can be performed at a profit during heavy passenger traffic hours, particularly during peak-load conditions with power at the cost of that used for passenger transportation purposes.

Package Freight Business

It is, of course, necessary to perform what we call "package freight" service; to wit, small, less than carload, shipments of merchandise, a large portion of which has to be delivered at prepay stations, non-agency points, highway crossings, country stores, etc., during daylight hours to avoid the same being stolen or damaged by the weather were it left at such points at night. Such shipments are generally handled in what we call "express-freight" cars, one, two, or three cars per train, according to volume of business, by two trips daily over most of the lines, one in the forenoon and one in the afternoon over the heavier traffic lines, and one such trip starting out in the early forenoon over the lighter traffic lines. Generally, these same cars return to Los Angeles loaded with milk, cream, and package shipments of berries, vegetables, etc., for the Los Angeles markets, the empty cans and crates being taken out and distributed on the outbound trips of such cars and trains. On some lines, however, the milk traffic is of such volume that some runs of such cars are classified as strictly milk trains and are in that service exclusively, returning the empty cans to their many points of loading on the outbound trips. Freight delivered in the forenoon is forwarded on the afternoon trip, and is generally in the consignee's hands the same afternoon or evening; that delivered during the afternoon and evening is forwarded on the next morning's trip of such distributing cars and is delivered to consignees before noon the day following its delivery for shipment to the freight station in Los Angeles. These express-freight distributing cars also carry what is commonly called less-than-carload perishable freight, such as the daily supply of fresh milk, ice cream, fresh meats, fresh fruits, vegetables, etc., from the larger markets in Los Angeles for the daily supply for the larger outlying cities, particularly the beach towns and cities, such as Long Beach, Venice, Santa Monica, and the various ocean and mountain resorts served by these lines. Heavy or imperishable shipments of less-than-carload merchandise received at the Los Angeles freight station during the day is, as far as possible, loaded into separate cars for the larger cities and towns like Long Beach, San Pedro, Santa Ana, Huntington Beach, Covina, Monrovia, Pomona, San Bernardino, and Riverside, thus reducing to the minimum the handling and distribution of less-than-carload shipments by crews on the night freight trains. Where there is sufficient of such shipments to fill a car or cars for a town, the cars are sealed at Los Angeles, sent out in the night freight trains and placed at destinations ready for unloading by the station force the first thing in the morning, so that consignees may secure the goods in time for that day's business.

It is, no doubt, this kind of service, to some extent necessitated by electric railroad exigencies, that causes the local merchants and shippers generally along the electric lines, even at points strongly competitive with one or more steam roads, greatly to prefer the electric railroad's freight service over that of the steam roads.

Typical Pacific Electric Local Station at Gardena, on the Redondo Line, with One Freight Car and One Express Car

Exterior View of Pacific Electric All-Steel Passenger Car

Head-on View of Pacific Electric Pressed-Steel Car, Showing Automatic Air and Electric Coupler, Anti-Climber, Etc.

Interior of Latest Pacific Electric Pressed-Steel Car, Showing Seating, Ventilators and Fare Collecting Mechanisms

Latest Pacific Electric All-Steel Combination Express and Passenger Car

New All-Steel Passenger Cars for the Pacific Electric Railway

A Description of the All-Steel Cars Just Delivered, Including Some Safety-First Braking Features, Modern Lighting, Etc., Is Given

By FRED F. SMALL
Mechanical Superintendent Pacific Electric Railway

THE following is a brief description of our twenty-four new all-steel passenger cars built for the 63-mile run on the 600-1200 volt d.c., Los Angeles-San Bernardino line, of the Pacific Electric Railway.

The car bodies and trucks were designed by the railway company and built by the Pressed Steel Car Company, McKees Rocks, Pa. In designing both car bodies and trucks the railway has kept the safety-first question constantly before it, and with that primary object in view has decided that the cars hereinafter described fulfill all requirements as to safety, speed and comfort to its patrons. No attempt has been made to reduce the weight of material required in the construction of these cars. They have simply been built strong and substantial and in keeping with the high-class passenger service for which they are intended.

The general dimensions of the cars are shown in the accompanying table.

Gage	4 ft. 8½ in.
Length over end sills	47 ft. 2 in.
Length over buffers	58 ft. 1 in.
Length over pulling face of coupler	59 ft. 7 in.
Bolster centers	34 ft. 0 in.
Width over side sills	9 ft. 2 in.
Width over all at eaves	9 ft. 4¼ in.
Width inside in the clear	8 ft. 7¼ in.
Height floor to ceiling	8 ft. 6 3/16 in.
Height rail to bottom of sills	3 ft. 7¾ in.
Height rail to top of platform	4 ft. 4 in.
Height rail to top of roof	13 ft. 1 11/16 in.
Wheelbase of trucks	7 ft.
Weight of car body (without equipment) estimated	50,000 lb.
Weight of two trucks (without motors) estimated	29,000 lb.
Weight of car completely equipped, estimated	108,000 lb.
Seating capacity	60

Car Body

The underframe consists of two 7-in. 15-lb. I-beam center sills and 6-in. x 3½-in. x ⅜-in. angle-iron side sills. The ends of the sills are securely riveted to combination bolster and platform steel castings furnished by the Commonwealth Steel Company. The sills are tied together by means of 4-in. 5.25-lb. channels which serve as bridgings to support the flooring. In addition to cross bridgings there are two cross-ties each consisting of two ½-in. x 5-in. plates, one plate passing directly over the center sills and the other extending directly underneath them.

Cross-ties are located symmetrically near the center of the car and are spaced approximately 11 ft. They are securely riveted to the top and bottom of the center sills, and are brought together at the side sills to which they are fastened by means of suitable plate gussets. These cross-ties serve to support the weight of the center sills and flooring, and transfer the same to the side framing. As applied to sills they project but little below them and offer no obstruction or hindrance to piping and equipment applied to the bottom of the cars. The arrangement of cross-ties and bridgings as well as the spacing of sills is shown on the cross-section and on the general plan drawings on page 491. The two car types are the same except that one has a 14-ft. express compartment.

The body side framing consists of 3-in. x 3-in. x 5/16-in. to ¼-in. 5.5-lb. tees securely riveted to the side sills at the bottom, and to 3½-in. x 3½-in. x 5/16-in. side plate angles at the top.

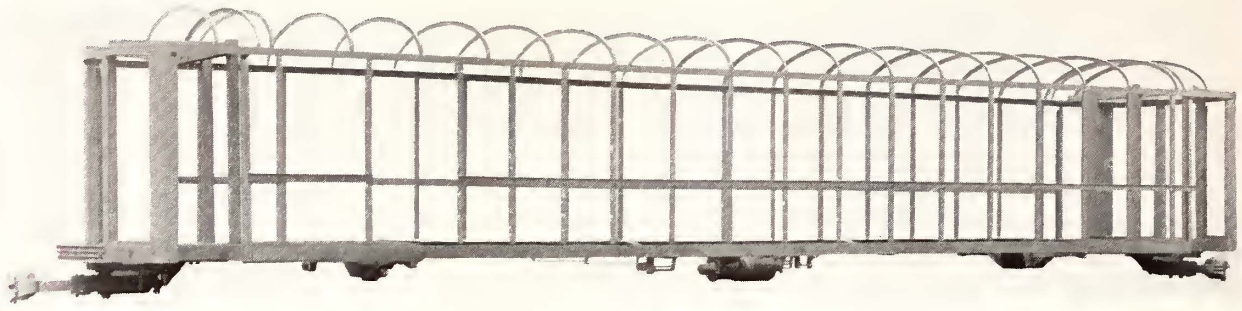
The belt rails consist of a 3½-in. x 1-in. x ⅜-in. dropper bar extending in one continuous length between the body corner posts. The side sheets and the letterboard are of ⅛-in. steel. The carlines are of 2½-in. x 1½-in. x ¼-in. angles securely riveted at the ends to the side plate angles. Roof sheets are of 3/32-in. steel.

The flooring is of Flexolith laid on Keystone galvanized steel floor sheets. A layer of ¾-in. magnesite is applied below flooring for insulation. The floor in the aisle is covered with a "Wearproof" mat extending the full length of the car between the body end doors.

Interior Finish

The cars are finished inside in mahogany and the ceiling and wainscoting are of ¼-in. Agasote. Light wood furring is fastened to the side posts and carlines to afford means of fastening the Agasote and the mahogany inside finish. The inside of the roof sheets and side sheets is lined with three-ply Salamander hair-felt insulation in order to afford protection against very high or low temperatures.

Each regular passenger coach is equipped with two toilets located diagonally opposite, one at each end of the car. The toilets are equipped with white metal wash basins and Duner water closets for use with air pressure water supply. The toilet room fixtures are Adams & Westlake manufacture. Cars



Body Frame of All-Steel Passenger Car for the Pacific Electric Railway

are equipped with continuous basket racks. The racks are enameled mahogany color to harmonize with the interior finish. The cars are also equipped with Automatic ventilators.

PLATFORM ARRANGEMENT

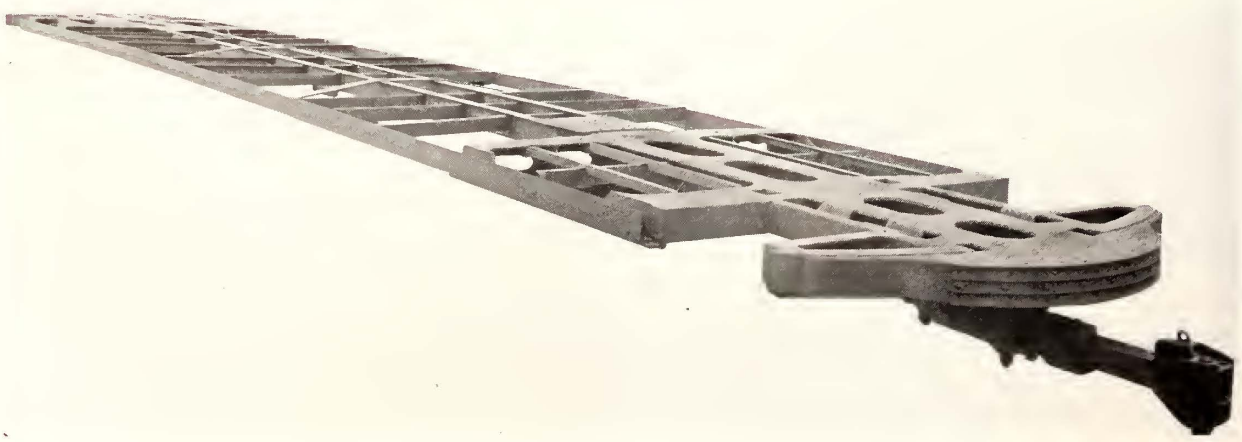
The arrangement of platforms and folding cabs is shown. The Dean end-post construction has been applied to these cars, and this, in conjunction with solid cast-steel platforms, affords an excellent protection to passengers as a means of preventing telescoping. The body and vestibule end posts consist of two 14.75-lb. I-beams each bent into a "U" and inserted through holes in the platform steel castings. In addition to the special heavy Dean end-post construction, the cars are equipped with Rico anti-climbers, which add further protection against liability of telescoping. An oak block is applied directly behind the Rico anti-climbers to serve as a cushion. In the event of possible collision it is considered that these blocks will be crushed and absorb most of the impact, thus relieving the platform and framing from unusually severe shock. The platforms are equipped with O. M. Edwards all-steel trapdoors. The rest of the platform flooring, including step treads, is covered with Mason safety carborundum tread. Stationary steel pilots and Eclipse fenders are also used on these cars.

On account of the short radius curves (45 ft. radius) around which it is necessary to operate these cars in trains it was not considered practicable to attempt to apply vestibule diaphragms between cars.

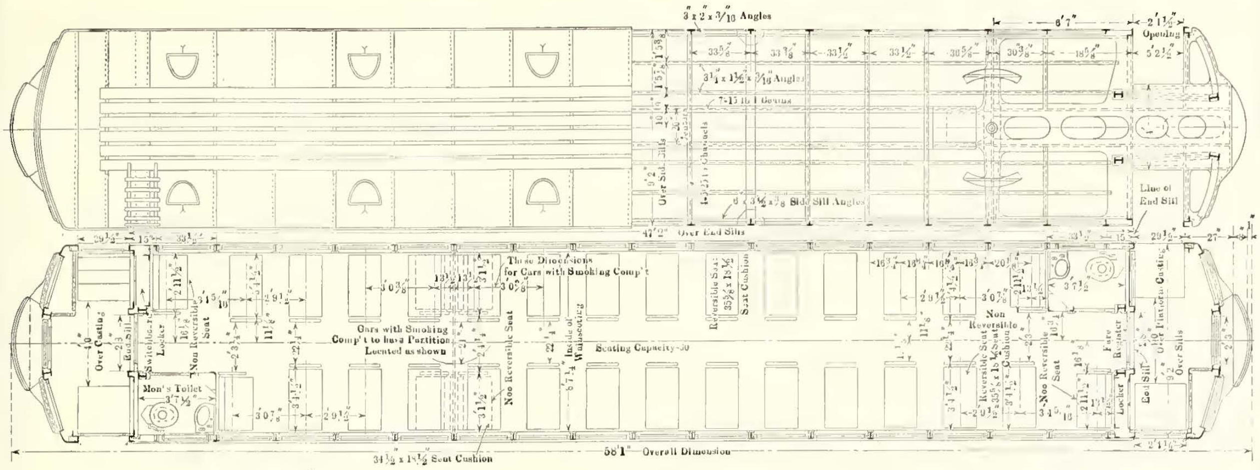
The Westinghouse Air Brake Company's combined car, air and electric couplers are used. These couplers not only serve as a mechanical connection between cars but at the same time make all air-pipe and electrical connections required between cars, thus doing away with air hose and electric jumper cables between cars, as well as the necessity for trainmen to go between cars when making up trains, or cutting off cars. It may be noted that the maximum swing of the couplers when the cars are coupled together and rounding a 45-ft. radius curve is 60 deg. from the center line of the car. On account of this wide coupler swing it is considered that quite an appreciable saving in maintenance will be effected by eliminating air-hose and electric cable connections between the cars.

The cars are equipped with Hale & Kilburn walk-over seats with foot rests and mahogany square-post arm rests. The seat backs are provided with head rolls, bronze grab handles and ticket holders. These seats are spaced 33¾-in. centers to give comfortable seating. They are upholstered in crimson mohair plush, the standard upholstering material on all cars of the Pacific Electric Railway.

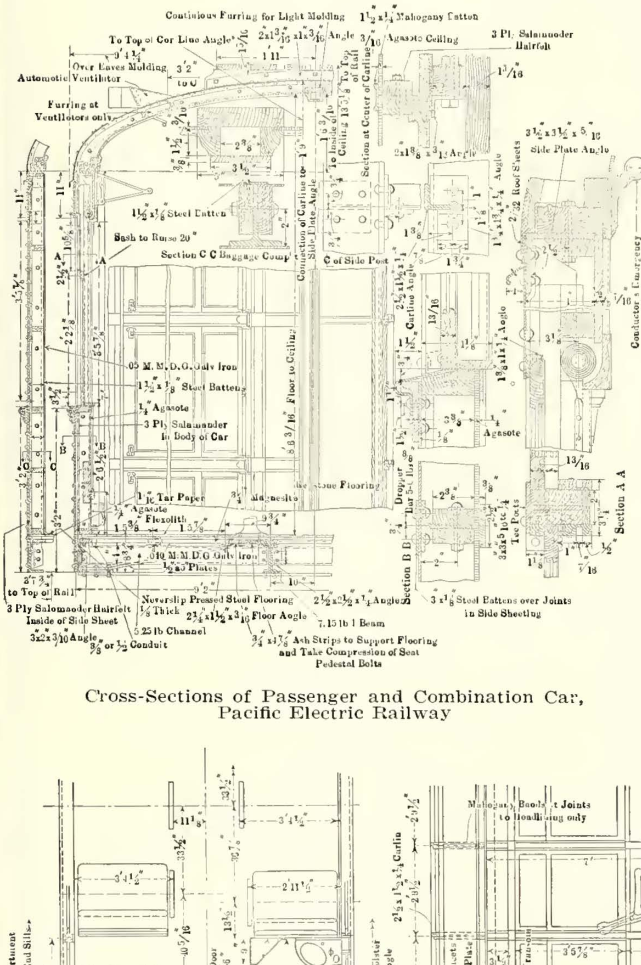
The curtains are of Pantasote and are equipped with the Curtain Supply Company's ring fixtures. The body sashes are of mahogany and are equipped with O. M. Edwards sash locks and compression



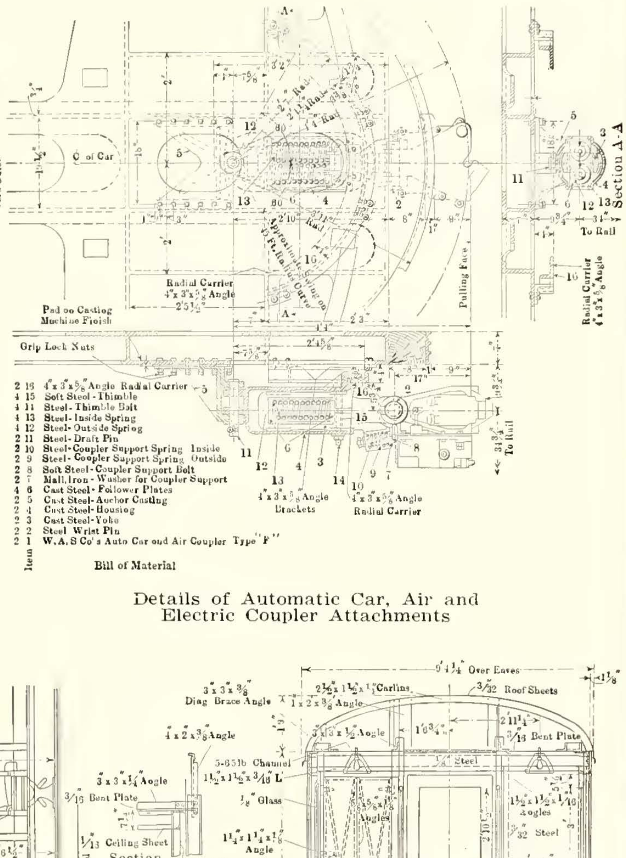
Underframe of All-Steel Passenger Car for the Pacific Electric Railway



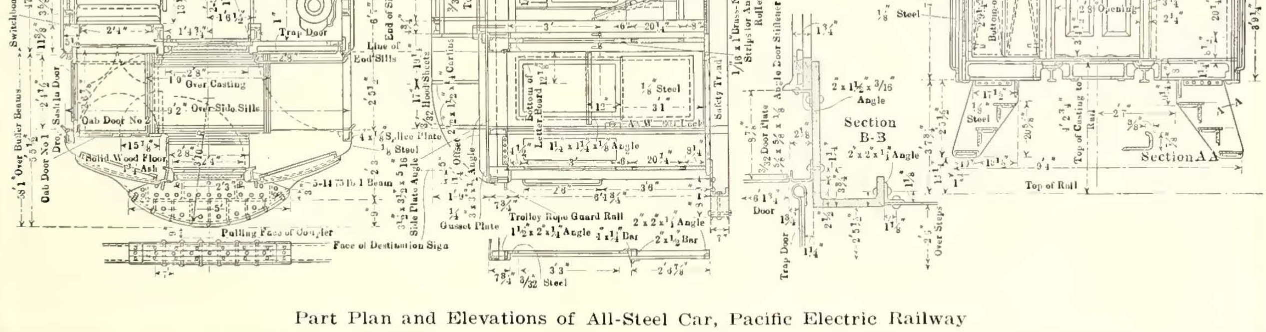
Seating and Framing Plans, 47-Ft. All-Steel Passenger Motor Car, Pacific Electric Railway



Cross-Sections of Passenger and Combination Car, Pacific Electric Railway



Details of Automatic Car, Air and Electric Coupler Attachments



Part Plan and Elevations of All-Steel Car, Pacific Electric Railway

rollers. Other body equipment includes Ohmer fare registers, Hunter illuminated destination signs and bronze, nickel-plated car trimmings.

Trucks

The trucks are of the built-up, double-equalizer swing bolster type with bolsters of cast steel and elliptic springs of sufficient length to possess good riding qualities. These trucks have 36-in. rolled steel wheels, 6½-in. A. E. R. A. Standard vanadium steel axles, 5-in. x 9-in. Symington journal boxes, Baltimore ball-bearing center plates, Woods roller side bearings and Harrison dust guards.

The pedestals of this equipment are provided with channel-shaped steel wearing gibs. Provision is made for raising up cars by the application of shims under swing hanger axle bearings, thus doing away with the necessity of disturbing the adjustment of the side bearing and center plate heights. The bolster chafing plates are arranged so that they may be renewed without removing the bolster from the truck. Case-hardened steel brake pins are used with case-hardened steel bushings.

Electrical Equipment

All cars are motor cars arranged for double-end operation. Each car is equipped with four General Electric 254-A, 150-hp. motors with the same maker's control, for either 600 or 1200-volt d.c. lines. The master controllers are equipped with emergency air-brake attachment. The change-over or commutating switch, by means of which proper connections are made for either 600-volt or 1200-volt lines, is operated by air and remotely controlled by the motorman. Suitable relays and protective devices are provided to prevent possible trouble due to any attempt to make 600-volt line connections while on 1200-volt line.

With the gear ratio applied cars are capable of a speed of 60 m.p.h. Each car is equipped with two of this railway's standard pneumatic trolley bases, 12-ft. trolley poles and No. 23 Kalamazoo trolley wheels and harps. The trolley bases are manufactured in our own shops. They are self-retrieving by means of air pressure. Trolley retrievers, therefore, are not required. "Ideal" trolley catchers are used to take care of the trolley rope.

Lighting and Heating

The lighting system consists of a single row of eight 56-watt Mazda lamps equally spaced along the center line of the ceiling. Each lamp is equipped with the Safety Car Heating & Lighting Company's brass nickel-plated shade holder fitted with holophane reflector. This arrangement when taken in connection with the ecru-colored oval-shaped ceiling, gives an excellent lighting system with ample intensity of light throughout the entire car. The platforms are lighted by means of dome lamps located directly over each stepway. To avoid interference with the motorman's vision these lamps are transferred to the destination sign on the operating end of the car. Step lights are located one at each corner of the car for the convenience of passengers boarding or leaving. For headlight service we use the 4-amp. portable combination Crouse-Hinds type L.A.A. luminous arc and incandescent headlights, with independent resistance.

Each car is equipped with twelve 500-watt, 1200-volt heaters of the truss-plank type, manufactured by the Consolidated Car Heating Company. The heaters are arranged for operating twelve in series on 1200 volts with suitable connections to the change-over switch for changing to two groups of six in series on 600 volts.

Brakes

The cars are equipped with the Westinghouse Air Brake Company's latest improved Universal, quick-action, high-pressure, automatic, air-brake equipments. Air pressure is furnished by means of a Westinghouse dynamotor compressor having a displacement of 35 cu. ft. An automatic control switch is inserted in the cable which furnishes current to the controller. This control switch remains open-circuited until the compressor has raised the air in the main reservoir to a certain pressure. By means of this simple device it is impossible to start the car in the usual way by any movement of the controller until the air pressure has been raised a predetermined amount considered sufficient for the proper operation of the air-brake equipment. This is a safety feature and prevents any movement of the car without the air pressure required to stop it. A spring by-pass switch is located in the motorman's cab to short-circuit this device, and when held closed by the motorman it enables the car to be moved without air pressure. This is installed to permit the cars to be run out of the carhouse, as in case of fire, without waiting for cars to pump up the air pressure required to close the automatic control switch.

In addition to these improved air brakes, the cars are also equipped with the St. Louis Car Company's "high power" pilot-wheel hand brake.

Conclusion

Without attempting to go into any long and tedious description of the cars the writer has attempted to show that the Pacific Electric Railway has spared no expense to obtain cars consistent with the best engineering design and practice. Much attention has been given to make the cars comfortable and easy riding, and I have no doubt that they will meet all requirements and be in keeping with the high-class interurban service for which they are intended.

Interior of Center-Entrance Car at Platform

Standardization of Twelve Car Types into Two at Los Angeles

One Truck Is Used for All Car Equipment, Whether of End or Center-Entrance, Passenger or Service, Two-Motor or Four-Motor Type

By E. L. STEPHENS
Master Mechanic Los Angeles Railway

STANDARDIZATION is that one appalling word which is written largely on the page of every activity. In its true sense it means efficiency. Conditions may be standardized in two ways: First, by bringing your present conditions to a high state of efficiency; and, second, by making complete changes in all conditions. As standardized conditions underlie the best results from all other principles, they therefore accelerate the progress of efficiency and make work quicker and easier. The conditions that govern efficiency are quantity, quality and economy.

While standardization could be brought about by discarding all equipment and purchasing a new standard, there are few companies which could undertake such a radical change, no matter how valuable the ultimate results might be. Therefore it would appear that the practical solution is that

Standard Center-Entrance, Pay-As-You-Enter Car, Los Angeles Railway

standardization should be gradual for both maintenance and for new equipment. This system involves no great extra expense and, at the same time, accomplishes many of the desirable things of life in a limited time.

The trouble in the standardization of some properties lies not only with the purchaser but with many manufacturers. The latter in designing equipment do not take into consideration the many conditions of interchange of the maintenance parts and will even go so far as to expect radical changes to be made to permit the use of their product. While this is true of some manufacturers, many purchasers also have ideals which are entirely vague. This leads them to make many changes which could not become standard either in their own rolling stock or on any other system. The undertaking of standardizing an electric railway which constitutes the amalgamation of a chain of small companies, each of which had discarded equipments purchased second-hand, is the problem which confronts many rolling stock superintendents at the present time in building all types to a common standard. While some systems have endeavored to be abreast of the times so far as their means would permit, the many miscellaneous items to be considered in standardization will tend to increase the reliability of the service to the public and decrease the maintenance costs of the company.

From Twelve Types to Two

The undertaking to standardize the rolling stock of the Los Angeles Railway was begun under most of the foregoing conditions. We had twelve different types of passenger cars, ten different designs of trucks, seventeen different types of axles and six different types of motors.

The adopted standard car bodies of this company now consist of two types, known as the California combination pay-as-you-enter rear-end car and the center-entrance car. While they differ essentially from each other in their general appearance, yet they are practically the same in construction, except the floor framing. All other construction and parts subject to maintenance such as vestibules, posts, sash, glass and draft attachments are identical and interchangeable.

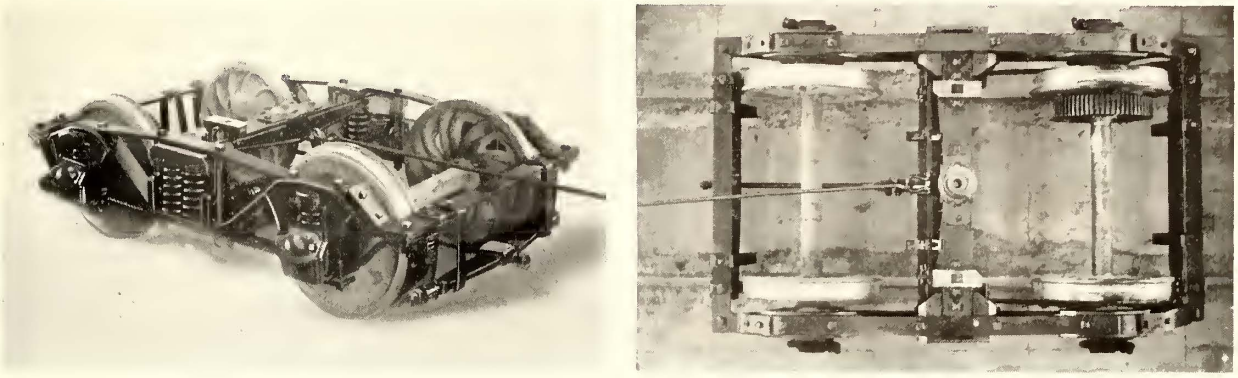
It would be rather difficult to give any detailed description of the rebuilding of these car bodies, as the work of rehabilitation was simply the overhauling of what might be considered obsolete standards.

Three hundred of these cars were changed to pay-as-you-enter rear-end type in the period of two years; but then the fashion of women changeth with the setting sun, and in this age of the hobble skirt, it becomes necessary to "rubber" for new designs to meet the prevailing changes in the mind of the fair sex. To be equal to their call, the development of the center-entrance low step became a necessity.

One Truck for All Cars

In the standardization of trucks, owing to the many different types, it was next to impossible to rebuild them to a common standard. Therefore, it became necessary to eliminate the old and to adopt an entirely new truck which could become a standard common to all cars, both passenger and service equipment, and which could also be used for either double or quadruple motor equipment. No concrete specifications were prepared for the construction of these trucks, as they were built at the company's shops. Special machinery and jigs were built expressly for this purpose. In the construction of this truck, all parts are not only a special standard but are also interchangeable. Thus the top and bottom arch bars, end plates and braces will fit on either end side, or reversed, and the pedestals are the same. No rivets enter into the construction of

Standard End-Entrance, Pay-As-You-Enter Car, Los Angeles Railway



Side and Top Views, Standard Los Angeles Railway Trucks

this truck, all of the parts being very firmly held in position by bolts, which give a perfectly noiseless truck.

Axles, Brakeshoes and Motors

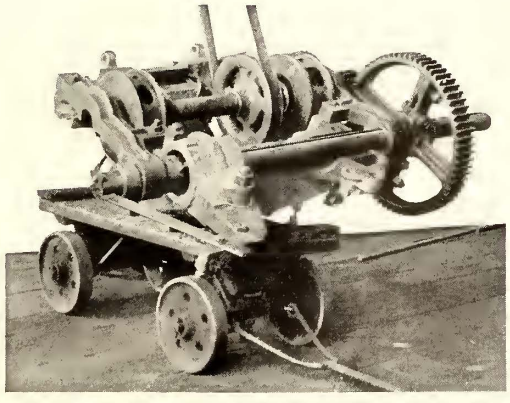
The maintenance of seventeen different axles was a serious condition. After due consideration a 4½-in. cold-rolled steel axle with 30-in. chilled cast-iron wheels was adopted. While we have a single truck as a standard, we have both double and quadruple motor equipments to maintain. This necessitates two different classes of brake construction. With the double motor equipment the brake attachments are simplified to the adjustment of a single nut.

The standardization of brakeshoes also received due consideration. Where seven different kinds of shoes to supply different trucks had been required, six were eliminated and a single shoe was adopted. This is a reinforced-back cast-iron shoe.

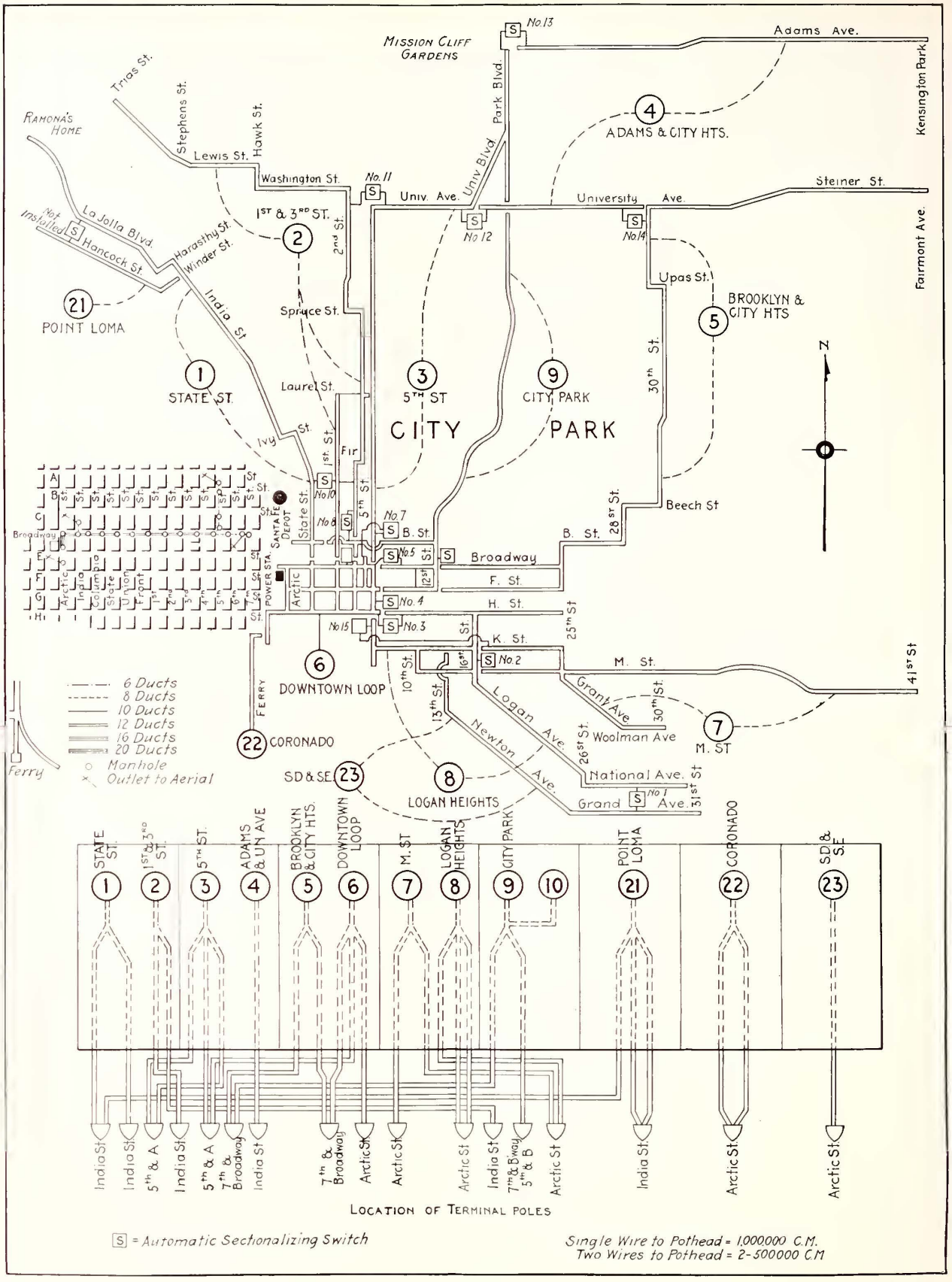
With seven different types of motors to maintain, some of which could not be rebored to fit the adopted standard 4½-in. axle, it became necessary to scrap many of the old motors. As the adopted axle was larger than that for which many of the motors were originally built, it was necessary to devise boring machines for this purpose. One of these machines rebored 828 motors. This was so constructed that it rebored all four bearings in a single operation. This type was shown on page 1332, Electric Railway Journal, Nov. 21, 1914. The other machine handled 384 No. 101 motors, reboring both axle bearings in a single operation. Some of these motors had different gear and pinion centers, requiring special gearings. These distances were changed to a single standard, which permitted the adoption of a single standard gear and pinion. The reboring of all motors for a standard axle also reduced a variety of motor bearings to a single unit.

Many of these motors were constructed originally for grease lubrication. As the later types of motors were constructed for oil the old motors with grease boxes were chipped out, and a special oil feed-cup was applied.

The work already done on standardization is an indication of our independence of the many varieties of car construction. Every standard has certain factors, as supply, use, price and assignment, and the exploitation of these has saved us time, material and equipment. Furthermore, the interest saved in store stock, where many repair parts were formerly carried, has been a large factor in bearing a portion of the expense entailed in this rehabilitation of rolling stock. The space required for stores is one-half of former days, although we are operating more cars, and the discarded space is now available for car stripping in summer and car washing in winter.



Motor Boring Bar Device



The Sectionalizing of Electric Railway Feeders at San Diego

Map and Diagram Showing Feeder Panels and Districts Controlled in Connection with the Use of Automatic Sectionalizing Switches

A View Among the State Buildings at the San Diego Exposition

The Sectionalizing of Electric Railway Feeders at San Diego

Sectionalizing Switches Adequately Handle Conditions that Otherwise Would Call for a 30 Per Cent Increase in Copper Over Present Use

By HOMER MACNUTT
Superintendent of Motive Power San Diego Electric Railway

THE overhead system of the San Diego Electric Railway, consisting of feeders and trolley, differs considerably from most street railways inasmuch as under normal working conditions the sections are connected together all over the system with automatic sectionalizing switches. The feeders, in consequence, all operate in multiple as shown in the accompanying drawing of trolley sections. The switches are automatic in the sense that they are controlled from the switchboard. At the power station, the feeders to the different lines are mounted on separate panels through switches and breakers in the usual manner, but in case of accident or ground, any section may be cut out by opening the feeder breakers. It is not necessary in any case when it is desired to cut power off of any section to send a man out to pull switches, and as soon as the trouble has been cleared, the operator puts the section back on the line, thereby closing such sectionalizing switches as may be connected with it.

The first part of the San Diego installation was made in 1911 when eleven General Electric switches were installed. They worked out so satisfactorily that in making additions last year five more were installed. Nine of the switches are located within a radius of 1 mile of the power station, and during the five years of application not a single switch was lost. Further, the total amount for repairs during this period has been less than $25.

As the feeders work in multiple, the peak demand is divided among several feeders and the maximum current on any one is much less than if all the current for that one section was delivered over but one feeder. The result is a comparatively steady load on each feeder out of the power station with each feeder designed for that steady load which is less than maximum. To obtain the same voltage conditions without the use of these sectionalizing switches, an increase in copper of about 30 per cent would be required.

When a "short" occurs on the line, all, or nearly all, of the breakers go out. This is considered an advantage rather than a disadvantage because the total current is divided among many breakers, while without the sectionalizing switches one feeder breaker must open the circuit with the consequent

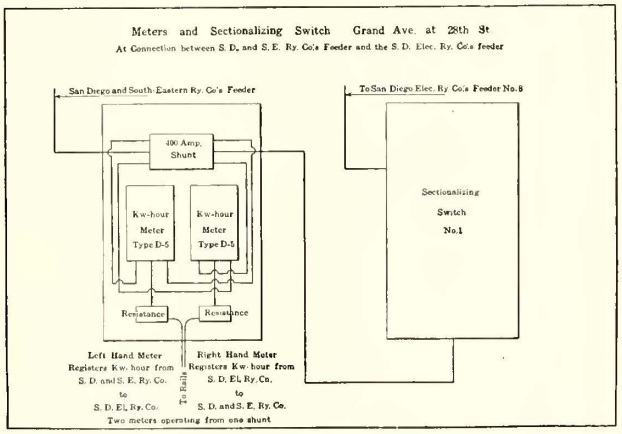


Diagram Showing Connection for Kilowatt-Hour Meters and Sectionalizing Switches

RECORD AT SECTIONALIZING SWITCH NO. 1

Twenty-eighth Street and Grand Avenue
Feb. 15, 1915

Taken before installing the 500,000 circ. mil additional feeder on Section No. 7, from power station to Sixteenth and M Streets.

This side of the zero mark shows the current in amperes flowing from the San Diego & South Eastern Railway Company's feeder to the San Diego Railway Company's Logan Heights feeder No. 8.

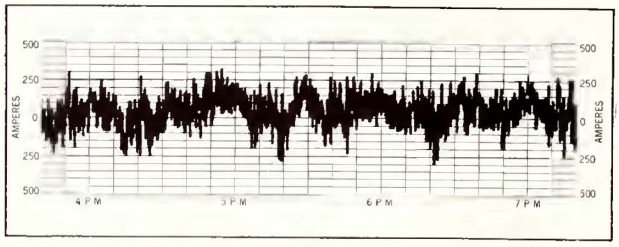


Fig. 1

This side of the zero mark shows the current in amperes flowing from the San Diego Electric Railway Company's Logan Heights feeder No. 8 to the San Diego & South Eastern Railway Company's feeder.

RECORD AT SECTIONALIZING SWITCH NO. 2

Sixteenth and M Streets
March 26, 1915

Taken before installing the 500,000 circ. mil additional feeder on Section No. 7, from the power station to Sixteenth and M Streets.

This side of the zero mark shows current in amperes flowing from the Logan Heights feeder No. 8 to M Street feeder No. 7.

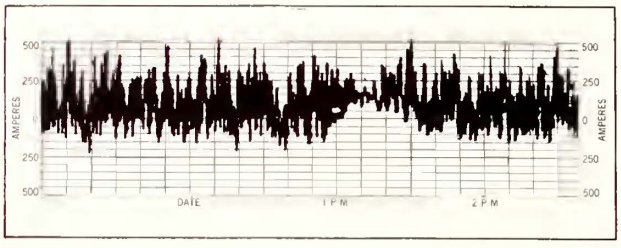


Fig. 3

This side of the zero mark shows the current in amperes flowing from the M Street feeder No. 7 to the Logan Heights feeder No. 8.

RECORD AT SECTIONALIZING SWITCH NO. 3

Fifth and Market Streets
Feb. 1, 1913

Taken before installing an additional 500,000 circ. mil feeder on Section No. 7, from the power station to Sixteenth and M Streets.

This side of the zero mark shows the current in amperes flowing from the Logan Heights feeder No. 8 to the downtown loop feeder No. 6.

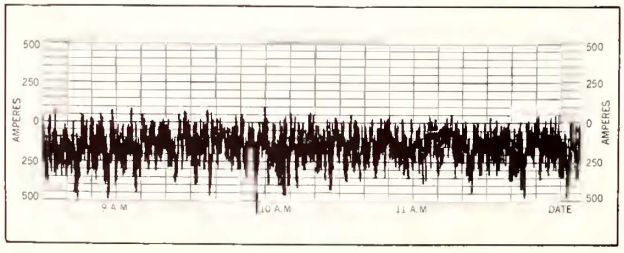


Fig. 5

This side of the zero mark shows the current in amperes flowing trom the downtown loop feeder No. 6 to the Logan Heights feeder No. 8.

RECORD AT SECTIONALIZING SWITCH NO. 1

Twenty-eighth Street and Grand Avenue
July 19, 1915

Taken after installing the 500,000 circ. mil feeder on Section No. 7, from the power station to Sixteenth and M Streets.

This side of the zero mark shows the current in amperes flowing from the San Diego & South Eastern Railway Company's feeder to the San Diego Electric Railway Company's Logan Heights feeder No. 8.

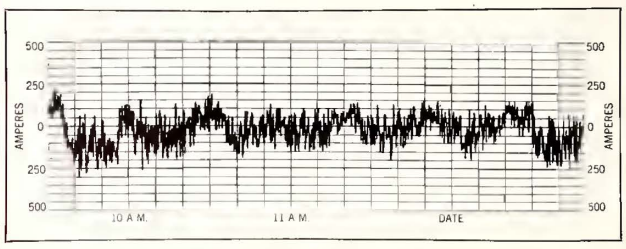


Fig. 2

This side of the zero mark shows the current in amperes flowing from the San Diego Electric Railway Company's feeder No. 8 to the San Diego & South Eastern Railway Company's feeder.

RECORD AT SECTIONALIZING SWITCH NO. 2

Sixteenth and M Streets
July 13, 1915

Taken after installing the 500,000 circ. mil feeder on Section No. 7, from power station to Sixteenth and M Streets.

This side of the zero mark shows the current in amperes flowing from the Logan Heights feeder No. 8 to the M Street feeder No. 7.

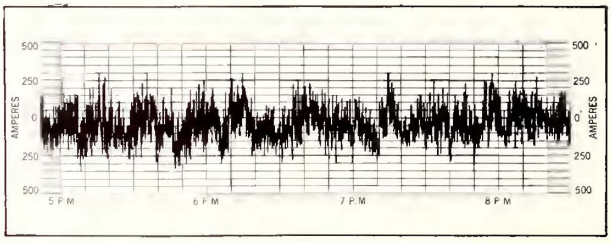


Fig. 4

This side of the zero mark shows current in amperes flowing from the M Street feeder No. 7 to the Logan Heights feeder No. 8.

RECORD AT SECTIONALIZING SWITCH NO. 3

Fifth and Market Streets
July 10, 1915

Taken after installing an additional 500,000 circ. mil feeder on Section No. 7, from the power station to Sixteenth and M Streets.

This side of the zero mark shows the current in amperes flowing from the Logan Heights feeder No. 8 to the downtown loop feeder No. 6.

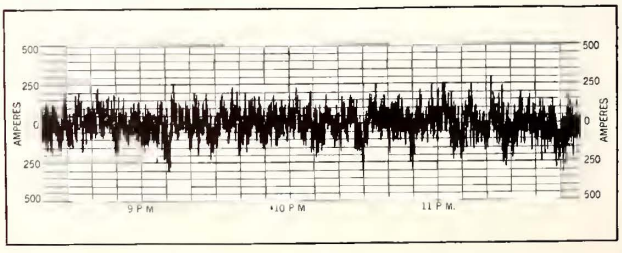


Fig. 6

This side of the zero mark shows the current in amperes flowing from the downtown loop feeder No. 6 to the Logan Heights feeder No. 8.

Graphs Showing the Flow of Current in Feeders Before and After Sectionalizing the San Diego System

burning. During the period this system has been used not a single breaker has been burned or put out of service.

With this system, the current delivered from the power station to any point on any feeder is simply proportional to the resistance. Should the resistances of the two feeders from a switch to the power station be equal, the average current through the switch will be zero, but if the resistances are unequal, the exchange will be all in one direction through the switch, the feeder with the lower resistance delivering the most current. The following example shows the effect of adding copper to one of several feeders operating together:

An additional 500,000 circ. mil. feeder was recently installed on Section No. 7, from the power station to Sixteenth and M Streets and records of the exchange of current through the sectionalizing switches Nos. 1, 2 and 3 were taken, before and after installing, by means of a General Electric Type C-5, curve-drawing ammeter, the zero of which is on the center of the scale. An examination of Figs. 1 and 2 shows that the installation of the additional feeder has made the average exchange of current at switch No. 3 practically zero instead of being about 175 amp. from the loop feeder No. 6 to the Logan Heights feeder No. 8. In other words, this load of 175 amp. has been shifted from feeder No. 6 to feeder No. 8. Similarly, Figs. 3 and 4 show how much the exchange current at switch No. 2 has been reduced and the load demanded by feeder No. 7 carried by the new feeder instead of being obtained from feeder No. 8. Going to switch No. 1, Figs. 5 and 6 show that feeder No. 8 now is in condition to deliver current to the San Diego & South Eastern Railway instead of demanding current from the San Diego & South Eastern Railway, as is seen by the charts.

The San Diego Electric Railway has extended this system to interurban and suburban lines which are customers and take 600 volts direct current direct from the power station. The benefit is mutual as it not only gives the customer additional capacity and better voltage, but gives the city lines the advantage of such copper as is in place on the customers' lines. An accompanying diagram shows the interchange of current between the San Diego Electric Railway Company and the San Diego & South Eastern Railway Company's feeders at switch No. 1. In general, the chart shows that this customer demands more current through this switch from the city lines than the city lines demand from the customer. At such points of connection it is necessary to install, beside the sectionalizing switch, two kilowatt-hour meters. One of these meters registers the energy transferred from the customer to the city lines and the other registers the energy transferred from the city lines to the customer. Each meter is arranged with a detent to prevent it from running backward when the current reverses. The difference between the amounts of power transferred in each direction is the net transfer in one direction. Should this net transfer be in favor of the customer, it is added to his monthly bill; but is subtracted if it is in favor of the city lines. Another drawing shows the connections of these kilowatt-hour meters and the sectionalizing switch with the feeders at Grand Avenue and Twenty-eighth Street. Such connections are made as far from the power station as possible.

The Calle Cristobal, San Diego Exposition. Street Lights Illuminating the Building Fronts

Jitney Attack in Full Swing as Photographed at About 5 P. M. at Eleventh and Main Streets, Los Angeles

The Rise and Decline of the Jitney in Its Birthplace

The Enfant Terrible of Transportation, Its Birth and Vicissitudes—The Unregulated Jitney Can Injure but not Supplant the Electric Railway

By E. L. LEWIS
Superintendent Los Angeles Railway

IN earlier years the only competitor of the electric railway was the wagon or bus transportation, begun by striking trainmen, but these never outlived the period of the strike and often died earlier. It remained for the free-lance 5-cent automobile, or jitney, to offer a seemingly durable competitor, if not a successor, to the electric street railway.

Since Los Angeles has the doubtful honor of having given birth to the jitney its experience with this *enfant terrible* of transportaton is longest and, therefore, possibly most illuminating. It was on July 1, 1914, that the first 5-cent automobile appeared on our streets. Our city, like the rest of the country, was in the slough of industrial depression, and thousands of men were ready to grasp at anything that promised a living. The newspapers also brought many into the jitney ranks by exaggerating the income and ignoring the inevitable items of outgo of jitney operation. No wonder, then, that by Dec. 31, 1914, the number of jitneys had reached the enormous total of 761 in a city of 500,000 people. Of course, it did not take very long to demonstrate the absurdity of operating automobiles at a 5-cent fare, despite the absence of anything but a perfunctory regulation by the police.

By Jan. 11, 1915, following the license renewal date, the number of jitneys had fallen to 501, many routes had been shortened and some abandoned altogether. In fact, at the present time the jitneys do not even attempt to operate in certain sections of Los Angeles.

But while jitney operators were continually drop-

First and Main Streets, Los Angeles, Where the Jitney Park Is Formed for Attack on Electric Railways

Charge of the Jitneys on Electric Railway Revenues at 5.09 P. M. at Fifth and Main Streets, Los Angeles

ping out of the field, on learning that they made less than laborers' wages, the number of machines in service without regulation remained fairly constant, say 490, between Jan. 15 and June 30, 1915. The explanation is the very simple one of "There's a new sucker born every minute." Los Angeles probably has at all times a larger floating, work-seeking population than any other American city of its size, so that defections within the jitney ranks are rapidly made up within the constant average mentioned. For example, sixty-six cars dropped out between March 1 and March 18, but seventy-two cars entered; between March 18 and May 11 137 cars came in and 139 cars went out.

Since Jan. 1, 1915, to Aug. 16, 1915, 1132 automobiles have worked in the jitney service. Of this number 302 were in the service on Aug. 16. On July 1, 1915, the regulatory ordinance became effective, requiring a bond for $11,000, together with the same license fee of $2.50 per month as heretofore paid, and with the additional requirement that the bus owner must elect the line he is to operate on and work on that line and always go to the end of the route before turning back. This regulation immediately reduced the number operating to 245. Since that time, however, they have been gradually adding to the number until something more than 400 have taken out licenses. The difference between this number and the number in operation on Aug. 16 is a brilliant illustration of the undependability of this service. There is no requirement or obligation anywhere that a man

Three Men on a Jitney Running Board Built for None

furnish service after he has taken out a license to do so or that he shall make any certain number of trips during a day.

Although 302 were operating at various times on Aug. 16, computing the total time operated by all machines and allowing ten hours for a day's work reduces the number to 265. On that date the trips made by the various machines were as follows: Eight machines made one trip; seventeen machines made two trips; fourteen machines made three trips; thirteen made four trips; twenty-four made five trips; twenty-two made six trips; twenty-four made seven trips; twenty-six made eight trips; thirty-seven made nine trips; thirty-seven made ten trips; twenty-seven made eleven trips; nineteen made twelve trips; fifteen made thirteen trips; five made fourteen trips; eight made fifteen trips; two made sixteen trips; three made seventeen trips; one made eighteen trips; total, 302 machines.

All recent checks show the income per jitney has increased from $1.50 to $2 per day, varying on the different lines. This is brought about by the decrease in numbers and favorable weather.

Bear in mind that prior to July 1 only the law of "jitney eat jitney" was in effect. The jitney was free to go where it pleased, to alter the length of its run at will, to furnish no bond and to pay no taxes whatever, except a fee of $2.50 per month. At the same time the paved streets of Los Angeles offered no physical hindrance leading to extraordinary tire wear or maintenance.

It follows, then, that with everything in its favor the 5-cent automobile can injure but not succeed the electric railway as the chief means of city transportation.

Where the Jitneys Come From. Significant Signs at the Open-Air Market on Main Street, Los Angeles

The Application of Established Legal Principles to the Jitney

New Aspects of Old Questions Concerning Financial Responsibility, Regulation and Taxation of Common Carriers Are Presented —If Treated Like a Street Railway the Jitney Cannot Survive

By W. E. DUNN
Vice-President Los Angeles Railway Corporation

EVERY development in the industrial or economic world brings its train of legal problems. In our law libraries and offices are found books, weighty volumes, bearing such titles as "Railroads," "Street Railroads" and "Automobiles," witnessing the law's interest in these successive developments of transportation. If the airship has not already found its place in the same company, it must be because the problems it has so far developed do not come within the range of ordinary law practice.

And now the jitney, mushroom growth though it appears to be, has entered the field of legal vision. Already it has claimed much legislative attention, and it must soon find its way into the courts. We may confidently predict, however, that it will prove with the jitney, as with more substantial and permanent developments of transportation, that the legal questions it presents will be for the most part only new aspects of old problems, and readily solved by the application of settled principles of the law.

Financial Responsibility

Perhaps the most novel, or apparently novel, question which the jitney traffic has raised is that of insuring financial responsibility on the part of the owner or operator. The imperative necessity for legal compulsion in this matter arises from the invariably impecunious condition of those who engage in the traffic. Our law has been familiar with bonds required from public officers to secure the faithful performance of duty, and from contractors on public work to secure the execution of their contracts, as well as for the payment of laborers and material men. But the astute legal mind may observe a difference between the requirement of a bond in these and other instances, in which there is a direct governmental interest, and the requirement of a bond to protect passengers or other persons suffering injury through the negligence of a jitney operator. The closest precedent we have mentioned, the public contractor's bond for the payment of laborers and material men, has been sustained by the courts as tending to secure satisfactory performance of public work, rather than protection to the creditors of the contractor.

Adequate grounds can, nevertheless, be found, sanctioned by judicial precedent, to sustain the requirement of indemnity insurance from the operators of motor buses. The courts are bound to recognize the necessity for such protection to the public. The dubious character of the vehicles usually selected for the jitney traffic, the want of previous experience in the handling of motor cars by most of the operators, and the constant inducement for haste and the consequent taking of risks, render accidents inevitable; and the police records of every city demonstrate how frequently these result in death or serious personal injury. It may well be, therefore, that the courts will hold the requirement of indemnity against such injuries within the scope of that comprehensive "police power" which gives practical force to the maxims *Salus populi est suprema lex* ("The welfare of the people is the supreme law") and *Sic utere tuo ut alienum non laedas* ("So use your own as not to injure another").

This police power has always been regarded as sustaining legislation excluding the incompetent from employments affecting the public health or safety. A familiar instance is the examination and licensing of physicians and dentists. Like requirements have more recently been sustained as to undertakers, plumbers, architects, etc. The examination of locomotive operators under state authority, and of navigators of vessels under federal authority, is another precedent very closely in point. It is thus clear that the incompetent may be excluded by legislative enactment from such an employment as the operation of motor buses on the public streets. It would seem equally clear that competency for such an employment would include the ability to respond financially to liability for injuries occasioned by the negligence of the operator.

Regulation

There is another legal aspect of the jitney traffic which will sustain the requirements we have been discussing, as well as the other regulations of its operation which the public interest may demand. It must be conceded, we think, that the jitney bus is a common carrier, a public utility. The business it undertakes is clearly a service "affected with a

public interest" within the conception established as the constitutional basis of regulation by the decision of the United States Supreme Court in Munn vs. Illinois (94 U. S. 113). The doctrine of that case is epitomized in this sentence from the opinion rendered by Chief Justice Waite:

> When, therefore, one devotes his property to a use in which the public has an interest, he, in effect, grants to the public an interest in that use, and must submit to be controlled by the public for the common good, to the extent of the interest he has thus created.

Subsequent decisions have more fully defined the nature of the power thus affirmed, setting necessary limits of reasonableness in its exercise, but at the same time giving it a most comprehensive scope. Thus, it is settled law that this power includes not only regulation of rates, but also of service, the extent and character of facilities afforded and kindred matters.

That the jitney traffic calls for most positive and effective regulation in the interests of the public even its friends must admit. The temptation to overcrowd its vehicles (of doubtful capacity to start with) to increase the margin of possible profit is irresistible to the average operator. Restriction of the number of passengers carried in respect to the normal capacity of the vehicle is, therefore, a necessity. So also is regulation of the manner of loading, as by prohibiting the carrying of passengers on the running board or in a manner to obstruct the driver's vision. The importance of examination to determine physical competency and moral fitness of the operator is likewise obvious.

Regulation in these and many other particulars by municipal or state legislation is demanded for the protection of the public. All of these matters, as well as the insurance of financial responsibility first discussed, appear to be within the scope of valid regulation of a public service.

Taxation

Another group of legal problems affecting the jitney traffic arises out of the fact that it makes a special use of the public streets for private gain. This has always been invoked as justification for imposing special and onerous burdens upon railways occupying public streets. The requirement of paving and keeping in repair a designated portion of the street is a familiar instance. In California, for example, this requirement covers not only the space between the rails and tracks, but a width of 2 ft. on each side of the outer rails. Since paving is required for and benefits not only the railway but the general public, exacting its cost from the railway is simply a tax; or, giving it the most favorable construction possible, a compensation demanded for the privilege of making a special use of the street.

Whatever justification this exaction may have as applied to street railways it must also have as applied to other modes of commercial transportation using the streets. Whoever, therefore, argues for the continuance of the jitney as a legitimate competitor of the street railway must admit that it ought to be subject to a corresponding tax for the privilege of using the streets. No one can deny that the jitney buses do an aggregate amount of damage to street pavements far exceeding that occasioned by railway transportation of an equal number of passengers. Indeed, the railway is of no substantial injury to the street or its pavement, while the motor car, with its rubber tires, is recognized as one of the chief destroyers of pavements and other street surfaces. Thus, a parliamentary investigation in Great Britain developed the fact that the cost of maintaining London pavements was more than doubled by the advent of motor buses.

The expense of paving is only one of many forms of exaction imposed upon street railways for the benefit of public revenues. Franchise taxes, car license taxes, percentage tax on gross receipts are burdens commonly laid upon the revenues of the railway companies. Equivalent burdens must be laid upon the jitney traffic or else there is no fairness in its competition with the railway. Protection to the public revenues must also demand such levies upon the jitney traffic, since the latter, if allowed to operate without adequate restriction, will substantially reduce the receipts of the street railway traffic. This directly reduces the amount of every form of taxation based upon gross receipts, and ultimately, if indirectly, other forms of tax as well.

It is evidently not feasible to apply all these special forms of taxation to the jitney traffic, but some equivalent may be devised. A license tax proportioned to the seating capacity of vehicles may afford the readiest solution of the problem. The courts have allowed to legislative bodies the widest discretion as to the amount of license taxes. They have also conceded the right to distinguish in manner and amount of tax between different occupations and lines of business, providing there is any substantial difference between them. The jitney readily differentiates from other modes of transportation, even such as also employ the automobile. It differs in such matters as the rate of fare and the mode of determining its amount, the manner of securing patronage, the receiving on the same trip of passengers from different points bound to different destinations, the control of time and route of journey by the operator, and the frequency of repeated trips over the same route. The last-mentioned point is specially important as justifying a higher license tax, since it marks the greater dam-

age done to street surfaces by motor bus operations.

What will be the future of the jitney if subjected to these necessary regulations and justifiable tax burdens? The experience of the cities which have tried the experiment, as well as the objections raised in other cities where such restrictions are proposed, predict the speedy disappearance of the jitney as a substantial competitor of the trolley car. All competent investigators have agreed that there is little if any margin of profit for the jitney, even when operating without regulation or special taxation. The cost of meeting even the minimum of requirements imperatively demanded by the public interest must prove prohibitive of continued operation of motor buses with a nickel fare.

There should be none to mourn this result. Even the would-be jitney operator is saved from a loss rather than deprived of a profit. And the community at large escapes the disaster which the jitney threatens by the reduction of street railway revenues to the point where adequate service to the public would be an impossibility and extension of lines would mean bankruptcy.

Public Utilities Should Be Protected

This vital interest of the community in the triumph of the street railway over the jitney bus suggests another interesting problem, but one which need never be solved if appropriate regulation realizes the result herein predicted. But if elimination of disastrous jitney competition with the street railway were not effected by the indirect method of regulation, would not its elimination by more direct action be sound public policy and a valid legislative act? The necessity is now recognized by public utility commissions and legislatures of protecting established utilities rendering adequate service to the public by preventing the entry into the same field of rival utilities whose competition could not substantially benefit the public and would be disastrous to the existing utilities. The duty of the public to afford such protection to an existing utility may be justly claimed as an essential complement of its asserted right to measure out the burdens to be borne by such utility. The principle of public policy and regulation thus recognized would seem clearly to justify legislative exclusion of the jitney bus where its competition might be disastrous to an existing railway system, even if the jitney promised when fully established to provide a satisfactory substitute in service to the public. But it is apparent that the jitney, as a substitute for the street railway, is impossible, and as an addition it is little better than a parasite sapping the strength and vitality of the railway service, and giving the public nothing commensurate in return. Wherefore, if the jitney does not voluntarily withdraw from the field, public interest must ultimately force its removal.

Typical Los Angeles Jitney

One Club in Los Angeles Railway Baseball League

Recreation and Welfare Work for Los Angeles Railway Employees

The Employees' Association at Los Angeles Is Unusual in that It Is Organized for Social Relations and Recreation Exclusively

By L. O. LIEBER

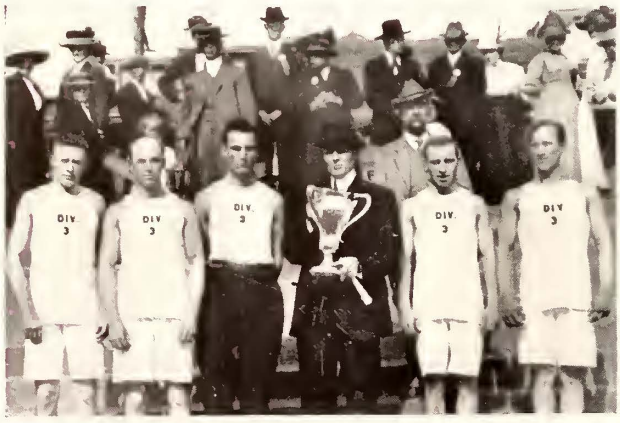
Electrical Engineer Los Angeles Railway and President Employees' Recreation Association

THE climatic conditions in Los Angeles offer such favorable advantages to all kinds of outdoor sports and amusements that nearly all large organizations which employ great numbers of men have extended financial support toward creating or maintaining active interest in the diversity of pleasures possible to their employees.

Through its active heads of departments the Los Angeles Railway has had a very decided interest in the 4199 men on its staff. For some years the platform men have had recreation rooms located at their respective carhouses where they are at liberty, while off duty, to assemble and enjoy billiards, pool, cards, checkers, etc. Gymnasiums and an up-to-date reading room well stocked with books and magazines are also provided.

Inter-departmental baseball has been encouraged. The divisions have been provided with playing suits and grounds for the development of this game.

We also have an active organization of our employees, known as the Los Angeles Railway Employees' Recreation Association. Its object is what the name implies—for the recreation of employees. This association was inaugurated at a picnic at the instance of the writer. The movement was heartily approved by the management and unsolicited support was rendered toward making each annual picnic or banquet one of social betterment.



Sporting Features at Picnic of Los Angeles Railway Employees' Recreation Association

Comedy Feature at Picnic of Los Angeles Railway Employees' Recreation Association

Through the association's direction an organized band of more than fifty pieces has been maintained by the company from a beginning of four or five pieces. The weekly practice nights are well attended as a rule and, as in the case of the baseball club, all uniforms for the band were donated by H. E. Huntington, president of the corporation. Occasional get-together smokers are held at the respective carhouses with the assistance of the band in uniform, where good music, speaking and smokes are enjoyed with a spirit of good fellowship by officials, employees, families and friends.

The company has begun to convert an unused building centrally located into a suitable clubhouse for the association, where it is expected that a still closer bond of co-operation, unity and sociability will be developed.

The association's officers and general committee are selected to embrace the several departments of the railway. At this time the writer is president, Superintendent E. L. Lewis, Assistant Superintendent F. Van Vranken and Master Mechanic E. L. Stephens are vice-presidents; Chief Operator J. E. Bass is treasurer and Clerk T. A. Donahue is secretary.

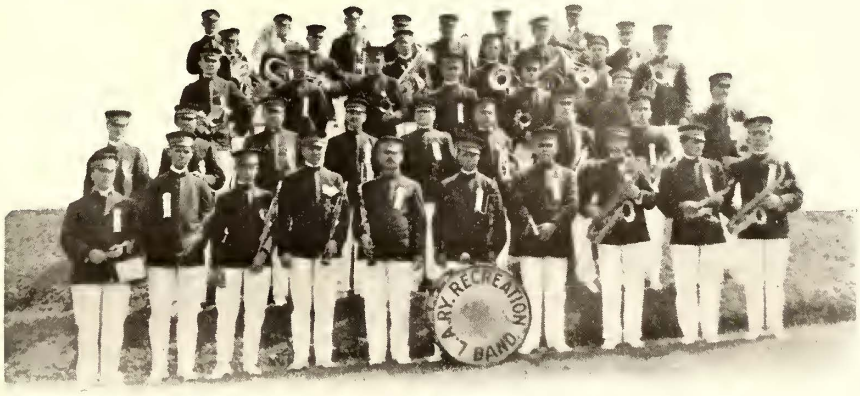
The general committee consists of foremen and sub-foremen of the different departments and several others who are chosen at large. Membership is open to all employees of the Los Angeles Railway. No dues are charged, nearly all expenses being borne by the company. For example, the annual picnics alone cost the company from $2,600 to $2,900 each, and the total outlay for the last three years averages $4,000 per annum. The only revenue which comes from the members is through their purchase of tickets for special events.

The first annual picnic was held at Redondo Beach, Sept. 17, 1910. The morning events were of athletic nature, such as races for men, women and children, tug-of-war and inter-departmental baseball. In the afternoon, dancing and water sports were the chief features. The winners of the sixteen events of the day received prizes, some donated by individuals in the company and others by local merchants.

The following picnics have been of like character except that one or more novelties were arranged for each occasion. Thus a "Cinderella" or "fit-the-slipper" contest and a "duck hunt" were features of the 1911 picnic; home-made vaudeville in costume, as illustrated, in 1912; egg and spoon and obstacle races in 1913. In 1913, also, the band came to the fore with a pleasing program of popular and classical music.

Increasing experience in giving the annual picnics showed that the visitors would enjoy themselves still better if they were not obliged to witness too many contests. Therefore, at the 1914 picnic a few events were omitted to give people time to amuse themselves in their own way.

It may be of interest to add that about two years after the formation of our association, a similar body was formed by the Pacific Electric Railway, which operates all interurban railways radiating out of Los Angeles.



Band of the Los Angeles Railway Employees

Electric Car Terminal of the San Diego Electric Railway

Handling Traffic to the Panama-California Exposition at San Diego

To Provide Adequate Transportation Facilities a New Line Was Built to Balboa Park, Which Previously Had No Railway Connections

By B. M. WARNER

General Superintendent San Diego Electric Railway

THE arrangements made by the San Diego Electric Railway to transport people to and from the Panama-California Exposition have proved ample for safe, expeditious and comfortable service. The grounds are located in Balboa Park, which previously had no railway facilities owing to its undeveloped condition.

We therefore constructed during 1914 a line running on Twelfth Street from F Street to the main eastern entrance of the exposition. This double-track line was 1.5 miles long, and at the same time it served to complete a loop service embracing lines already running on B Street, Third Street and F Street, as shown in the accompanying map. The new work was installed at a cost of $45,000, exclusive of the $20,000 terminal described in the ELECTRIC RAILWAY JOURNAL for March 20, 1915.

As stated in the description of the terminal, passengers alighting from either of the two lines which serve the main entrance walk downstairs, from either of the two unloading platforms, under the departure tracks and return to the original level after passing through exit turnstiles. The latter are used, of course, to prevent improper ingress.

Passengers entering the cars by way of the single loading platform of 2000-passenger capacity first pay their fare by dropping the exact amount into any one of ten turnstile boxes made by the Coin Machine Manufacturing Company, Portland, Ore. A change-making booth is available for those passengers who lack the exact fare. Under this scheme, the passengers enter their cars in the shortest possible time, the conductor being relieved

of all work incidental to the collection of fares except the later issuance of transfers.

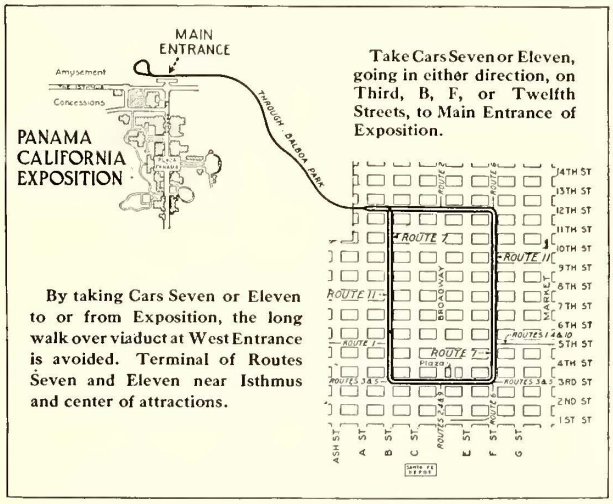
NEW ROLLING STOCK

To handle the extra business anticipated we purchased during 1914 from the St. Louis Car Company forty double-truck center-entrance cars 50 ft. long over all. These cars differed from the preceding type in being 6 ft. longer and having ramped floors instead of a 5-in. riser at the edges of the well. In order to avoid accident from having two types of car wells, the original twenty-four center-entrance cars were rebuilt for ramp operation. The seating capacity of the larger center-entrance cars is fifty-two passengers and of the smaller forty-four.

During heavy service we operate the cars in two-car trains, always using exactly the same type for leader and follower. We find that two-car trains can be operated over the loading tracks at an average of one a minute without the least confusion. It should be stated that the loading platforms are long enough to care for three trains at a time, discharging or loading. The train connections are readily made with the aid of a Westinghouse automatic type C coupler, which takes care of air and coupling. For night service, however, a jumper for the lighting circuits is put in by hand. General Electric type M K control is used with GE-201 motors.

TRAVEL DATA FOR PUBLIC

An interesting point in connection with the routing of travel to the exposition was the education of the riding public. With the original Fifth Street or No. 1 line it was possible for the public to reach the western entrance of the grounds by walking over a bridge. Local riders, familiar with the territory, were especially prone to do this. We therefore issued a pocket folder the inside of which is exactly the same as the illustration already mentioned. This shows that Routes 7 and 11 are preferable for riding to the exposition as they go



San Diego Electric Railway Map, Showing Direct Route to Exposition

directly to the main entrance. The same lines also serve the great concrete stadium which the city of San Diego opened on May 31, 1915. This stadium cost $150,000 and seats 30,000—one-third of San Diego's present population. Soon after the issue of this pamphlet in January we found that the No. 1 line, which required a three-minute service for regular business alone, was no longer loaded with exposition travel.

POCKET CARDS FOR TRAVELERS

For the general information of the public we have also issued two pocket cards. One of these cards describes the routes which correspond to our system of route numbers, the other names places of interest and how to reach them. The back of the second card also carries the schedule of the Coronado (Tent City) division showing the cars that make the local steam railroad connections. Visitors are also aided by our uniformed street solicitor at Third Street and Broadway, who not only directs people but is prepared to sell them tickets to various points of interest. In addition inspectors are stationed at different points in the congested district.

Boarding Cars After Passing Through Turnstiles

Two-Car Train at the San Diego Terminal

Economics of the Jitney Problem from a Traction Company's Viewpoint

With Taxes Imposed in the Form of Licenses and Under Reasonable Regulations the Jitney Is Proving an Economic Impossibility

By C. N. BLACK

Vice-President and General Manager United Railroads of San Francisco

FROM the street railway company's standpoint the most important question in connection with the jitney bus problem is unquestionably the economic one.

If it is financially possible under reasonable regulations to operate a five-passenger Ford automobile on the streets of any city, and carry passengers for a 5-cent fare, the jitney bus has come to stay, and if such is the case the sooner the street railway companies realize the fact and adjust their operating conditions to meet this competition the better. Of course, this would mean the adoption of the European zone system or something of that character. On the other hand, if it is not financially possible to operate an automobile, even under the most favorable conditions, and carry passengers for a reasonable distance, from 2 to 3 miles, for a 5-cent fare, it is safe to assume that the jitney is a passing fad, which will die out within a comparatively short time.

Generally speaking, it has been found that, in those communities which have imposed taxes in the form of licenses, even approximately comparable with those paid by the street railway companies, and other reasonable traffic regulations, the jitney buses have practically ceased operation. It would seem, therefore, that even the apparent margin of profit is extremely small. The words "apparent margin of profit," are used advisedly, because of the fact that the majority of those who are operating jitney buses have no accurate knowledge of the actual cost of the service. This cost will naturally vary to a greater or less extent in different cities, depending upon the character of paving, the topography, the length of haul and the obstructions in the streets caused by other traffic.

In San Francisco the great majority of the jitney buses operate on Market Street, and all of the conditions affecting the cost of operation, with possibly the exception of obstructions in the streets caused by other traffic, are as favorable as can be found anywhere.

For a five-passenger Ford car making an average of 125 miles a day, and operating 300 days a year, the actual cost is very close to $2,500. This cost is made up as shown in the accompanying table.

The depreciation charge is based upon the assumption that the car will have a useful life of one year and at the end of that period it will have a scrap value of $65.

The cost for liability and fire insurance is the present cost of an insurance policy as required by the San Francisco ordinance. Taxes and licenses are based upon the present State and municipal requirements.

It will be noted that the taxes and licenses amount to what is equivalent to $6.75 per passenger seat, while at the present time the street railway companies of California pay to the State alone for taxes an equivalent of approximately $20 per seat, and in municipal taxes, car licenses and paving maintenance there is an additional tax equal to approximately $30 per seat, or a total of $50 per seat, as compared to the $6.75 paid by the jitney buses.

From the above it will be noted that the actual daily operating cost of a jitney bus in San Francisco is at least $8.28, and unless the gross earnings equal or exceed this amount, or unless the driver is willing to render his services for less than $2.50 a day, it goes without saying that the business is conducted at a loss.

From numerous counts of the passengers actually carried by the jitney buses operating in direct competition with the street railways in San Francisco, it has been found that the average receipts are less than $7.50 a day. If these statistics are correct it will naturally be asked how is it possible for them to exist. In other words, where does the revenue come from which the jitney bus driver is enabled to meet the deficit between the actual operating costs and the gross revenue derived from the business of a common carrier?

It is unquestionably a fact that a certain percentage, perhaps a small one, of the men operating jit-

EXPENSES OF FIVE-PASSENGER FORD MAKING 125 MILES PER DAY

Daily operating expenses:	
Gasoline, 7.4 gal., at 10 cents per gallon	$0.74
Oil and greases	0.12
Tires	1.25
Inner tubes	0.21
Lights	0.10
Repairs and miscellaneous	1.00
Driver's wages	2.50
Total	$5.92
Annual expenses and fixed charges:	
Daily operating expenses, $5.92 for 300 days	$1,776.00
Depreciation	450.00
Garage and washing	120.00
Liability and fire insurance	96.00
Interest	15.00
Taxes and licenses	27.00
Total	$2,484.00

This is equivalent to $8.25 a day.

ney buses have been enabled to make a profit over and above a reasonable driver's wage of, say, $2.50 to $3 a day. The amount of $7 to $7.50 per day is probably more than the average jitney bus can earn even by operating twelve hours a day in direct competition with the street cars, but there is another source of revenue available to him, viz., the field occupied by the taxicab. When business is slack along the lines of the street railway the jitney turns to the taxicab business and by furnishing the service at one-half, or less, of the rates charged by the taxicab from $2 to $3 additional revenue is picked up. Of course, this is possible only by reason of the fact that the operators of these cars are permitted to choose their own route, and that they are sole judges as to the service which they shall render. Should they be required to operate over a fixed route, under a given headway and for a specified number of hours a day, the combination service now rendered would be practically impossible. All street railways are limited to a prescribed route, and, generally speaking, they are not permitted to change their routes without municipal permission.

Notwithstanding the inequities to existing industries, however, if the jitney is really an advance and furnishes additional transportation facilities, it will become a permanent industry and transportation companies will have to meet the new conditions.

What are the advantages offered by the jitney service?

First—As claimed by the operator of the jitney bus, a ride in a comfortable conveyance, on upholstered seats, in the open air.

Second—A material saving in time required to reach the rider's destination.

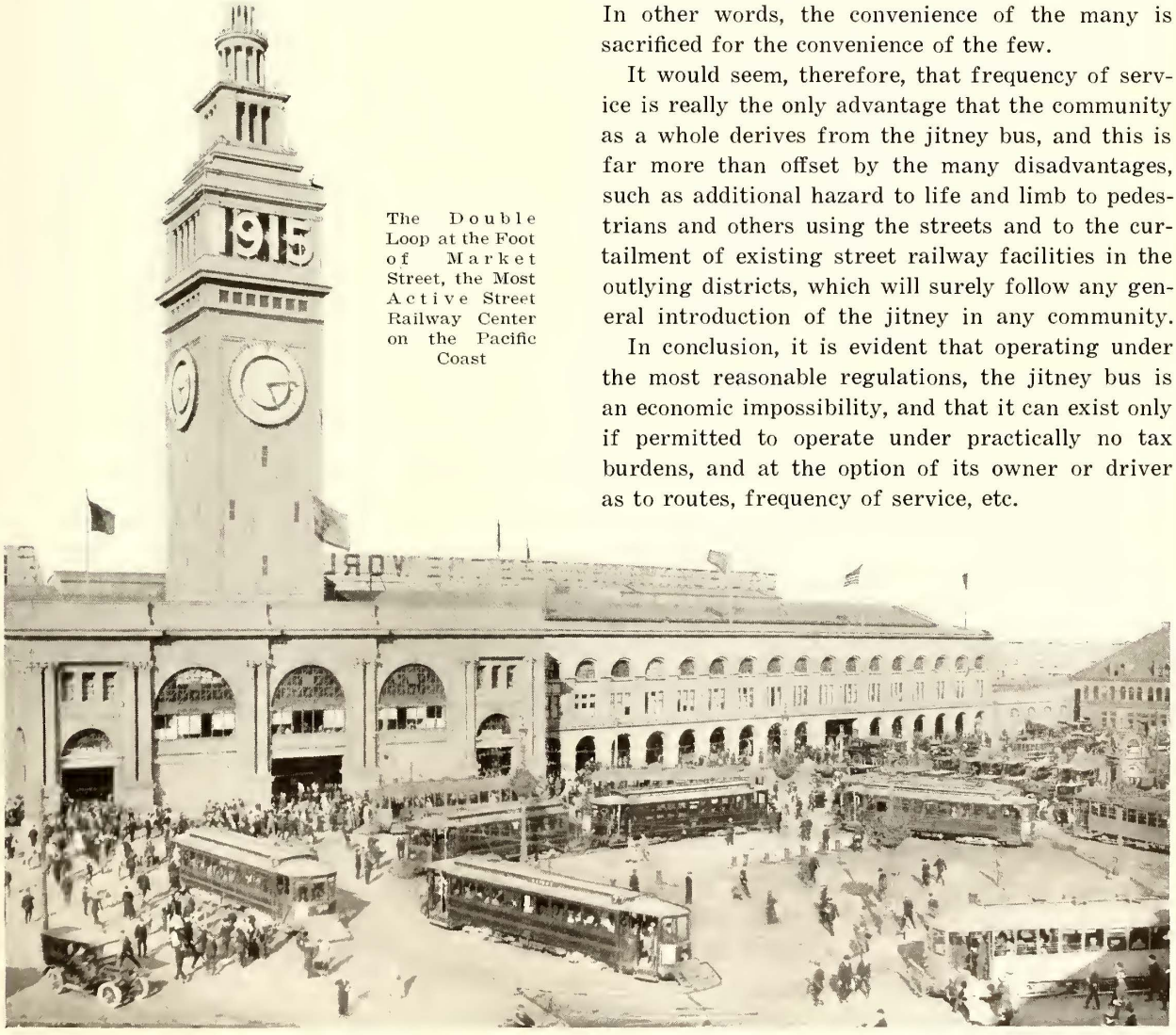
Third—Frequency of service.

The first may be considered as more or less of a passing fad and is largely dependent, as far as comfort is concerned, on weather conditions.

The second is partially true as far as the person patronizing the jitney bus is concerned, but, and this from the community's standpoint, is a most serious objection. While the rider in the jitney is enabled to reach his destination in a few minutes less time, the riders in the street cars, who number at least ten to one jitney rider, are delayed very materially by reason of the congestion of traffic on those streets over which the jitney buses operate. In other words, the convenience of the many is sacrificed for the convenience of the few.

It would seem, therefore, that frequency of service is really the only advantage that the community as a whole derives from the jitney bus, and this is far more than offset by the many disadvantages, such as additional hazard to life and limb to pedestrians and others using the streets and to the curtailment of existing street railway facilities in the outlying districts, which will surely follow any general introduction of the jitney in any community.

In conclusion, it is evident that operating under the most reasonable regulations, the jitney bus is an economic impossibility, and that it can exist only if permitted to operate under practically no tax burdens, and at the option of its owner or driver as to routes, frequency of service, etc.



The Double Loop at the Foot of Market Street, the Most Active Street Railway Center on the Pacific Coast

United Railroads Front-End Fare Collector at Work

Front-End Fare Collection Improves Service at San Francisco

Three Years' Operation with Front-End Collection Has Demonstrated Its Value in Relieving Congestion and Improving Car Loading

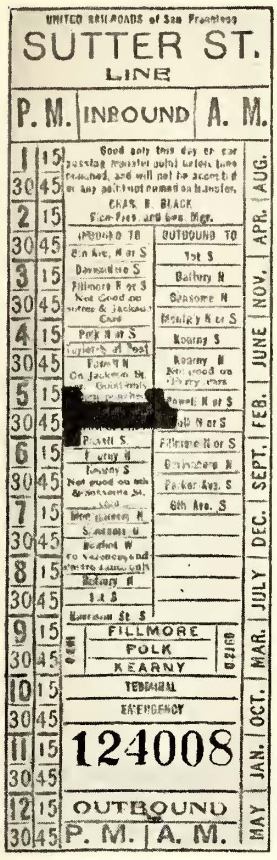
By HENRY T. JONES
General Superintendent United Railroads of San Francisco

LIKE most other city railways of the United States we are blessed with a number of traffic knots or congestion points. The principal one in San Francisco is at the Market Street ferry, where nine lines of the United Railroads and four of the Municipal Railroads come in over a double-track loop. In addition, this locality is the gathering point of hundreds of jitneys, sightseeing vehicles and the various hotel buses and taxicabs to meet the incoming travel from the East. In short, the Market Street ferry has the peculiar although undesirable distinction of being the greatest local and foreign traffic channel in the world. At this place we handle cars on less than a thirty-second headway, and for short periods even on a fifteen-second headway.

Other places where traffic congestion occurs are at our safety stations or isles along 1 mile or so of Market Street, at the exposition grounds, at the top of Fillmore Street hill, at the Third Street depot of the Southern Pacific Railroad, etc.

Of course, the prime essential in avoiding or minimizing congestion is to use every possible means to obtain quick loading. Our cars are all of prepayment type, both the front and rear platforms being from 5 ft. 4 in. to 6 ft. 3 in. over all with a railed entrance aisle of 36 in. on the platform. The steps are of moderate height, and, since the cars are of California open-end type, there are no bulkhead doors at the ends. In spite of this easy access construction the use of prepayment collection by way of the single aisle at the rear platform alone was too slow to meet our conditions. Thus the average time for loading a car with sixty-five people was as high as sixty seconds, thereby seriously handicapping the uniform movement of cars over the loops.

As we did not want to lose the benefits of prepayment fare collection we decided in 1912 that the best way to secure the quickest handling of passengers and still retain the prepayment feature would be to employ front-end fare collectors as aids

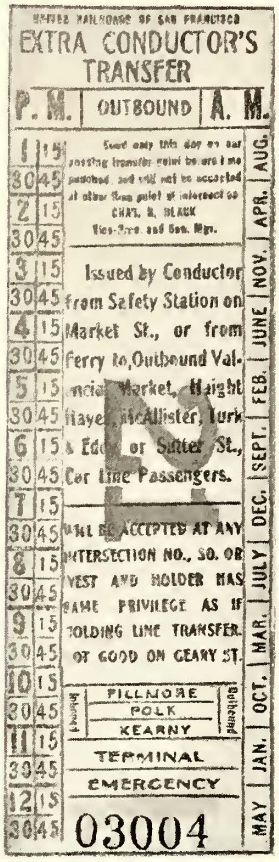


Regular Conductor's Transfer

to the regular conductor. These men, of course, are stationed on the street so that the same man collects fares for the successive cars that come through during the rush hour. In this way the entire width of the front platform is made available for entrance in addition to the entrance aisle at the rear. The time of loading a car with sixty-five passengers is thereby cut down to the point where a fifteen-second headway with prepayment is practicable. Furthermore, as passengers enter from both ends the cars are evenly loaded.

The men employed for front-end collection are our most experienced conductors, chosen especially for their quickness in fare collection and for their ability to direct passengers to the proper routes. For Market Street alone we may require as many as seven men, while at safety stations long enough to accommodate two cars we use two men. In all we employ from ten to twenty collectors, all in evening service between 4.45 and 6.15 o'clock.

Each man carries an International portable register. He rings up each fare as collected, the same showing as a large figure on the front, while the totalizer indication is on the back. No record is made of the fares collected for individual cars. In the meantime the fares received by the conductor on the rear platform are dropped in International or Johnson counting fare boxes, except on those



Extra Conductor's Transfer

The New Type of Market Street Safety Station, San Francisco

lines where fares are collected by hand and then registered on International machines by means of a foot plunger.

DIFFICULTIES IN ACCOUNTING

Of course, from the accounting standpoint the non-segregated registration of the front-end collectors is a disadvantage in not knowing the exact intake per car or even per line. So far as crediting each line is concerned, this is readily cared for by the accounting department, which assigns to each route its due pro-rata. The pro-rata, of course, can easily be determined by using the morning rush-hour receipts as a guide, since the passenger who goes out in the morning must come back in the evening. The only weakness is in the difficulty of checking conductors unless the inspector rides on the car for a considerable distance to watch pick-up traffic. It should be borne in mind, however, that the great bulk of the fares is taken at the street collection points where accurate inspection is easy. The system would be ideal from the checking standpoint if the register of the front-end collectors contained a means of separately totalizing the collection of the successive cars.

SPECIAL TRANSFERS

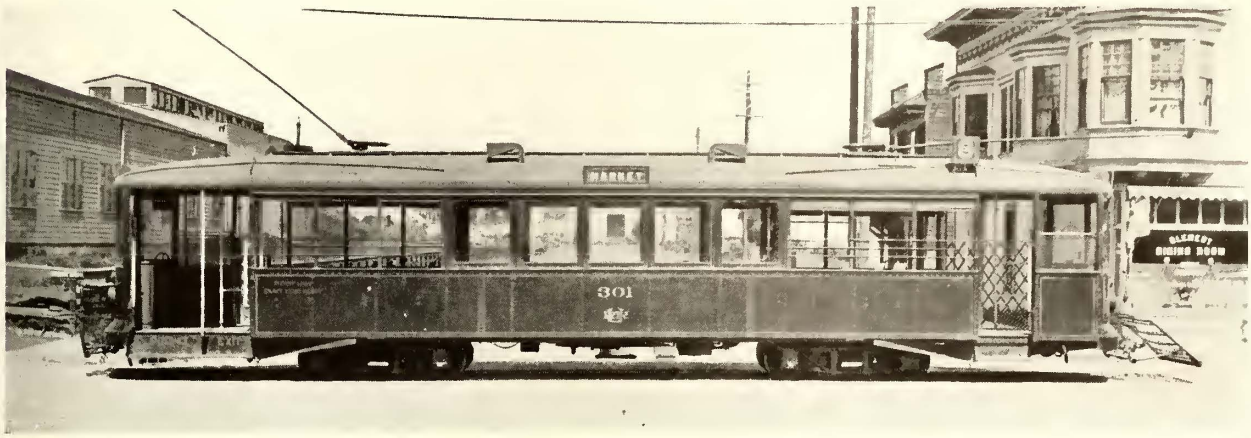
In order to relieve the regular conductor from distributing transfers to passengers who enter via the front way, the collectors are supplied with transfers of the type illustrated. These differ from the regular transfers in that they do not bear the name of any issuing line, but do show the names of the connecting lines on which they are valid within the time punched. One feature of the transfer issued on the car is that it shows the transfer intersections in order, thus serving as an effective aid to the stranger who is watching for his transfer point.

On the whole, nearly three years' experience has convinced me that no more effective means than front-end collection could be devised for reducing congestion at so small an expense. Any company is warranted in giving it a thorough trial before going to the cost of building terminals in downtown districts.

United Railroads Low-Floor Car with Longitudinal Seats in the Center Closed Section and Cross-Seats in the End Sections

The Development of a Light, Low-Floor Car for San Francisco

By JESSE M. YOUNT
Master Mechanic United Railroads of San Francisco



The Latest Car Developed by the United Railroads Is the Low-Floor Type

THE earliest type of electric car for San Francisco was the double-step, open-end California design, that is to say, a car with a central closed section fitted with longitudinal seats and open-end sections also fitted with longitudinal seats, the steps running the full length of the open section.

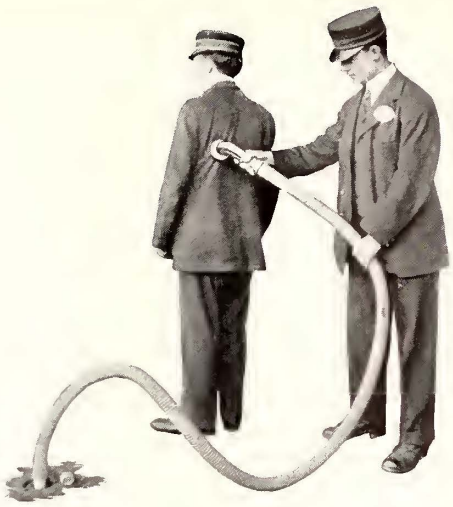
The first advance, made in 1904, was to eliminate the full length steps of the open sections, regular length platform steps being placed near the ends of the closed section. Following this, in 1906, the California design as such was superseded by a closed, open-platform car similar to those long used in the southeastern part of the United States. This design proved unpopular because a large number of Californians prefer to ride in the open all the year around. In 1913, therefore, we returned to the California type except that a drop platform was substituted for one flush with the main flooring.

The 1913 car was much wider and longer than the early California type. It has proved so popular with the riding public that it has been adopted as standard by both our company and the San Francisco Municipal Railway, contrary to earlier recommendations made to the latter by its consulting engineer, Bion J. Arnold. Nevertheless, this car with standard equipment was heavier than what our management considered desirable for San Francisco conditions. We therefore set about to see what mechanical and electrical improvements were possible to retain all desirable features while making the car lighter, easier of access, safer and cheaper to operate.

Naturally, much of the excess weight was in the motor and truck equipment. This led us to adopt for future cars the 24-in. wheel truck with the baby-type, high-speed motor and 10-cu. ft. compressors. By these changes alone we cut down the weight of the under-body equipment approximately 10,900 lb.

While the greatest reduction in weight came through changes in equipment under the car body, we also made a closer study of car-body framing and fittings. Among the changes that followed were the elimination of composition headlining, leaving the roof boards exposed; the size of carlines was very much reduced and the center line of the arch roof was lowered 3 in.; the length and width of the car were not altered from the dimensions of the 1913 type, but the platform construction was changed to avoid a riser from the platform into the car body. We are now using a ramp which is inclined upward 4⅜ in. within the 8-ft. length from the platform edge to the bolster line. This was accomplished by offsetting the end sills as described on page 1016 of the ELECTRIC RAILWAY JOURNAL for May 29, 1915.

The results of the most recent improvements may be summarized as follows: We now have a car 47 ft. long, 9 ft. 2 in. wide, furnished with four GE-247 35-hp. motors, seating fifty people and weighing 34,180 lb., or 683 lb. per passenger. This compares with a car of the same dimensions weighing 49,000 lb., or 980 lb. per passenger. Probably no other city in the United States needed a light car so much as San Francisco, for on account of our many grades the average energy consumption per car-mile greatly exceeds that of other cities.



An Unexpected Vacuum Application

Use of the Vacuum System for Cleaning Cars in San Francisco

Vacuum Apparatus Has Replaced Hand Sweeping and Dusting at Two Carhouses with Noticeable Improvement in Cleanliness and Reduction in Cost

By F. W. ALLEN
Division Superintendent United Railroads of San Francisco

ON Aug. 14, 1912, we made our first installation of a vacuum outfit for car cleaning, the equipment being placed in our Geneva Avenue carhouse. The very first work indicated the superiority of the vacuum process over handwork, both in speed and quality, and the results since obtained with experienced men have proved still better. The initial tests of Aug. 14, 1912, for sweeping and dusting showed up as follows for vacuum and hand operation respectively:

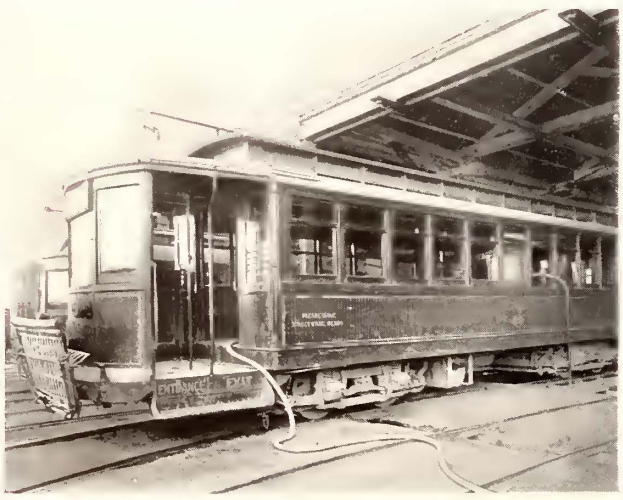
Type P & W Cars—Five cars averaged fifteen and one-half minutes per car with vacuum, and a second five cars averaged twenty-five and one-half minutes per car by hand.

Type 1200 Cars—Twelve cars averaged eleven and one-quarter minutes per car with vacuum and eleven cars averaged twenty-six and two-eleventh minutes per car by hand.

Type 1700 Cars—Six cars averaged eight and one-third minutes per car with vacuum, and five cars averaged twenty-four minutes per car by hand.

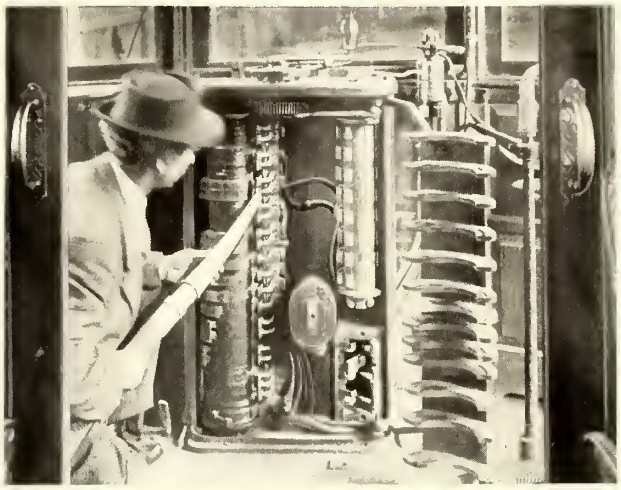
Type 1300 Cars—Six cars averaged six and two-third minutes per car with vacuum, and seven cars averaged twelve minutes per car by hand.

Continued experience with our vacuum cleaning outfit has proved to our satisfaction that it is the most efficient method of cleaning. Brooms and dusters merely agitate the filth and cause it to lodge in another part of the car after the agitation ceases; whereas the vacuum cleaner takes out

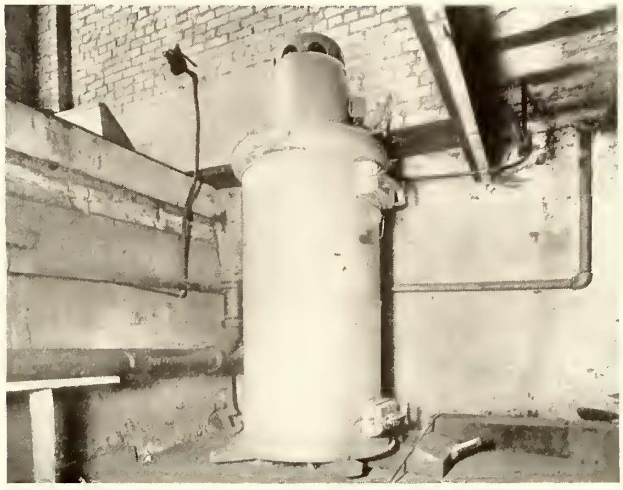


Method of Getting Hose Into Car

Vacuum Hose and Fittings for All Cars



Rubber Nozzle Attached to Hose for Removing Dust from Controller Fingers and Segments



6.5 Hp. Machine Complete with Motor, Vacuum Producer and Separating Tank

of the car all dust, dirt and insects. Furthermore, while the cleaning is going on, the car is getting more than 100 cu. ft. of free air per minute. When the job is done the car floor looks as if it had just been scrubbed with a mop. The car cleaners like the machine, too, as they lose no working time from breathing dust and becoming ill in consequence.

Our first equipment was placed in daily operation on Aug. 15, 1912, and it required no attention at all until Sept. 27, 1913. The apparatus comprises but one 6.5-hp. motor-driven 3500-r.p.m. machine of Tuec type, made by the United Electric Company of Canton, Ohio, and San Francisco, Cal. This machine supplies four 1¾-in. lines of hose at one time, an intake of 80 cu. ft. of air per minute being required at the nozzle of each line. We handle with this machine ninety-six cars in a nine-hour day, but if required the machine could handle 250 cars in twenty-four hours.

The installation cost of the plant was about $1,500, while the maintenance cost has averaged but $20 a month, inclusive of hose and tool replacements and repair. Its economy is shown by the fact that the old method of hand cleaning required the services of nine men whereas the vacuum cleaner has enabled us to dispense with three men for nine months of the year. An extra man is put on only during the rainy season when there is much mud. The annual saving in labor is $1,980, and allowing $20 a month maintenance expense, the annual saving, exclusive of fixed charges on first cost, is $1,740.

I might add that we have altered the original fittings in only one respect, namely, in replacing bristle brushes with felt, as the latter material is much more effective for going over both plain floors and maple strips. The felt also costs us but 35 cents to 40 cents compared with $3 to $4 for the original brushes. We also modified the aluminum nozzle connection to the brush by using a less abrupt angle. The consequent absence of an offset prevents matches, toothpicks and similar objects from fouling the nozzle.

Owing to the satisfactory results obtained with the Geneva Avenue equipment, a duplicate outfit was placed in our Twenty-eighth Street carhouse.

Old Hand Broom Method of Cleaning

New Vacuum Method of Cleaning

Improvements in Transit Lines to Handle Exposition Traffic

Transportation to the Exposition Is Ample—Front-End Fare Collection Has Proved Especially Helpful in Accelerating Car Movement

By T. A. CASHIN
Superintendent Municipal Railways of San Francisco

San Francisco Ferry Building from the Bay

WHEN the question of electric railway transportation to the Panama-Pacific International Exposition came up during 1913, the only means of reaching the grounds was by the Fillmore Street and Peak Street lines of the United Railroads of San Francisco. These two routes, however, could not furnish the most direct service from the principal centers of population. One reason for this condition was that the exposition grounds were located along a previously unused waterfront. In fact, a large part of the exposition is on made ground.

As the United Railroads and the California Street Cable Railroad considered the city's franchise provisions for extensions prohibitive, the municipality undertook to build the necessary routes as permanent extensions to the system which had begun with the Geary Street line. This meant an increase in single track from 15.08 miles to 41 miles. This total, however, includes the old Presidio & Ferries line which comprised 7.14 miles. The total amount of new track was therefore 33.86 miles. This work, including additions to the Geary Street carhouse, a new carhouse at Seventeenth and Hampshire Streets, track connections and 125 new cars, cost about $3,000,000 in all. An important feature toward avoiding heavy grades was the accelerated building and completion of the Stockton Street tunnel, a project which had been in hand for several years.

Before the exposition, we had only forty-three cars, just enough for the Geary Street line. Toward the end of 1913 contracts were let with the Jewett Car Company, Newark, Ohio, for 125 cars of California type and substantially similar to the latest design of the United Railroads of San Francisco. These cars seat fifty to fifty-two people each.

Employment of Additional Men—Front-End Fare Collection

The exposition travel also compelled us to employ about 400 extra platform men, eight front-end collectors and sixteen inspectors, thus increasing our transportation force from 375 to about 750. I

might add here that the use of front-end collectors, with San Francisco registers, has proved exceptionally beneficial. This practice not only speeds up fare collection and the loading of cars, but causes strangers to direct their inquiries at the collectors on the street rather than blocking car platforms while talking to the conductor. The front-end collectors also act as starters. At the main gates of the exposition the use of front-end fare collectors enables us to keep the cars on headways of fifteen seconds and even less.

Owing to local charter provisions all employees had to be hired by way of the civil service. The nature of the educational and physical examinations for platform men and inspectors has already been detailed at length in your issues of Sept. 5, 1914, and Nov. 14, 1914. Out of 3000 applications for platform jobs, 554 men passed the final examination in arithmetic, rules, etc., as motormen and 633 as conductors. Of the 140 candidates for inspectors, not more than seven passed the quiz of December, 1914, but fifty-six passed the examination held in April, 1915. All platform men work an eight-hour day and receive a minimum of $3, or 37.5 cents an hour, with time and one-half for overtime. Inspectors receive $115 a month with one day off per week.

In the original examination for the first Geary Street men and in the December, 1914, and April, 1915, examinations the employees were all experienced railroaders. The second of the later examinations, however, brought a great majority of inexperienced men. The reason for this was that we made a large reduction in the credit for experience. This brought the desired increase in younger men and better physique. About 400 of this class are now at work.

We have been very fortunate in regard to accidents, in view of the fact that new men have been dealing with a riding public which naturally has a large proportion of strangers. On some days we carried 225,000 people without serious mishap.

It is a peculiar fact that the stream of travel within the exposition grounds does not take the course almost everyone expected. It was the general belief that most visitors would enter via the main gates at Fillmore and Scott Streets, on Chestnut Street, the thought being that they would see the large palaces first and then leave through the zone section. In practice the use of the gates has not followed any definite course. Both the United Railroads and the Municipal Railways have found, therefore, that the terminals built at Van Ness Avenue and Fort Mason respectively were not entirely necessary, especially as the front-end fare collectors do so much to speed up the traffic.

A most agreeable surprise of exposition travel is that the visitors straggle in and out of the grounds leisurely, so that peaks are handled with more ease than in the ordinary American rush hour.

Outside of the service given by both street railway companies, the San Francisco-Oakland Terminal Railways gives a direct rail and ferry service from its territory, so that patrons from Oakland, Alameda, Berkeley and other transbay communities can visit the exposition without using San Francisco cars. On special days the Northwestern Pacific Railway gives a similar service from Sausalito. In San Francisco itself the street railways have to compete with 10-cent jitney service and 10-cent double-deck bus service. The number of jitneys running to the exposition is about 125 and the number of buses about a dozen. It is an illuminating fact that some of the buses came from Los Angeles and other towns where they had failed to pay in every-day transportation. Thus, with the various sources of competition enumerated, not forgetting the private automobile, the street railways are having no difficulty in handling all the business they can get.

Municipal Railway Car at the Scott Street Entrance to the Exposition

Reduction in Power Cost Effected by the Use of Coasting Recorders

The Greatest Value of Car-Checking Devices Is Declared to Be the Improvement in All-Around Work of the Men

By W. R. ALBERGER
Vice-President and General Manager San Francisco-Oakland Terminal Railways

THE use of the Railway Improvement Company's coasting recorders on the cars of the San Francisco-Oakland Terminal Railways has resulted in a very satisfactory decrease in the cost of power consumed in operating cars. By this I do not mean to say that the mere installation of the coasting recorder has resulted in a saving of power, for such is not by any means a fact. Reduction in consumption of power has been brought about through the use of coasting recorders in enabling the company to keep a record of the performance of its various motormen and to keep all concerned advised as to the efficiency of each man.

The desirability of some method of checking the performance of motormen has been recognized for some time. Electric railway companies have, without exception, spent large sums in various devices for checking conductors in the handling of fares and transfers, but very little has been done toward the checking of motormen who are handling equipment worth many hundreds of dollars and who are also responsible for the lives and safety of their passengers. Any device which would enable the officers of a railway company properly to check and keep track of the performance and efficiency of motormen is, in my opinion, a most valuable adjunct to the economical and safe operation of electric railways.

It can be scarcely expected, under the limitations of human nature, that a man will be as careful and conscientious in his duties knowing that there is no check whatever upon his actions as he will when he is aware that there is a careful watch kept upon him, and that his superiors will know positively whether or not he is exercising due diligence in the discharge of his duties. Hence the benefit to be derived in the use of the coasting recorders is not entirely through the operation of the recorder itself—it is through the securing of reliable information by the instrumentality of the recorder as to the manner in which a motorman is operating his car and in his own knowledge that his record is reported to and closely scanned by the officers of the company as well as by his own mates.

The experience of this company has been that in keeping the principles of coasting before our motormen many other points in connection with economical and safe operation of cars are naturally brought out. Our records show very clearly that motormen with good coasting records also show good records on other matters as well. It seems quite evident that the fact that a motorman's performance is being recorded tends to keep his mind upon his work, to the end that he not only secures a good coasting record but handles his car better in every way and is much more alive to the safety of his passengers. If the coasting alone were the result of the installation of recorders I would not feel that they were entirely successful, but the general improvement in the efficiency of the motormen of this company since the installation of the recorders convinces me that this method of checking motormen is an exceptionally good one, and I believe that there can be no question whatever as to the desirability of a check upon the performance of motormen.

The cost of power used by this company for operation of cars has been decreased from 15 per cent to 20 per cent since the installation of coasting recorders, in addition to which there has been an appreciable reduction in the cost of brakeshoes and also in the cost of maintenance of electrical equipment. All of this, I believe, is due to a more careful and more intelligent handling of equipment by our motormen, which improved handling is due to an awakening of their own ambition to make good records, as well as to the general instructions which they have received in connection with the special instructions regarding coasting.

As stated before, the mere installation of coasting recorders will not alone produce results. A constant follow-up course and constant supervision and instructions to motormen are necessary. Without question all electric railways spend considerable money on inspectors for motormen, and it is my belief that reports secured through coasting recorders act as a guide to the inspectors, giving them the necessary information as to what motormen need instruction and the sort of instruction required.

The expense of maintaining recorders and maintaining the office force necessary for keeping the records and making reports is nominal and should not in any way be considered in connection with the benefits derived.

909. HOPKINS STREET LINE - DAILY EXCEPT SAT. & SUN. 909.

In effect June 14 1915 Central District, Route 19

Block	Lv.C.S.	Terminus																						In
		Run No.	300								300 -	2.59 - P.M.	- 301									301		
1	5.19	13 & Wash.		6.99	7.09	8.09	9.09	10.09	11.09	12.09	1.09	2.09	3.09	4.09	5.15	6.19	7.19	8.19	9.19	10.19	11.19	12.21	1.19
	A. M.	36th Ave.	5.39	6.39	7.39	8.39	9.39	10.39	11.39	12.39	1.39	2.39	3.39	4.39	5.49	6.49	7.51	8.51	9.51	10.51	11.51	12.49	A.M.
		Run No.		302						302 -	2.09 - P.M.	- 303.									303			
2	6.19	13 & Wash.		6.49	7.19	8.19	9.19	10.19	11.19	12.19	1.19	2.19	3.19	4.19	5.23	6.29	7.31	8.31	9.31	10.31	11.31		12.29
	A. M.	35th Ave.		6.49	7.49	8.49	9.49	10.49	11.49	12.49	1.49	2.49	3.49	4.49	5.57	6.59	8.03	9.03	10.03	11.03	11.59		A.M.
		Run No.	304								304 -	3.19 - P.M.	- 307									307		
3	6.35	13 & Wash.		6.29	7.29	8.29	9.29	10.29	11.29	12.29	1.29	2.29	3.29	4.29	5.31	6.39	7.43	8.43	9.43	10.43	11.43	12.41	1.39
	A. M.	35th Ave.	5.59	6.59	7.59	8.59	9.59	10.59	11.59	12.59	1.59	2.59	3.59	4.59	6.05	7.09	8.15	9.15	10.15	11.15	12.13	1.09	A.M.
		Run No.	306								306 -	3.29	P.M. - 311									311		
4	5.55	13 & Wash.		6.39	7.39	8.39	9.39	10.39	11.39	12.39	1.39	3.39	3.39	4.39	5.39	6.49	7.55	8.55	9.55	10.55	11.57	1.01	1.59
	A. M.	F'vale Ave.	6.14																				A.M.
		35th Ave.		7.09	8.09	9.09	10.09	11.09	12.09	1.09	2.09	3.04	4.09	5.09	6.13	7.19	8.27	9.27	10.27	11.27	12.29	1.29	
		Run No.												308										
5	4.55	13 & Wash.													5.47								6.43
	P. M.	35th Ave.												5.17	6.21								P.M.
		Run No.	308							308 -	1.39	P.M. -	305				305							
6	5.55	13 & Wash.		6.49	7.49	8.49	9.49	10.49	11.49	12.49	1.49	2.49	3.49	4.49	5.55	6.59	7.59						8.07
	A. M.	35th Ave.	6.19	7.19	8.19	9.19	10.19	11.19	12.19	1.19	2.19	3.19	4.19	5.25	6.29	7.29							P.M.
		Run No.	310							310 -	2.49	M. &	3.49	C. - 309							309			
7	5.50	13 & Wash.	5.59	6.59	7.59	8.59	9.59	10.59	11.59	12.59	1.59	2.59	3.59	4.59	6.03	7.09	8.07	9.07	10.07	11.07	12.07		12.14
	A. M.	35th Ave.	6.29	7.29	8.29	9.29	10.29	11.29	12.29	1.29	2.29	3.29	4.29	5.33	6.39	7.39	8.39	9.39	10.39	11.39			A.M.
		Run No.												3.02									
8	4.58	13 & Wash.												5.07	6.11								7.02
	P. M.	35th Ave.												5.41	6.39								P.M.

13th Ave. South

		Run No.	305	M. &	314 C.		8.05	M. -	9.16	A.M. -	314	M.	314	C. & M.									
9	6.59	18th St.	7.06	7.16	und	5	min.	each	way	to		6.26	6.36										6.54
	A. M.	11th St.	7.11	7.21								6.31	6.41										P.M.

Time Due on 12 Minute Headway					Time Due on 10 Minute Headway					No.2 Slow Time		No.1 Fast Time		Time Points + Running Time	No.1 Fast Time		No.2 Slow Time		Time Due on 10 Minute Headway					Time Due on 12 Minute Headway				
55	43	31	19	07	59	49	39	29	19	09	0	0	0	0	13th & Wash.	7	27	7	29	36	46	56	06	16	26	30	42	54	06	18
02	50	38	26	14	06	56	46	36	26	16	7	7	7	7	Cent. Car Sta.	7	20	9	22	29	39	49	59	09	19	23	35	47	59	11
09	57	45	33	21	13	03	53	43	33	23	16	9	14	7	11th Av. & 23 St.	3	13	3	15	22	32	42	52	02	12	16	28	40	52	04
13	01	49	37	25	17	07	57	47	37	27	20	4	18	4	32nd St.	1	10	1	10	19	29	39	49	59	09	13	25	37	49	01
14	02	50	38	26	18	08	58	48	38	28	21	1	19	1	14th Av. & Hoph.	9	9	9	9	18	28	38	48	58	08	12	24	36	48	00
22	10	58	46	34	26	16	06	56	46	36	29	8	27	8	35th Ave.	0	0	0	0	09	19	29	39	49	59	03	15	27	39	51

Synopsis of Runs. Reliefs at Cent. Car Sta.

300 out 5.15 A. M. block 1. off 2.59 P. M. 9.44
801 rels 300 on block 1 at 2.59 P. M. in 1.10 A. M. 10.11
302 out 6.10 A. M. block 2, off 2.09 P. M.
4.68 P. M. block 8, in 7.02 P. M. 10.08
314 Cond. out 6.59 A. M. block 9 off from 12.06 to
1.46 4 turn in at 6.54 P. M. 10.15
814 Mot. rels 806 on block 9 at 9.46 A. M. in 6.54 P. 9.08

Total Car hours 126.18 inc. 13th Ave. S.
Total Cars 9 " " "
Total Runs 13 " " "

909 Supersedes 801 & supplement No. 1110 of May 13. 1915 Time set back 2 min. from first to last car, except leaving time from Car Sta. in morning

Special instructions.

On single track inward cars are superior to outward cars See rule 72
Inward cars will proceed on time if the Elec. block Signal shows clear block
Outward cars if their regular meet has not been made will wait one minute over their time and proceed if signal shows a clear block.
Observe closely rules 253 & 266
If the electric signals fail inward cars will wait 5 minutes at meeting points & proceed as prescribed by rule 90 Outward cars if unable to make clearance in time allowed will be governed by rule 87

Use the No. 2 or Slow running time leaving Wash. St. from 5.07 to 6.19 P. M. inc. & leaving 35th Ave. from 4.39 to 6.13 P. M. inc. Otherwise use the No.1 or Fast Time

Construction of a Day Table, Showing Crews Handling a Given Car (Block Number), Use of Two Sets of Time Points, Explanatory Notes, Etc.

Time-Table Practice of the San Francisco-Oakland Terminal Railways

By U. S. SLITER

Efficiency Superintendent San Francisco-Oakland Terminal Railways

As so little has been published on the subject of time-table practice on the Pacific Coast, operating men from other parts of the country may be interested in our method of planning schedules to compare it with their own.

The information for the schedule is based upon traffic data derived from special traffic counts obtained by checkers who are stationed at various points along the line at important intersections, as well as from conductors' trip cards or from traffic slips. Trip cards, of course, show the total business of a line, whereas the traffic slips and checker reports show the amount of travel at selected points, which travel is of special importance in showing the changes in the maximum load at given points. We find that the traffic slip is the most popular method of securing the necessary information when a change of schedule is contemplated, and the direct saving is appreciable. Because of the high class of conductors employed by the San Francisco-Oakland Terminal Railways we can rely upon their figures. We are, therefore, using very few checkers since the traffic slip illustrated was introduced.

From the information obtained in this manner, traffic charts are prepared on 7-in. x 10-in. cross-section paper, convenient for filing. These charts usually show a whole day's performance of a line in half-hourly or hourly periods, together with the number of cars operated, headway, seating capacity and other information that may be desired by the transportation department to show at a glance all the traffic conditions of the line so that loss of revenue will not ensue because of ignorance or hasty conclusions in making alterations in schedules on account of changes in business.

One of the prints reproduced shows the number of cars in service, by hours, on a typical week day. Our morning peak on both divisions is from 7 to 9 o'clock and our evening peak from 4 to 7 o'clock. During these periods 40 per cent of the total traffic

is handled. On the Key division the transbay travel to San Francisco represents about 20 per cent of the total; commuter travel on the Key division alone represents 40 per cent of the traffic on that divison, or 8 per cent of the total. The mid-day travel begins about 1 o'clock and increases until 3 o'clock, due to shoppers and pleasure seekers.

Our runs are divided as follows: straight day, 29 per cent; straight night, 35 per cent; swing runs, 36 per cent. Only 4 per cent of the swing runs are divided into more than two parts. The time per run averages nine hours and forty-five minutes a day. Swing runs are laid out to give a man at least twelve hours between his last run of the day and the first part of his run the following day. All trainmen, on both the Key and Traction divisions, are off duty one day each week, a sufficient number of regular crews being assigned to relief runs so that all men are relieved regularly.

A typical week-day time-table, reproduced on page 521, is that of the Hopkins Street line. In the first place it will be noted that the first column carries nine block numbers. Each block number represents a car, but the time that this car is handled by successive crews is indicated by the run numbers written horizontally across the table. The second column shows the time the car of each block number was taken out of the station. The third column shows the terminal, and the following columns except the last show the scheduled leaving times at the terminals known as Thirteenth and Washington Streets and Thirty-fifth Avenue. Spaces are provided over each group of time figures to show when the crews are relieved. The last column, of course, shows time in at car station.

Below the schedule of the Hopkins Street line and its Thirteenth Avenue branch will be found a detailed table of the time points and running time. The first two sections of this table applying to east-bound trips show the motorman at what minute past the hour he should pass the time points

Date_____191__

Line _____ Run _____

Conductor_____ Badge _____

Showing Actual Number of

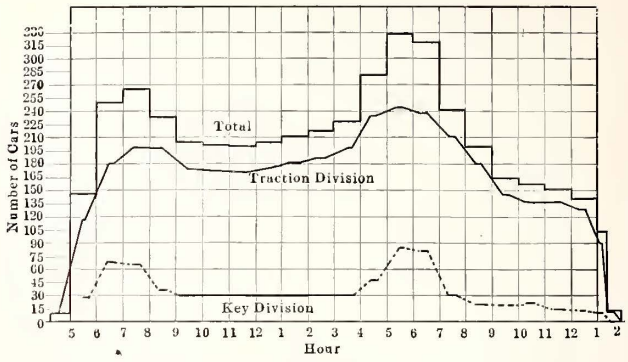
Passengers on Car at _____

4-7-15-10m-S-779

Trip	Leaving Point	LEAVING TIME Hour	LEAVING TIME Minute	A. M. or P. M.	Number of Passengers	Remarks

This Traffic Slip must be turned in, on completion of day's work, at Car Station

Traffic Slip Turned in by the Conductor



Variation in Car Requirements from Hour to Hour

presented in the center of the table. The last two sections of the table cover the same information for west-bound trips. It will be observed that two sets of time points are used; one corresponding to a twelve-minute headway and the other to a ten-minute headway. "No. 1 Fast Time" and "No. 2 Slow Time" at the immediate right and left of the time points in the center of the table show running minutes between the time points and total minutes from initial leaving point. "Slow Time" is used when it is necessary to run at a lower rate of speed during the rush-hour period as designated in the last paragraph under "Special Instructions." A comparison of scheduled leaving times and actual running time will show that lay-overs up to three minutes are provided. At the base of the table synopses are prepared for the convenience of those interested. For example, a crew can see off-hand just what it is expected to do throughout the day. The rest of the table shows the total car-hours, total cars, total runs, etc.

The time-table described is for use daily except Saturday and Sunday. On account of the variation in traffic conditions on Saturdays and Sundays, as compared with week-days, a different schedule is used for each of these days on most of our lines.

Saturday peak-load conditions remain about the same as other week days, but we find it necessary to extend the tripper service, and also to allow the closer headway to operate to a later hour on congested district lines to meet the increased travel during the evening.

Sunday morning travel does not warrant tripper service except for baseball or special events. The comparatively light business enables the company to lengthen the headway during the forenoon, which partially offsets the increased expense caused by the additional cars operated for Saturday traffic.

In compiling our time-tables the information is arranged to provide for cutting and filing in a uniform manner. On the left-hand margin of the schedule in its original form, circles are used to show where perforations are to be made, and a short line appears at the left to show where the sheet should be cut so that the information will be conveniently divided on all pages of the schedule.

San Francisco-Oakland Terminal Railways' Way Standards

By GEORGE H. BINKLEY
Chief Engineer Maintenance of Way and Structures Department

Pier Terminal Yard, Showing New Construction with 2-Mile Fill

THE San Francisco-Oakland Terminal Railways operate a system of tracks in nine municipalities and two counties on the east side of San Francisco Bay with a ferry connecting the East Bay Cities and San Francisco. All of the cars are operated by electricity, but some of the lines are doing a strictly street railway business, while others are in the nature of interurban lines, handling both freight and passengers, requiring track construction for M. C. B. equipment.

Owing to the requirements of so many municipalities and the varied character of service, it has been impossible to adopt standards of construction to apply to the entire system. Generally speaking, the recommendations of the American Electric Railway Association have been followed in the construction of tracks and paving.

Excavation and Drainage

Trench excavation as a rule has been made by hand, loading material on cars or wagons, but recently good results have been obtained by using a Brown hoist and a small steam shovel, materially reducing the cost of loading excavated material. Where a trench is located in the streets, it is the custom to scarify the macadam surface.

Most of the tracks are laid in a clay soil, and because of the character of the soil it has been deemed advisable in all recent work, whether under a concrete mat or stone ballast, to install a drain tile connected with the city sewers. Most of the drain pipe installed is 4-in. farm tile, but in one case second-class vitrified conduit was used. Most of the tiling is laid under the center of the space between the two tracks. In laying this tile a trench is excavated, approximately the width of a shovel, and the space around the drain is filled with clean crushed stone. Where concrete is to be used for the track foundation, a strip of roofing paper is laid over the drainage ditch in order to prevent the wet concrete from filling voids in the stone surrounding the pipe. Where practicable, a power roller is used to roll the subgrade, but in some cases, owing to the presence of service pipes near the bottom of the trench, it has been necessary to use a light horse roller.

Concrete Foundations

For some years past, concrete beam construction in different forms has been used to some extent, but in recent construction a 6-in. concrete mat has been laid, the concrete for all track construction being a 1-3-6 mix. Where the density of traffic is so great that it is not practicable to remove track in order to place a concrete mat, from 6 in. to 8 in. of stone ballast is placed under the track and thoroughly grouted.

Material for concrete is hauled to the street by cars. The concrete is mixed by an Austin two-sack cube mixer, operated by steam and burning oil. This machine is mounted on wide-tired wheels, running on the street. The mixer is charged with a one-sack batch, but when laying paving foundation under traffic, and the machine cannot discharge during the passage of cars, a second batch is mixed, so that as soon as the car is clear the machine discharges two batches, thus materially increasing the output of the machine. There has never been a time when it was possible to have trench or track work completed far enough ahead to work the mixer to its full capacity for an entire day.

The mixer is self-propelled, but carries no large

water supply and moves slowly, so that in moving from one job to another it is hauled by team or by means of a gasoline road roller. Owing to its weight long moves are somewhat trying on the machine, and for that reason two machines are in service, located in different territories.

In order to avoid absolute rigidity and to obtain some degree of elasticity, the top of the concrete mat is laid 2 in. below the bottom of the ties, and the ties are tamped with dry concrete, no water whatever being used in the mix. This dry concrete, however, absorbs moisture from the paving foundation of wet concrete when it is laid and hardens somewhat, although there is no difficulty in loosening it with picks in case of repairs or reconstruction. This concrete mat with dry concrete tamping material has proved successful so far, even when 70 lb. A. S. C. E. relayer rail was used.

Three accompanying drawings show the general style of construction, using the 141 lb. Trilby rail, 6-in. 60-lb. T-rail and 70-lb. A. S. C. E. rail.

Ballast

On the Traction lines, where the traffic is not dense and where lighter cars are operated, the tracks are laid on 6 in. of stone ballast, under which drain tile has been installed and the subgrade rolled. The tracks on which there is interurban service are ballasted with 12 in. of crushed stone. There are several stone quarries in this vicinity, and it is possible to obtain excellent ballast at a reasonable cost. All ballast is bar tamped.

Ties and Rail

For standard construction 6-in. x 8-in. x 8-ft. split redwood ties, spaced 2-ft. centers, are used; under crossings pine timbers of large dimensions are used. Ties are not treated, as in stone ballasted track the mechanical life of the tie governs, and where laid in concrete it is assumed that the life of the tie will equal the life of the rail.

In laying these split ties, it is necessary to adze them in order to obtain a uniform bearing and good alignment with 9-in. rail. Where tie plates are used, they are placed by means of a plating machine in the yards, but no tie plates are used in the concrete construction. An effort is made to have on hand at all times sufficient ties to permit proper seasoning before laying.

Like a great many other roads which have been in operation for a number of years, this company has rails of various sections, as follows:

70-lb. A. S. C. E. in 33-ft. lengths.
6-in. 60-lb. T in 60-ft. lengths.
7-in. 80-lb. T in 60-ft. lengths.
9-in. 106-lb. Trilby in 60-ft. lengths.
9-in. 125-ft. Trilby in 50-ft. lengths.
9-in. 141-lb. Trilby in 45-ft. lengths.

The 9-in. Trilby rail has been used to satisfy the requirements of municipal authorities, but, except under conditions of very dense traffic, good results have been obtained with 6-in. 60-lb. T-rail.

Specifications recommended by the American Electric Railway Association as to chemical composition have been followed in purchasing rail. There has been no serious trouble from corrugation. Where rail has become badly worn or cupped at the joint, material has been replaced by electric welding and ground, using a Kerwin power grinder operating on the track.

Practically all of the track is laid on tie plates, and for some time the shoulder tie plate has been used exclusively. As previously stated, tie plates are omitted with concrete construction. Standard spikes are used, there being no screw spikes in the track. Flat tie rods are used with all rail except the 70-lb. A.S.C.E. section, where no rods are used.

Joints and Special Work

When constructed, a considerable portion of the track was laid with angle bars, and these have been replaced largely by Continuous joints. All new work has either Continuous joints, or the rails have been electrically welded.

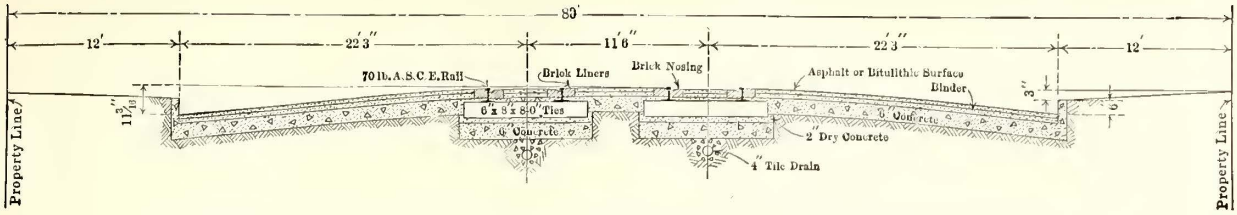
During 1914, this company welded about 6000 joints on different sections of rail, most of the welding being done on old track. This was the first use of the Lorain process west of Lincoln, Neb. The total failures to date on all sections of rail under varying conditions of track and rail have been 0.8 per cent of the number of joints welded.

The Vixen rail planer is used when installing new Continuous joints on new rail. The Continuous joints used are as follows:

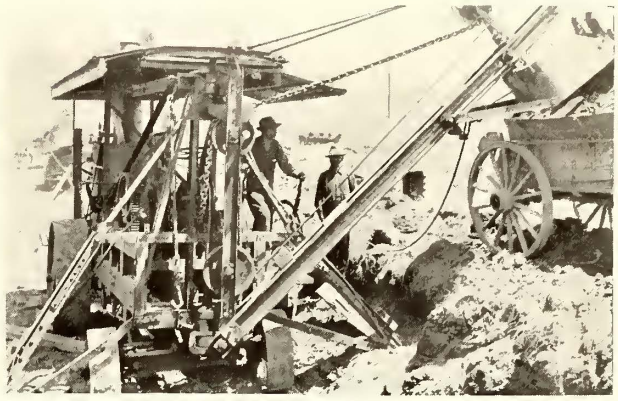
For 70-lb. A. S. C. E., four hole, 26 in.
For 6-in. 60-lb. T, six hole, 26 in.
For 7-in. 80-lb. T, six hole, 26 in.
For 9-in. 125-lb. Trilby, eight hole, 24 in.
For 9-in. 141-lb. Trilby, eight hole, 24 in.

On the Traction lines with frequent service, insert manganese centers have been generally used, although there is some solid manganese. Split switches are used in open track where provision must be made for M. C. B. flanges. Where such cars operate in streets, double-tongue manganese switches with a radius of 350 ft. are installed.

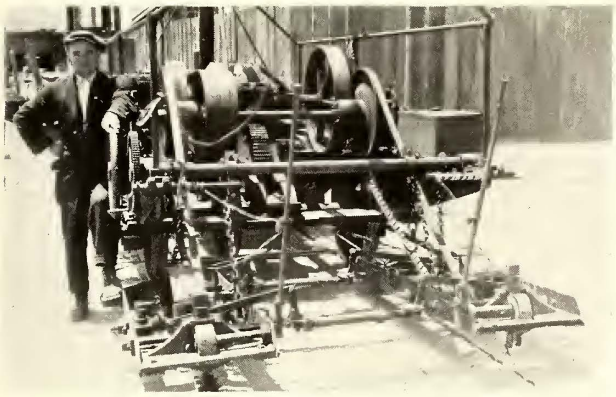
Crossings maintained by this company are built-up crossings, or have manganese centers. Built-up crossings and frogs for open track are constructed in the company's shops. Where renewable centers have been used in crossings and special work, they have not always remained tight, and there has been some trouble from breakage. In some cases this is perhaps due to the fact that the manganese castings are not heavy enough to stand up under the traffic requirements, but the failures are nearly



Typical Cross-Section of Grove Street Between Allston Way and Woolsey Street, Oakland



Traction Excavators Used on Trench Excavation on Park Street, Alameda

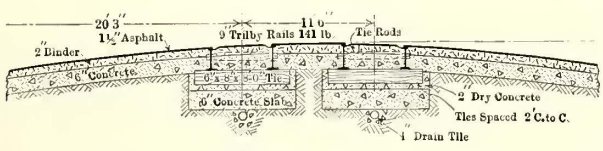


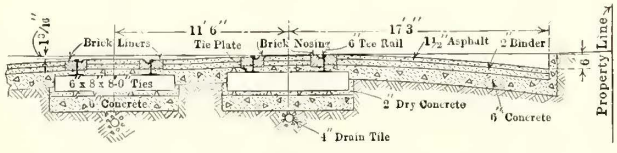
Rail Grinder on Hollis Street, Oakland

Rail Planer on Grand Avenue, Oakland

Photos by Bullis

Cube Mixer on Park Street, Alameda; Discharge End





Typical Cross-Sections—At the Left, Shattuck Avenue from Ward Street to South City Limits, Oakland; at the Right, Twelfth Street from Broadway to Fallon Street, Oakland

always where crossings or special work are designed to accommodate the use of different sized wheel flanges, thus prohibiting the installation of flange risers. Where special work is not flange bearing at crossings the receiving section breaks or wears, and the paving deteriorates rapidly.

Specifications are being prepared with the idea of establishing a standard for all heavy traffic of 9-in. solid manganese construction for special work and crossings. In installing such work, special attention will be given to the preparation of good foundations, and it is believed that the manufacturers are now producing a better quality of manganese castings than formerly.

The recommendations of the American Electric Railway Association are being followed as to the length and radii of switches and mates.

Spirals are used on all curves, and the minimum radius is 55 ft. All double track curves are designed so that cars will clear, excepting where the streets are so narrow that this is impossible.

PAVING

Practically all of the paving on this system consists of two kinds—oil macadam is used in outlying districts, and on main thoroughfares standard asphalt paving consisting of a 6-in. concrete base, on which is laid a 2-in. binder course with a finish surface of $1\frac{1}{2}$ in. of asphalt. Recently there has been a movement for the use of bitulithic pavement, consisting of a 2-in. course of bitulithic laid on 5 in. of concrete or on a macadam base.

This company does practically all of its oil macadam construction and repair work, the principal exception being when the street is being improved by a municipality, when the pavement outside of the tracks is done by the contractor for the street. For this work, covering more than 100 miles of single track measurement, there is an equipment consisting of a wagon oil spraying outfit, a car oil spraying outfit, and three 12-ton three-wheeled gasoline road rollers. The oil macadam pavement is serviceable and easily kept in repair, but is not adapted to heavy vehicular traffic, and at times during the warm weather there is too much oil on the surface.

In the selection of paving in its tracks, this company is governed by the State law, which specifies that the tracks must be paved with the same character of paving as is used on the rest of the street, so that very little latitude is allowed, although in some cases a municipality permits the use of a pavement differing somewhat from the adjacent paving.

The company has a stationary asphalt plant of a capacity sufficient to manufacture all asphalt paving material for its own use, and is doing all of its own paving with the exception of the strips laid by the street contractor, as in the case of oil macadam, this arrangement being made in order to eliminate the paving joint alongside of the tracks.

The Railroad Commission of California has ruled that the minimum distance from center to center of double track in streets shall be 11 ft. 6 in., and the State law requires all companies to pave 2 ft. on each side of its tracks, so that in all cases it is necessary to pave this strip, at least 20 ft. in width.

In carrying out asphalt street improvements, the manufactured product is hauled from the plant in steel side dump cars, having a capacity of 5 cu. yd. This permits delivery of the material at the proper temperature, as it can be delivered in this manner in large quantities, and much more quickly than by wagon or truck. Rolling is done by use of an oil-burning steam tandem 5-ton roller, which has been weighted so as to give a compression of 250 lb. per linear inch, a 5-ton roller being selected for this purpose because of its having a roll 29 in. in length, which permits it to operate between rails.

Liners of three kinds are used, asphalt brick, vitrified brick, and basalt stone. The asphalt brick liners have not stood up under traffic and the vitrified brick have not been entirely satisfactory, as there is a tendency to break along the rail, and the basalt liners do not make a smooth pavement, nor can they be used except with a high rail. A special vitrified brick with a depth of $3\frac{1}{2}$ in. has been used with the 70-lb. A. S. C. E. rail. Liners are laid as headers in cement grout.

In the most recent installation of Trilby rail liners have been omitted, and so far this seems to be satisfactory.

Owing to the reduction in the number of steel-tired vehicles using the streets, and the fact that the company has its own asphalt plant and can readily and cheaply make paving repairs, it would seem advisable to omit liners under all conditions except at intersections carrying maximum traffic.

BRIDGES, TRESTLES AND CULVERTS

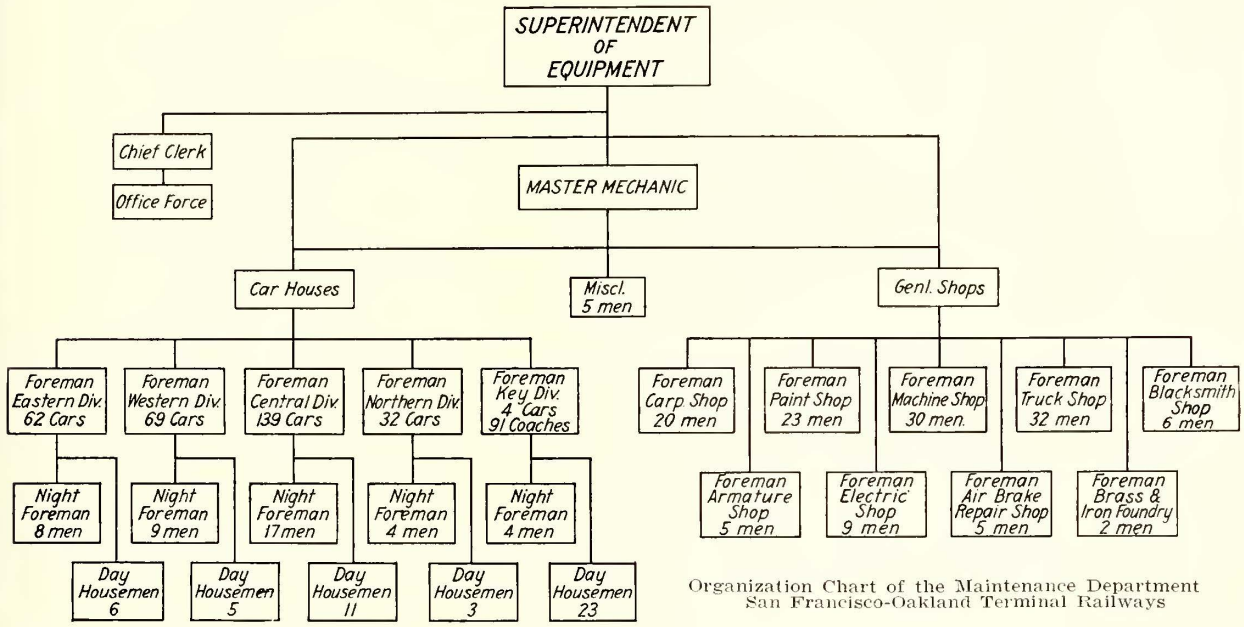
There are two subways on the system, both of which require daily pumping, but there are no large bridges or long trestles aside from the double-track trestle at the Pier Terminal, which extends at present 3 miles from shore (the longest trestle of its kind in the world). A solid fill for 2 miles of this distance is now under construction, this being the limit for which the federal authorities will allow a solid fill to extend into the bay.

Culverts installed under the tracks in paved streets are in most cases metal arch culverts of the same design as used by the municipalities, but in some cases where low rail is used in paved streets, in order to obtain clearance, concrete culverts with the upper part constructed of 40-lb. rail and concrete have been used.

Car Maintenance on the San Francisco-Oakland Terminal Railways

One Feature of the Cost Keeping Is that All Work of This Kind Is Concentrated in One Statistical Organization, Which Gives the Engineering Departments Any Desired Information on Demand

By GEORGE ST. PIERRE
Superintendent of Equipment San Francisco-Oakland Terminal Railways



Organization Chart of the Maintenance Department San Francisco-Oakland Terminal Railways

THE San Francisco-Oakland Terminal Railways department of car maintenance and construction has charge of 402 passenger cars which average about three motors per car, and about seventy miscellaneous work motors, freight and service cars. Work is also done for outside departments, as on buildings, manufacture of frogs and crossings for the track department, construction of overhead material and manufacture of miscellaneous material of all sorts on store department orders. Further, we maintain five ferry steamers.

As the average location of car equipment is but 4½ miles from the general shops all heavy repair work is done at the shops, inspection, cleaning and light repair work only being left for the carhouse forces to do.

When cars are in operating condition advantage is taken of the central location of the shops to route shop cars as trippers from outlying divisions to the central part of the city in the mornings and vice versa in the evenings.

Running Inspection and Overhauling

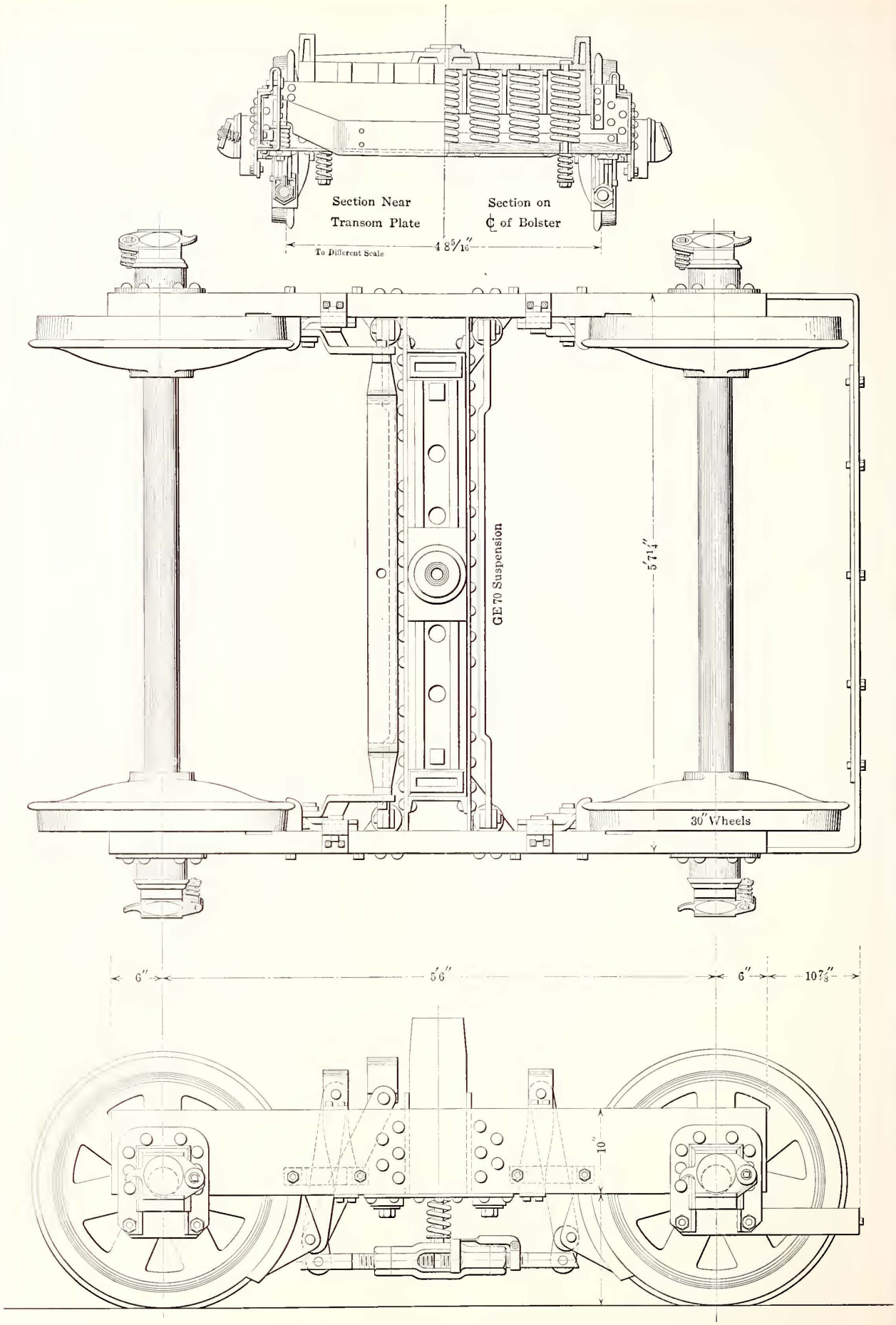
At the carhouses each car receives a running inspection daily, special attention being given to brakes, motor bolts, etc. Controllers and trolleys are lubricated every third day. General inspection and lubrication are on a mileage basis, 800 to 1500 miles being allowed between inspections according to the class of equipment. Car cleaning is done on a time basis, but cleaning periods are made to coincide with inspection periods whenever possible.

Cars are brought into shops for varnish and body overhauling every fourteen months.

Overhauling is on a mileage basis. Obsolete type motors are overhauled every 15,000 to 20,000 miles; semi-modern motors 50,000 to 75,000 miles and modern motors every 100,000 to 130,000 miles. Air compressors are overhauled on an average every 100,000 miles. These overhauling mileages are not arbitrarily adhered to, but are made to coincide whenever possible with the painting and body overhauling. We have some equipments which are varnished twice while the motors are overhauled but once.

Statistics

The company maintains a statistical department by which statistical information of any nature required is furnished to any other department on request. The several departments furnish the original information to the statistical department in the form of properly segregated charges on time cards and material requisitions.



Standard Passenger Car Truck Built in the Shops
of the San Francisco-Oakland Terminal Railways

The concentration of this class of work into one organization operates satisfactorily, and no doubt brings a considerable saving over the old method wherein each separate department maintained its own statistical organization. Thus the maintenance of equipment department receives from the department of statistics monthly comparative statements giving maintenance costs, total and per 1000 car-miles, on car bodies, trucks, painting, air brakes, accidents, headlights, gongs, fenders, wheel guards, broken glass, grinding wheels, route signs, coasting clocks and fare boxes, all chargeable to account No. 30; while on account No. 33-A detail charges are received giving separate costs per 1000 car-miles on each of the ten different types of controllers and the cost per 1000 motor-miles on each of the thirteen different types of motors. Costs per 1000 car-miles are also given on miscellaneous control equipment, pantograph trolleys and pole trolleys.

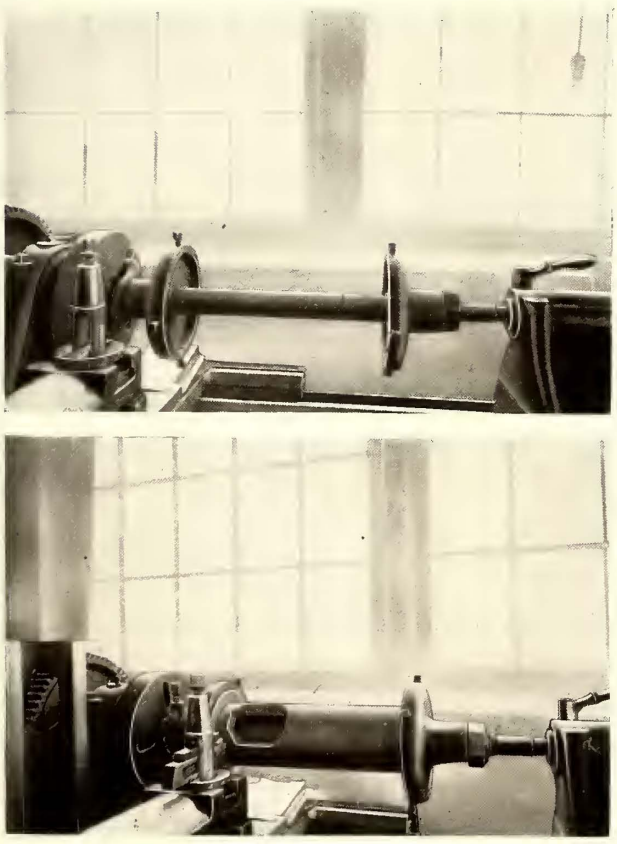
Reports are also received for each carhouse giving total costs per 1000 car-miles for lubrication (labor and material in detail) car cleaning, sanding, inspecting, switching, signing, changing cars on road, advertising, dispatching, testing fare boxes, reading fare registers, inspecting coasting clocks, fire drills, incandescent and arc lamp supplies, trimming headlights, inspecting alarm gongs, lamps and markers and general carhouse expense. Details are also given for the amounts which are spent on regular maintenance work at the various carhouses.

Monthly meetings are held with all foremen wherein these statements and other matters pertaining to department efficiency are considered.

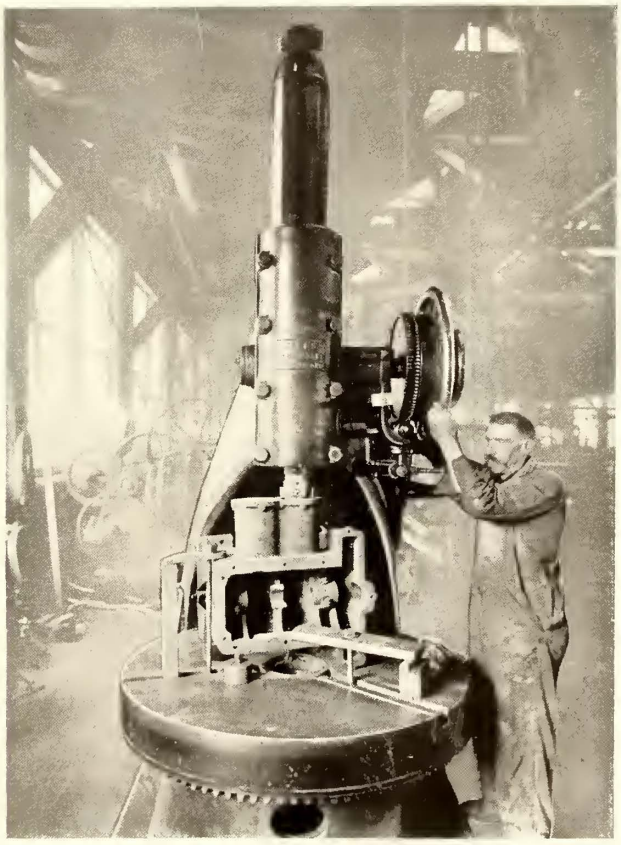
New men hired for carhouses receive a few months' training in truck and motor repair work at the company's general shops before being assigned to the carhouses.

Shop Areas and Equipment

The main shops, built in 1904, consist of twelve buildings of wood frame and galvanized iron construction, including: Carpenter shop, 100 ft. x 200 ft., with twelve tracks—capacity eighteen cars; mill, 60 ft. x 100 ft. equipped with woodworking machinery necessary for car building and general repair work; paint shop, 100 ft. x 200 ft.—thirteen tracks inside and four wash tracks outside, capacity about twenty cars of various sizes; truck shop, 100 ft. x 200 ft.—fourteen tracks, capacity seventeen cars of any size. We have eleven motor-driven car hoists capable of raising eleven of the largest cars at one time, and all tracks are served with air hoists on jib cranes for truck and motor work. The building serving the machine shop, armature and air-brake departments is 70 ft. x 200 ft. and is equipped with air hoists or jib cranes and traveling trolleys where necessary.



Top View, Jig for Boring Axle Brasses; Bottom View, Brass in Place



Reboring Air Compressor Cylinder on Wheel Boring Mill

The brass foundry is 40 ft. x 50 ft., equipped with two oil furnaces for melting brass in pots and two babbitting furnaces. The iron foundry immediately adjacent is equipped with one Swartz No. 5 oil furnace for melting iron in 1800-lb. heats.

The blacksmith shop, 40 ft. x 200 ft., has ten fires and is equipped with two steam hammers and furnaces, shears and bulldozer. This department turns out all forgings for the boats and cars and all special track work. It has a capacity of turning out two new cars per week outside of the equipment and maintenance of 500 cars and five steamboats. It also turns out all material for the maintenance of way and building departments.

At these shops we have built ninety street cars of an average length of 44 ft. and ten Key Route cars 58 ft. long with seating capacity for sixty-eight, sixteen Key Route cars 69 ft. long with seating for seventy-four and remodeled seventy-six California type open-end cars into pay-as-you-enter type. With the exception of the electrical equipment these cars were manufactured complete at these shops.

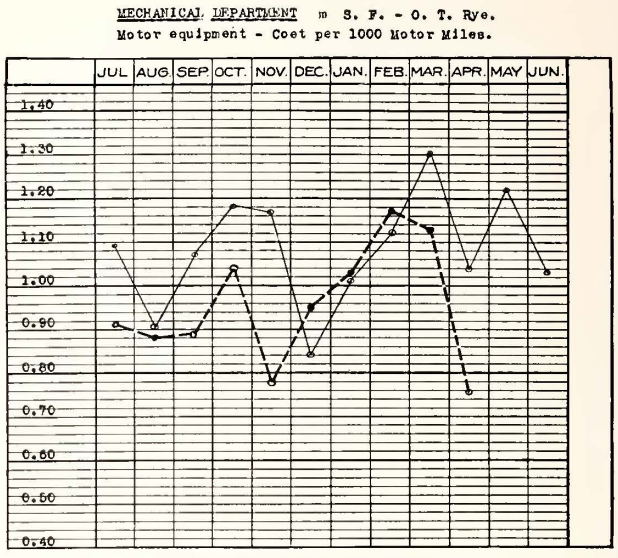
Maintenance and Repair Practices

Our axles are made from hammered steel. All bearings are turned and rolled in the lathe with the holder, and a revolving hardened roller is pressed up to the axle by the screw of the compound rest to insure a smooth surface and prolong the life of the axles.

Trucks made in our shops are one-piece frames riveted with ¾-in. rivets. They consist of two ½-in. x 12-in. x 5 ft. 6-in. transom plates, with ½-in. x 3-in. angles 5 ft. 6 in. long, with a ⅜-in. x 8-in. plate for the bottom and seven 5½-in. x 14-in. round 1-in. steel coil springs set in the frame with a cast-iron hollow truck bolster fitting on the springs. The sides of the truck frame are made from 10-in. channel 6 in. x 6 ft. long riveted to the transom by one 4-in. x 4-in. x ½-in. angle, on each corner of the channel. U-shaped 3-in. x 3-in. x ½-in. angles are riveted into the side frames to receive the journal box.

Axle brasses are cast in one piece, after which they are planed and put in a jig on a lathe to be turned. This jig is made to turn one pair at one setting. We turn the body and face inside of collars, and then part them in the center with parting tool, making two pairs, at one sitting. The lathe jig is made from a 2-in. shaft with two hollow heads with four set screws in each head, one solid with the shaft and the other up with the nut on the shaft. Then we turn up the brasses by means of set screws, this making very quick operation. Finally we place the brasses in a chuck and bore them.

Armature brasses are made in our brass foundry.



Motor Maintenance Graphs, San Francisco-Oakland Terminal Railways

They are then turned, bored and tinned before babbitting. We leave a space of 3/32 in. for babbitt.

We manufacture all our own crossings, frogs and switch points with cast-iron fillers which are made in our foundry.

As the compressors become worn out in the bore of the cylinder we set them on a wheel-boring machine, trueing them up by the top and bottom of the cylinder, parts which are not worn by piston travel. We then bore the compressors ¼ in. larger than standard size within ½ in. of the bottom of the cylinder to the squared shoulder. Next we take liners made from the very best cast iron, chuck the liners in the lathe, turn and bore them at one sitting, this practice insuring true liners after cutting them off the correct lengths. We press the liners in the cylinder by using clamps with long bolts on the top of the liner and on the bottom of the cylinder. The compressor is then ready to be assembled as good as new.

When old steel tires are worn down too thin for Key Route car service we cut them up in sections, draw them out into bars and use them for all track tools such as: tamping bars, pinch bars, pick points, chisels, etc. As they are of very good steel they make first-rate tools.

Our cars are painted according to the Ce Ve process of the Chicago Varnish Company, which requires seven days to complete or nine days for service. The system may be summarized as follows: No. 1, primer for wood or iron; No. 2, surfacer; No. 3, varnish color and two coats of Supreme varnish. In addition, a glazing compound is applied over No. 2. This is put on with a brush and then knifed, sanded or rubbed with a rubbing stone. Where expeditious work is required this painting process is desirable.

Key System Pier Terminal

Maintaining Proper Relations Between a Railway and Its Car Men

Verbal and Written Communications to the Men Have Proved to Be Very Effective in Promoting Appreciation of the Operating Rules

By GEORGE H. HARRIS

General Superintendent San Francisco-Oakland Terminal Railways

THE San Francisco Oakland Terminal Railways realizes that no other one thing is more productive of satisfactory operation, both from the standpoint of the company and the public, than a proper understanding on the part of the car men as to what is expected of them in carrying out the rules and regulations of the company.

In order to keep the men fully informed in this respect our company has for some time held periodical meetings for the car men in a schoolroom specially provided for the purpose. At these meetings short talks on matters pertaining to operation are made by the chief instructor, division superintendents and other officials, after which the car men present have an opportunity to bring up and discuss any subject of interest.

These discussions frequently result in bringing out valuable suggestions from the men and give to them an opportunity to present their viewpoint on any subject under discussion.

In addition to these meetings it has been the practice for some time to issue monthly pamphlets which are distributed to the men with their pay checks. These pamphlets are of a size convenient to be carried in the pocket, and deal with various subjects of operation, such as: "Courtesy," "Service," "Co-operation," "Slippery Rails," "Accidents," "Coasting," "Safe and Comfortable Operation," etc. This method of getting important points of operation before the men has also proved effective, notably in the case of a pamphlet on "Coasting."

It is a well-known fact that with the installation of coasting clocks, if the motormen are not properly instructed on coasting they are likely to get an entirely erroneous idea of the manner in which a car should be operated to obtain the desired results. All cars of this company are equipped with coasting clocks and at the time of installation every effort was made fully to instruct the motormen on coasting. First two, then later one coasting inspector has been regularly employed to look after this work, but with a large number of cars in operation the instructor is not able to get around to each motorman at close intervals. As an aid to this important work a "Coasting" pamphlet was issued.

In this pamphlet the more important points in connection with coasting were briefly set forth, serving the motorman as a rule book, as it were, to which he might frequently refer. It was found that this pamphlet was of much benefit in bringing to the attention of the motormen the proper manner in which a car should be operated to obtain the greatest amount of coasting. In this case also, as with other similar pamphlets, a better understanding with the men was obtained.

The spirit in which our pamphlets are written

is exemplified by the following extract from the one issued in February in connection with the exposition:

"To Motormen, Conductors and Collectors:

"During the present year the company will be called upon to handle an increased number of passengers, on account of the Panama-Pacific International Exposition, many of whom will come from all parts of the United States and foreign countries.

"These visitors will not be familiar with the city, or car routes, and they must naturally look to some one *who knows* to direct them to their desired destination, and to the various points of interest in and around the East Bay cities.

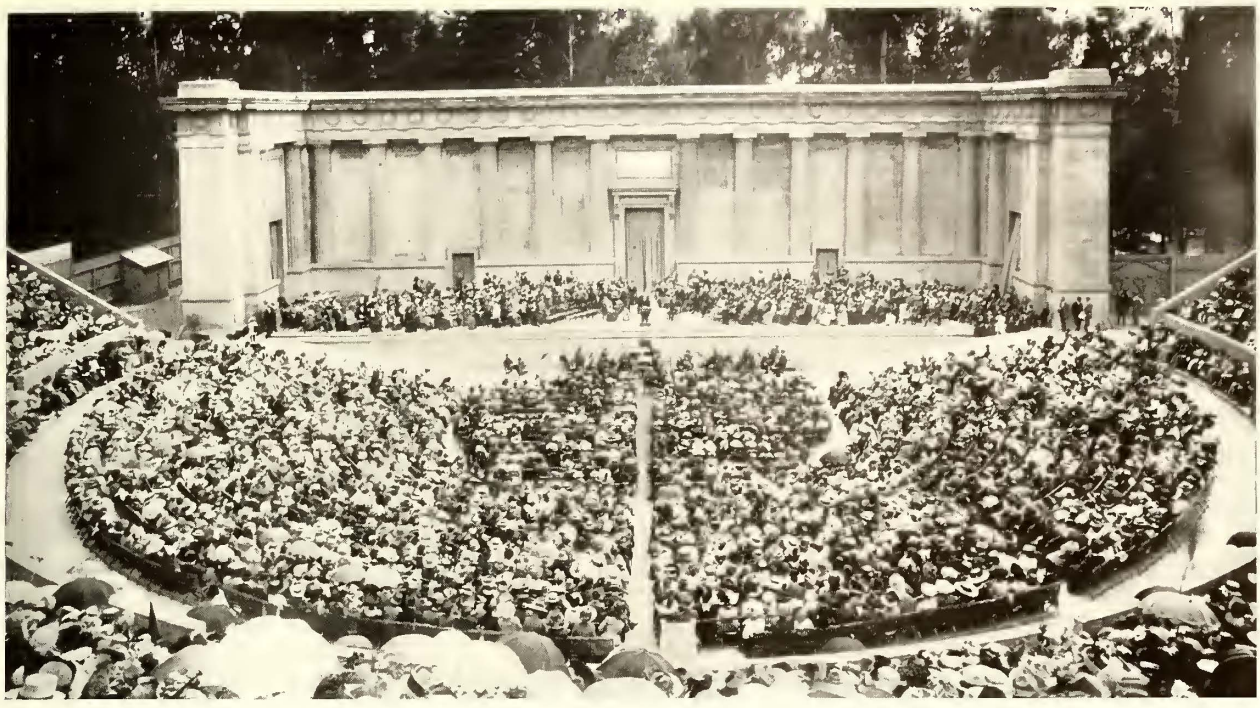
"It is to this class of patronage that I wish to draw your special attention at this time. The strangers in our city will look to the car men more than to any other public employees to give them information about the city, and to direct them how to reach any point therein. May I therefore impress upon each of you the importance of thoroughly familiarizing yourselves at this time with the various car routes operated by the company, and the territory into and through which each line runs, so that *you* will be the one *who knows* and can direct the stranger?

"In addition to the service now in operation the company will inaugurate and maintain during the exposition period a direct ferry service between the Key System pier and the exposition grounds. A heavy expense has been incurred in preparing for this service and we want your full co-operation in making it a success.

"To derive the greatest benefit from this service and to make it entirely satisfactory to the public, cars, trains and boats must be operated on schedule as near as possible; the public must be able to readily obtain information relative to the service, and it will be *you* from whom they will naturally expect to be able to get the information desired."

As a rule it is not a difficult problem to obtain satisfactory service from car men, and to have the most cordial relations exist between them and the company, provided they are properly instructed as to their duties when first starting to work and also if they are followed up by interesting methods of bringing the more important points of operation before them, somewhat along the lines described. Under this plan it has been observed that a majority of the men make an effort to concentrate their minds on the work and endeavor to carry out their duties in an entirely satisfactory manner.

Ten-Car Key Division Special Train of University of California Cadets Going to the Exposition



Greek Theater in Berkeley

Building Up Local Pleasure Travel to Points in the East Bay Cities

Co-operation with Privately-Owned Parks Is a Regular Feature—Special Provisions Have Been Made to Facilitate Direct Travel to the Exposition

By J. H. BROWN

Traffic Manager San Francisco-Oakland Terminal Railways

THE development of pleasure travel on the urban and interurban lines of the San Francisco-Oakland Terminal Railways is retarded to a certain degree by the geographical location of the cities served on the east side of the Bay of San Francisco, the movement of the pleasure traveling public being toward San Francisco. This condition is not dissimilar to the condition prevailing in other territory contiguous to a large city.

San Francisco, with her beautiful parks, ocean view and bohemian life, offers inducements to all classes of the public and affords competition that our local pleasure resorts meet only to a certain degree. Different inducements are offered local pleasure travelers to influence their trips between various points in the East Bay cities.

This company maintains a beautiful park adjacent to Richmond to which free admission is given to all organizations, except such as desire the exclusive use of the park or charge an admission thereto. No liquor privileges are permitted in this park, an arrangement which is very popular with Sunday schools and fraternal organizations of San Francisco and the East Bay cities. Thereby, in a way, we offset the regular pleasure travel toward San Francisco.

Oakland and her sister East Bay cities maintain and support a number of the best equipped children's playgrounds on the Pacific Coast. These, to a certain extent, influence pleasure travel during the school vacation period.

In addition to the foregoing pleasure resorts there are a number of privately-owned picnic parks, some with and some without liquor privileges. The managements of such parks, of course, have their regular bookings of picnic parties, and our traffic department co-operates with them in every way possible, thereby assisting them in securing bookings with the result that, to a certain degree, these resort managers act indirectly as passenger agents for our company. As a medium of making friends for the company, I believe this policy of dealing with privately-owned parks is a good thing.

Inviting Tourists to See Us

San Francisco has always been a magnet for the tourist travel, and with the Panama-Pacific International Exposition located in her boundaries this year she offers a greater attraction for tourists than any other city in the United States. The method of inducing a large number of these tourists to cross the bay and visit the East Bay cities is

Tea House at Piedmont Park

A View in One of Oakland's Public Parks

being worked out through the co-operation of Alameda County, the various civic organizations, hotel association and this company by the distribution of attractive advertising matter and personal solicitation by the various arganizations mentioned.

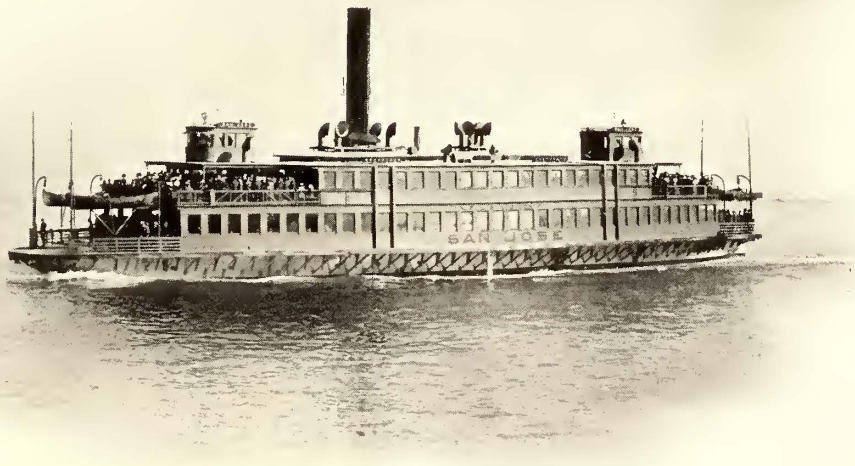
In addition to its large exhibit at the Panama-Pacific International Exposition, the county maintains exhibits and information bureaus throughout various Eastern cities, at the San Diego Exposition and Los Angeles through which the advantages of the East Bay cities receive publicity.

For the Panama-Pacific International Exposition tourists, this company has established a special visitor's ticket good for transportation direct from the exposition grounds to and through various points in Oakland or Berkeley and return to San Francisco proper. These tickets are on sale only at the exposition grounds and receive publicity through the medium of a pictorial folder containing a bird's-eye view depicting an area of approximately 75 square miles of the territory served by our lines. This folder also contains a number of photographic reproductions of points of interest in the East Bay cities, with complete information regarding various car lines serving such points.

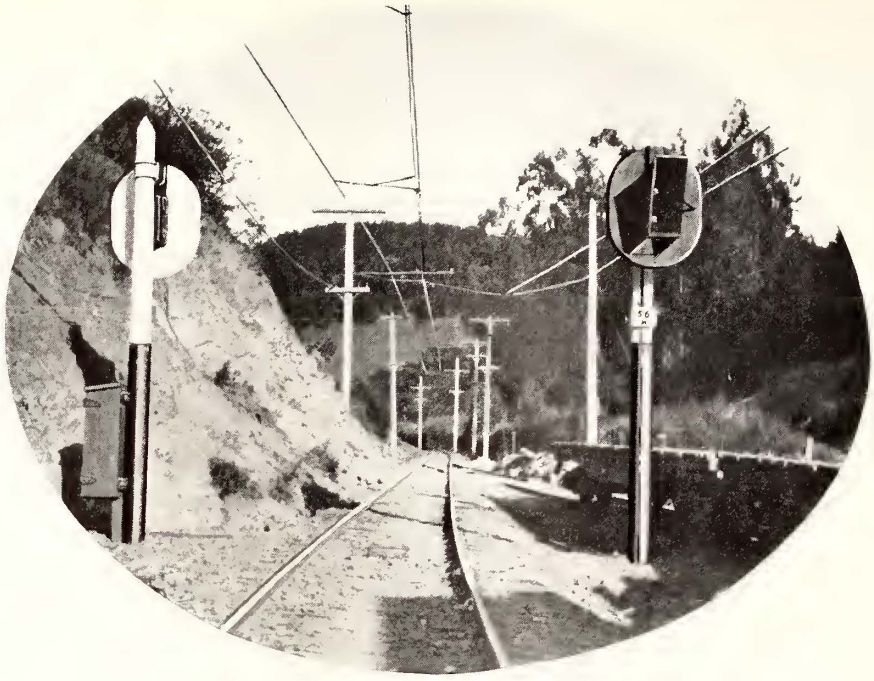
In the printing of such folders we have used a soft tone of green color on a white background, thereby avoiding strong and distinctive colors. The soft color tones used have met with many favorable comments from the public.

As the San Francisco-Oakland Terminal Railways is the only company operating a direct ferry service between the cities of the east side of San Francisco Bay and the exposition, we are often called upon to handle peak loads which are subject to attendant congestion at ticket agencies, inasmuch as no exposition tickets are sold on our cars. To avoid possible congestion at agency points, we have our tickets on sale at many hotels and business houses, the proprietors of which act as our ticket agents without remuneration. The popular demand for such class of tickets carries with it an advertising value to such agents, and in all cases we have found them very glad to offer such an accommodation to their guests or customers. As these selling agencies are distributed in such a manner as to cover practically all main-line points we are enabled to handle large crowds with little or no congestion at any one ticket office.

At our pier terminal we have constructed a large waiting room with twenty-five entrances, arranged in such a manner that we can handle any size crowd without delay. Exposition passengers pass from this waiting room through exit doors, where count is made, and board boats. We are thus enabled to keep an exact count of passengers boarding boats and also to close the exit gates immediately upon loading a boat to its maximum, thereby avoiding overloading any boat. The patronage of this service bespeaks its popularity.



Key Division Boat on San Francisco Bay, Headed for the Panama-Pacific Exposition



Signals at Hartens

Signal Operation on the Oakland, Antioch & Eastern Railway

By F. A. MILLER
Superintendent of Power and Equipment

THE Oakland, Antioch & Eastern Railway is a purely interurban high-speed railway operating out of Oakland for 85 miles of route east and north to Sacramento. At Oakland we have trackage rights over the lines of the San Francisco-Oakland Terminal Railways so that we can run cars to that company's ferry terminus.

The greater part of our line is, of course, single track with sidings at intervals varying from 2 to 5 miles. Our passenger trains are run up to a maximum speed of 62 m.p.h., although our cars are geared for 55 m.p.h. Trains consist either of motors and trailers or of locomotives and trailers. We also have extra fare parlor buffet cars with porter service. The locomotives are used chiefly for special excursion service as they can haul five 60-ft. sixty-seat cars at 57 m.p.h. on level track. Westinghouse 600-1200-volt motors and HL control are used throughout.

Between Oakland and Bay Point 30 miles distant we operate a mixed through and local service; beyond that point to Sacramento all passenger trains are of through character, connecting with the Northern Electric Company at Sacramento, where parlor cars are attached to trains of that company, thus giving through service to Chico, 180 miles from Oakland. We operate also four branch or feeder lines on which we give local passenger service.

Our freight service is so arranged that one local train is operated between Oakland and Bay Point and another between Sacramento and Bay Point, which is our place of car and l. c. l. interchange with the Southern Pacific and Santa Fé Railways. At Oakland we interchange with the San Francisco-Oakland Terminal Railways and at Sacramento with the Northern Electric Railway. The freight trains, which are hauled by electric locomotive, leave Oakland at 8.50 p. m. and Sacramento at 6 p. m. respectively, meeting at Bay Point. The freight train for Oakland reaches that city by 4 a. m., and the Sacramento train reaches its depot about 5 a. m. The last passenger train leaves Oakland at 8.30 p. m. and the first morning train does not leave Oakland until 7.50 o'clock, so that there is no interference whatever with freight. On the other hand, the last passenger train out of Sacramento leaves at 7 p. m., overhauling the out-bound freight at Headquarters siding. In the morning, however, the freight and train has returned to Sacramento two hours and fifteen minutes before the first passenger train leaves. Freight trains run up to 35 m.p.h.

In general, our through passenger trains are run on a two-hour headway and local trains on the hours between. Therefore, between Oakland and Bay Point we have one train an hour each way, but the limited trains each way, one in the morning and one in the afternoon, do not stop in the entire run of 85 miles between Sacramento and Oakland. The lim-

SIGNAL MAINTAINER'S TROUBLE REPORT

.....6/16.....1915

To.....F. A. Miller, Sig. Supt.....

Following Apparatus R. B. O. by.....Condr. #11.....

.....Sig. 691H.....*at*.....11.37....*A.M.*.

Report received by me.....

While at.....Train #11.....

Arrived at apparatus at.....11.37.....*A.M.*

Repaired and O. K. at.....1.00.....*P.M.*

Reported O. K. to.....Dispatcher.....*at*....1.00.....*P.M.*

Following trains delayed.....#11 about 2 minutes.....

Cause of failure:.....Section gang lining track at Millor spur put switch-box out of adjustment.....

.....Manear.....*Maintainer*

SIGNAL MAINTAINER'S DAILY INSPECTION REPORT

.....6/15.....1915

To Superintendent of Signals:
The following signals and signal apparatus have been inspected by me and found in the condition noted:

No. of Signal		No. of Signal	
462D	Lamp No. 2 B. O.	544D	O.K.
464H	O.K.	546N	"
465H	"	547H	"
467D	"	549D	"
490D	"	562D	Lamp No. 2 B. O.
492H	"	564H	" " "

.....Manear.....*Maintainer*

SIGNAL LAMP RECORD

Signal No. 178-D *Location* Saranap

Lamp No.	Make	Volts	Date In	Date Out	Remarks
2	Westinghouse	120	3–5–15	4–19–15	2 to 1
1	Westinghouse	120	3–5–15	4–19–15	Burnt out

Signal Maintainer's Daily Report Forms; Signal Lamp Record

iteds make this run in two hours forty-five minutes exclusive of four minutes' running time on about 0.39 mile of city track in Sacramento.

Choice of Signals

The present signal system was completed in May, 1914, following the extension of the original Oakland & Antioch Railway from Lafayette to Oakland, at which time the service was altered from suburban to interurban type. The original line had no signals whatever. The system now in use was furnished by the Union Switch & Signal Company, both for the section between Oakland and Bay Point and the last extension completed September, 1913, to Sacramento. This signal installation is the only a.c. track-circuit system in the vicinity of San Francisco which uses light signals.

The signal system is operated by sixty-cycle current which is supplied to the signal mains at 2200 volts at Eastport and Concord for the signals from Oakland to Mallard, and at Dozier or Lisbon for the signals from Chipps to Sacramento. At Concord current at 2200 volts is available, but at the other places two transformers are installed to step down the voltage from 11,000 to 2200. A double-pole, double-throw oil circuit breaker connects either transformer to the line.

The transformers at Drawbridge substation are not in use on the signal system at the present time. At signal locations and cut sections 0.6-kva. transformers supply current at 110 volts for relays and signals. Adjustable-core transformers feed the track circuits at the center, though about twenty less than 4000 ft. in length are end-fed. All spurs have a light switch indicator to show when a train may enter the main line. Sidings having one set of home signals are provided with light switch indicators at the east ends; sidings having two sets

MONTH OF August 1914.

SIGNAL NO.	LOCATION	DATE	TIME	CREDITABLE STOPS: TRAIN IN BLOCK	TRACK FOULED	OPEN SWITCH	BROKEN RAIL	DEPARTMENT RESPONSIBLE: TRACK: DEFECT TRACK	MISCELLANEOUS	MECH.: DEFECT EQUIP	TRANS: WEAK OFF	POWER	SIGNAL: DEFECT INSTAL.	DEFECT MAINT'CE	ERROR OF MAINT'R	UNCONTROLLABLE CAUSES: TAMPERING	DAMAGE BY ELEMENTS	DAMAGED APPAR.	TOTAL DELAYS	REMARKS
TRAINS RECEIVING STOP SIGNAL FROM VARIOUS CAUSES.																			Min	
18 H	R'Bridge	8-21	4:15P						1										2	Section Gang Had Switch Open.
663 H	G'Leg	8-21	6:25P											0					0	Dark Signal.
761 H	Lisbon	8-24	7:35A						1										0	Trackmen Cutting rail W. E. Yard Trestle.
402 D	Chaplin	8-30	7:30A	1															10	Freight Train Not in clear
TOTAL				1					2					0					12	
TRAINS RECEIVING FALSE CLEAR SIGNAL FROM VARIOUS CAUSES																				

TOTAL TRAIN STOPS 3 TOTAL FAILURES 4

TOTAL SIGNAL INDICATIONS (310,000 Approx.)

NO. OF STOPS PER 100,000 INDICATIONS 0.09

NO. OF STOPS PER 100,000 INDICATIONS DUE TO SIGNAL DEPT. 0

SIGNED F. A. Miller

SUPT. OF SIGNALS

Performance Sheet Showing Character of Defects Repaired by Maintainers

of home signals are provided with light switch indicators at both ends.

Signals are hung on cedar poles, 25 ft. long, 7-in. tops, shaved and painted. All wiring is carried down poles and underground in redwood trunking and galvanized conduit. Bonding at switches and frogs and connections to impedance bonds are No. 0000 D. B. W. P. stranded copper.

Track circuit wiring is No. 6 copper, rubber-covered, and all connections between line wires and signals and relay boxes are made with No. 12 and No. 14 copper, rubber-covered. Spare wires are drawn through all conduits. Distant signals (non-automatic) placed 1000 to 2000 ft. in advance repeat the indications of their respective home signals. The overlaps favor west-bound trains; they vary in length from 300 ft. to 400 ft.

Two No. 6 bare copper wires for the signal mains and three No. 10 D. B. W. P. copper wires for common and east and west-bound control were strung by the line department. Distant signal and switch indicator wires were strung by the signal department. The number of miles protected is 85; the number of home signals, 117; the number of distant signals, 90; and the number of crossing signals operated in conjunction with signal system, 14.

BEHAVIOR OF SIGNALS

We have approximately 300,000 signal movements per month, and our averages for the twelve months from May, 1914, to May, 1915, show as follows:

Total train stops	7.3
Total failures	9.07
Number of stops per 100,000 indications	2.02
Number of stops per 100,000 indications due to signal department	0.5

The signal system auxiliaries comprise fourteen automatic flagmen highway crossing signals which are operated from the track circuits. They ring a bell, swing an arm and show red and white lights. The flagmen originally were operated from the 1200-volt d.c. trolley circuits, but we found that the maintenance costs would be decreased by using alternating current at 110 volts in place of 220 volts direct current. The flagmen were furnished by Bell & Jamison, Los Angeles.

Three men are employed exclusively for the maintenance of all signals and telephones. Each man has approximately one-third of the mileage to inspect and maintain. Gasoline cars of Mudge type are used to get over the line quickly. It may be added that we began with four signal maintainers, but increasing experience leads us to believe that two men will suffice in the near future.

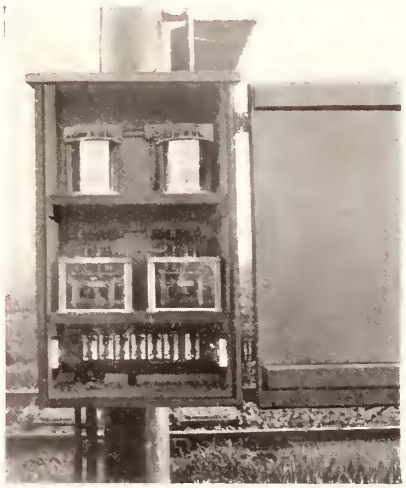
The maintainers must report to the dispatcher every hour, thus furnishing an account of their movements and giving the dispatcher the information needed to enable him to locate the maintainers quickly in case of telephone trouble and the like.

The principal trouble experienced is broken and burnt-out lamps, this amounting to about two per month. To minimize such failures each signal location is supplied with a signal lamp record (illustrated) which shows the period the lamp has been in service. We use a 112-volt 25-watt GE-18½ tungsten bulb, the average life of which is four months of twenty-four hours a day. Other signal troubles are so rare that they can scarcely be called recurrent.

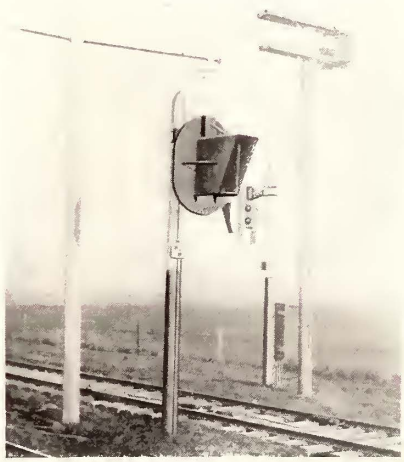
In addition to the regular system on our own lines we operate a Westinghouse electro-pneumatic interlocking plant with eleven active and twelve spare levers at our Oakland connection with the San Francisco-Oakland Terminal Railway.

The total maintenance cost of the track circuit signals, highway crossing automatic flagmen, electro-pneumatic interlock and telephones averages $400 per month, including both labor and material.

Although we have every confidence in the signal system we do not feel that we would be justified in having it take the place of regular train order dispatching. Both practices in co-operation appear necessary to secure the greatest degree of safety.



Signal Box Ready for Inspection



Side View of Light Signal

Automatic Train Stop in Key Route

Typical Eight-Car Suburban Train on the Northwestern Pacific

Signal, Bonding and Contact Rail Notes on the Northwestern Pacific

This Company's Pioneer A.C. Track-Circuit Signal System, Installed in 1903, Has Made an Excellent Record in Maintenance—Soldered Bonds Are Also Used Successfully Despite Earlier Failures

By F. T. VANATTA

Chief Electrician Northwestern Pacific Railroad, Sausalito

THE Northwestern Pacific Railroad is one of the few third-rail lines on the Pacific Coast and the first of its kind in this territory. We operate a total of 32.6 miles of single track electrically, the rest of our mileage being steam. A peculiar feature of the service is the operation of both standard-gage steam and electric and narrow-gage (3 ft. 6 in.) steam trains, the narrow gage being formed by a third running rail as illustrated.

Because of the mixed steam and electric operation with two gages unusual signal arrangements prevail. On the double track between Sausalito and Corte Madera all six rails are used for the railway return circuit. The narrow-gage rail is tapped into the center of the inductive bonds of the signal circuits, and the transformers and relays of the signal equipment are connected across the narrow-gage track. Ordinarily the connection would be from outside rail to outside rail, but this would not give satisfactory signaling for narrow-gage trains. The signals on this section are operated by alternating current.

Between Corte Madera and San Anselmo the two

Twelve-Year-Old A.C. Track Circuit Signals at East Portal of Corte Madera Tunnel

First Step in Moving Live Conductor Rails

common rails are used as a signal rail, the other four serving for the railway return. This arrangement was the original one for all electric track, but on this section the signal rails are not yet required to increase the capacity of the railway return. The signals on this section are direct current, operated from storage batteries in the signal cases, these batteries being charged from the third-rail.

One addition made by us to improve the efficiency of the signal system is a change in the control of the signals which govern short single-track sections, particularly of single-track or gauntlet track in tunnels. The standard signal post was cut down until the blades in their horizontal position were 12 ft. from the top of the rails to remind the motormen that they were for a special purpose, and also to bring the operation within their line of vision from the train as they ran by. The signal which has the preliminary is held normally at danger, its control circuit being looped through a mechanical switch of the signal at the opposite end of the block section. Hence this signal cannot be cleared until the opposite signal has been brought to the stop or danger position. When a train enters the preliminary of the block section it throws the signal at the opposite end, which will allow this train's proceed signal to go to clear if there is no other train in the block.

This signal installation is notable as the first a.c. track-circuit outfit installed by the Union Switch & Signal Company. The first equipment, placed in 1903, was for 10 miles of double track, and this has since been extended to cover the 32.6 miles of electric track and 8 miles of the steam track. During the entire period of its service this pioneer installation has proved entirely satisfactory. To-day, after twelve years' use, the upkeep expense is not appreciably more than when the apparatus was new. On several occasions the signals have more than paid for their cost, notably in giving warning of broken rails in our 2200-ft. tunnel near Corte Madera.

Second Step in Moving Live Conductor Rails

Twelve-Year Old A.C. Track Circuit Signals at Ross

We have five interlocking plants, one of which is of the General Railway Signal Company's all-electric type, two of the Union Switch & Signal Company's mechanical type and one of the latter company's all a.c. electro-pneumatic type, and one of the same company's all d.c. electro-pneumatic type.

Successful Soldered Bonds

We can also lay claim to some pioneer work in soldered bonds. Our first bonds, placed in 1903, were of the plastic alloy or mercury amalgam type. These soon went to pieces. Next we tried a short-ribbon bond which was soldered to the ball of the rail. These bonds, including the loop, were only 8 in. long over all. They were soon shaken off,

partly because of bad soldering and partly because vibration broke the short ribbons. In 1906 we adopted a third bond but stuck to the soldering principle as we felt that success would come with a better design and more experience in application. The new bond was of wire strand type with T terminals, was of 300,000 circ. mil capacity and 8 in. to 9 in. long between the centers of the terminals. This bond has proved entirely satisfactory.

As the soldered bond has lost favor during the past few years, it is proper to explain why we have retained faith in it. The failures with our first soldered bond taught us that the question of temperature during application was all-important. To apply a bond we first chip the rail and then heat

Third Step in Moving Live Conductor Rails

the chipped section just enough to permit tinning instead of trying to bring the rail to a temperature hot enough to melt the solder. The bottom edge of the bond is then held against the rail with the top edge about ¼ in. away. The gap at the top is then filled with solder melted with the gasoline torch. Heat is applied to the terminal until the solder is just warm enough to handle in the way that a plumber wipes a joint. Next the bond is straightened, and the extruded solder is wiped off, thus completing the job. Two men average eighty bonds in a ten-hour day.

A soldered bond correctly applied in the manner described has between the terminal and the rail a cushion of solder which is thick enough to absorb a good share of the rail vibrations. On the other hand, the use of excessive heat causes the solder to run down and spread until it is little more than a film. We also use soldered bonds on our contact rails, their terminals being attached to the base of the rails.

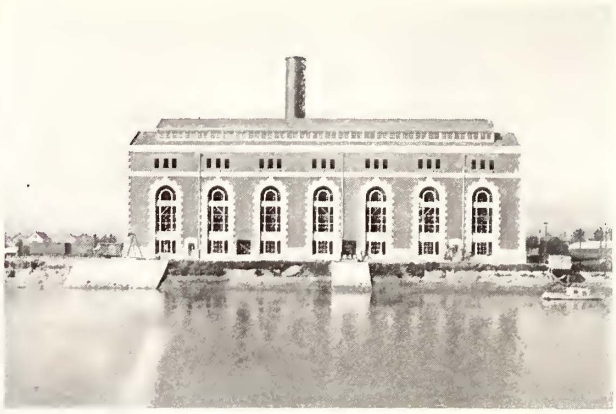
TRANSFERRING CONTACT RAILS ALIVE

Our contact rails are of the over-running type. We have made no change in them since the original 60-lb. T-rail conductors with aluminum rod and copper cable feeders on opposite sides of the rail web were installed. In 1913, however, owing to

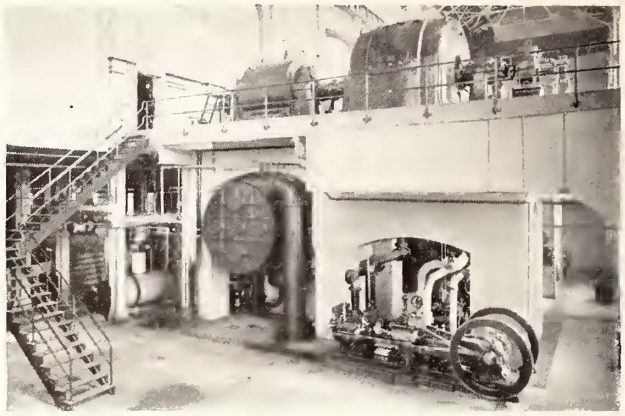
Fifth Step in Moving Live Conductor Rails

double-tracking, we had occasion to transfer about 2000 ft. of the contact rail from one side of the track to the other. The interesting point of this work was that the rails were alive during the entire operation so that service was not interrupted. To accomplish this we first placed 9-ft. ties at right angles to and under the contact rail at intervals of 15 ft. for the complete distance. The naked contact rail was then pushed over to its new location by means of wooden priers. The gang numbered seventeen men, about twelve of whom stood about 10 ft. apart to pry over one section of rail while the others set the rail in its permanent position. The circuit was maintained with flexible insulater cable at the ends. The job was done in thirty minutes.

Fourth Step in Moving Live Conductor Rails

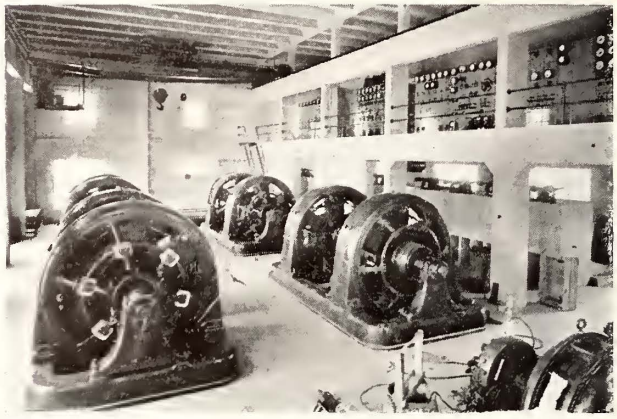


Southern Pacific Power Plant, Fruitvale

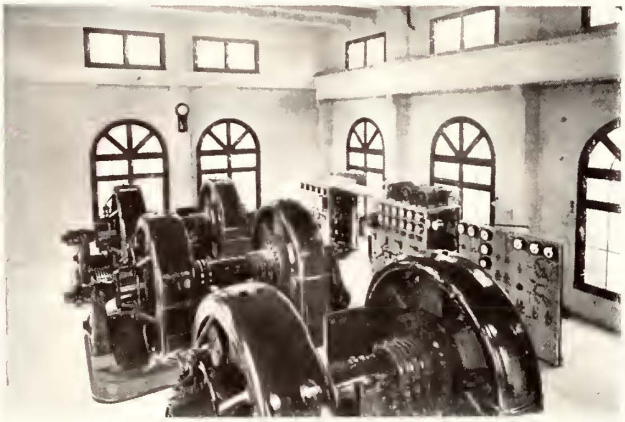


Interior View of Southern Pacific Power Plant, Fruitvale

Battery Room, Southern Pacific Power Plant, Fruitvale



Rotaries, Southern Pacific Substation, Oakland

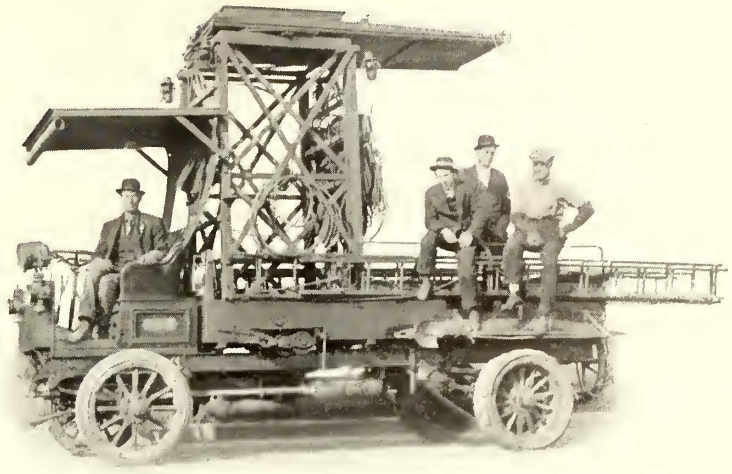


Second Floor, Southern Pacific Substation, Berkeley

West Oakland Substation and Flower Garden

Car Repair Room, Southern Pacific Shops, Alameda Point

Interior View of Southern Pacific Electric Car



Gasoline Emergency Line Auto Truck, Southern Pacific Electric Lines

Maintenance of a 1200-Volt Catenary on Southern Pacific Lines

By JESSE B. NICHOLS
Supervisor Overhead Lines Southern Pacific Company, Electric Division

THE Oakland, Alameda & Berkeley lines of the Southern Pacific Company serve the Bay cities on the east side of San Francisco Bay, comprising the towns of Oakland, Alameda, Berkeley, Albany, Emeryville and San Leandro. They comprise 101.04 miles of track, or 52.38 miles of road.

The overhead construction consists of a 7/16-in. messenger and a No. 0000 grooved copper trolley wire, with a catenary hanger of the loop type, which gives good flexibility to the system. The operating voltage is 1200 volts direct current.

The center pole and span wire catenary construction is used exclusively with the exception of both Alameda and Oakland Moles, which are of bridge construction with double catenary overhead. Iron poles set in 6½ ft. of concrete are used. They are first given a coat of red lead, and a second coat of black carbon paint. The span varies from 60 ft. to 120 ft., while the bridge spans commonly are 240 ft. long.

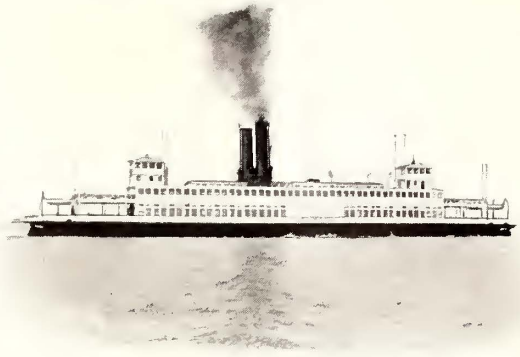
For high-tension circuits we use a seven-strand No. 0000 copper wire with a voltage of 13,200 volts alternating current, which is installed either underground or on iron lattice poles 65 ft. above the ground, excepting the estuary crossings, which are either submarine or are installed on towers 265 ft. high, spanning the estuary about 1200 ft. apart.

The 1200-volt direct current is distributed over the system by aluminum feeders, ranging in size from 1,000,000 circ. mil to 2,000,000 circ. mil. These are strung on bridges, towers, catenary and high-tension poles. The feeders are sectionalized at different points, thus making it possible to kill parts of the lines at a time.

Other overhead circuits consist of signal, arc, light and power, which are installed on bridges and both catenary and high-tension poles. We also maintain a private telephone system, the cables for which are installed both underground and on catenary and high-tension poles on the overhead. Telephone instruments are installed on bridges and catenary poles in the most convenient places for the use of the operating forces.

For maintenance and emergency, three crews are required for the three districts. Each crew consists of one foreman, three linemen, one groundman, one driver and one crew caller. For tower trucks, we use two Kelly gasoline and one General Vehicle electric. Other crews required are for splicing and bonding, the former consisting of a cable splicer, helper and teamster, and the latter being composed of a foreman and helper.

Electric Vehicle Truck for Line Maintenance



Southern Pacific Ferryboat, "Alameda," San Francisco Bay

Notes on Southern Pacific Electric Service in the Bay Cities

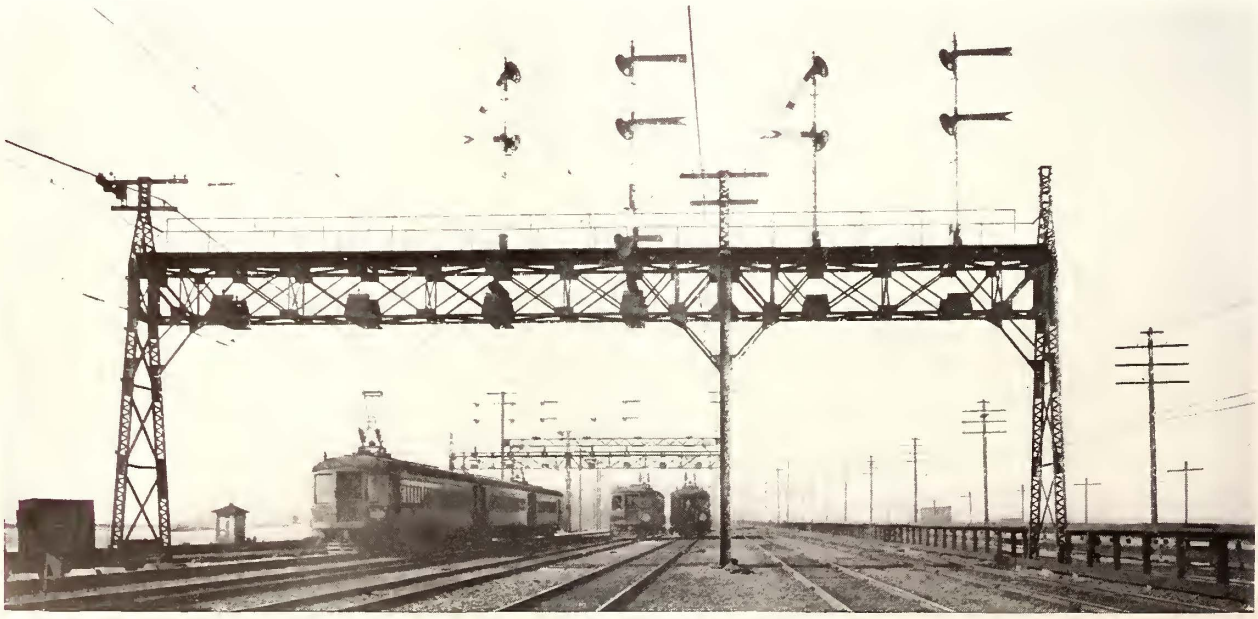
In the Remarkable Ferry and Rail Service for the Cities of Oakland, Alameda and Berkeley Trains Up to Seven Cars Are Operated on Headways as Low as Twenty Minutes

By J. C. McPHERSON
Superintendent Electric Lines Southern Pacific Company

THE passenger traffic handled via the Oakland, Alameda and Berkeley electric lines of the Southern Pacific Company is composed principally of people whose work or business is located in San Francisco, but who make their homes in Oakland and vicinity. This results in very heavy travel between 6.30 and 9 a. m. and 4 and 7 p. m., between which hours we estimate from 60 to 70 per cent of the traffic is handled. During other hours of the day and night our traffic is light, having to depend almost entirely on local business and pleasure seekers and shoppers to and from San Francisco. The average number of passengers carried per month approximates 1,800,000.

Schedules

In the way of schedules, we maintain twenty-minute service between the San Francisco ferry building and Oakland Pier, and thirty-minute service between the San Francisco ferry building and Alameda Pier from approximately 6 a. m. until 8 p. m., when the interval between trains operating out of Oakland Pier is lengthened to forty minutes and out of Alameda Pier to forty-five minutes. On



Block Signal Bridge, Oakland Mole

Saturdays and Sundays twenty-minute service is maintained on the Oakland Pier lines until midnight.

Each ferryboat arriving at Oakland Pier connects with four Berkeley and two Oakland trains, and during morning and evening rush hours with one train to Alameda. Boats arriving at Alameda Pier connect with one Oakland and two Alameda trains. The size of the trains varies from one to seven cars, according to the density of travel. During the peak load about two and one-half or three minutes are consumed in loading and unloading passengers. This means that within three minutes from the time the ferryboat hits the slip all passengers have left the boat, boarded their respective electric trains to the different suburbs mentioned and gone on their way.

Southern Pacific Electric Cars

To meet the demands of our patrons for fast service, advantage is taken of every condition tending to expedite the movement of trains, after first, however, conserving the safety feature. A good idea of the service can be obtained by considering the schedule of our Alameda line, where a train travels 14.6 miles, 8 miles of which is through city streets and makes twenty-four stops, in a total running time of forty-five minutes. The distance between the stations varies according to density of population, but as a general rule the stations average about 1500 ft. apart.

The fare collection during periods when travel is heavy sometimes presents quite a problem, as at some points on the system it is often necessary for the collector to take up 100 fares or more, besides assisting in the supervision of passengers boarding and alighting, within a period of less then ten minutes. Ohmer fare registers are used exclusively on the trains, the collector registering each fare separately as it is taken up. At the ferry building a standard form of ticket chopper is used. All passengers paying their fare before admission to the waiting room have access to both landings. No fares are collected on the boats.

All motormen who are used in operating the electric trains are locomotive engineers, whose seniority rights give them the privilege of working on the Southern Pacific steam locomotives out of the Oakland terminal or on electric trains. The conductors are now also taken from extra-passenger lists of the Southern Pacific steam lines. The collectors are classified as gatemen and employed as the business warrants. The best of these men are retained in the service and they are promoted to the position of brakeman after passing the examination which is prescribed by the American Railway Association.

The average train-miles operated per month approximates 250,000, while the average car-miles operated per month approximates 400,000.

Automatic Wigwag Danger Signal at Berkeley

Southern Pacific High-Speed Car at West Alameda Shops

Maintenance of 1200-Volt D.C. Cars by the Southern Pacific Company

By R. E. HEWITT
Master Mechanic Southern Pacific Electric Lines

THE Southern Pacific Company, electric division, since June 1, 1911, has been operating a high-speed service with 1200-volt d.c. equipments through the trans-bay cities of Oakland, Alameda and Berkeley. At this time eighty-one motor cars, sixty trailers and ten center-entrance cars are in use. Most of the motor and trail cars are 72 ft. over all, and the center-entrance cars which are used in crosstown city service between Oakland and Alameda are 45 ft. over all. The big cars are 10 ft. 5⅞ in. over eaves, thereby making possible a triple seat on one side of the aisle and a double seat on the other side. This gives a total seating capacity of 116 in all straight passenger cars, and of eighty-eight in the twenty-nine combination baggage and smoking cars, which are 67 ft. long. All cars are of steel construction. The 72-ft. 4½-in. motor cars weigh 943 lb. per seated passenger and 1562 lb. per running foot; the corresponding trailer figures are 579 lb. per seated passenger and 929 lb. per running foot. The side sill and center the sill of all of the cars are of 7-in. channels and the floors are of corrugated steel covered with Flexolith.

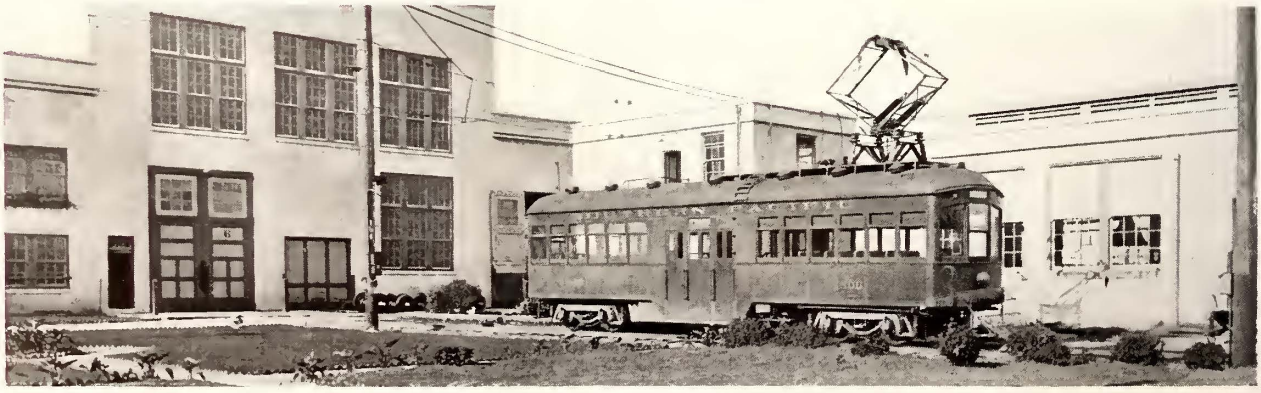
Motor cars are inspected at intervals ranging from 1200 to 1500 miles, and trailers every 2000 miles. Both are overhauled every eighteen months to two years, including paint retouching.

Car-Body Maintenance

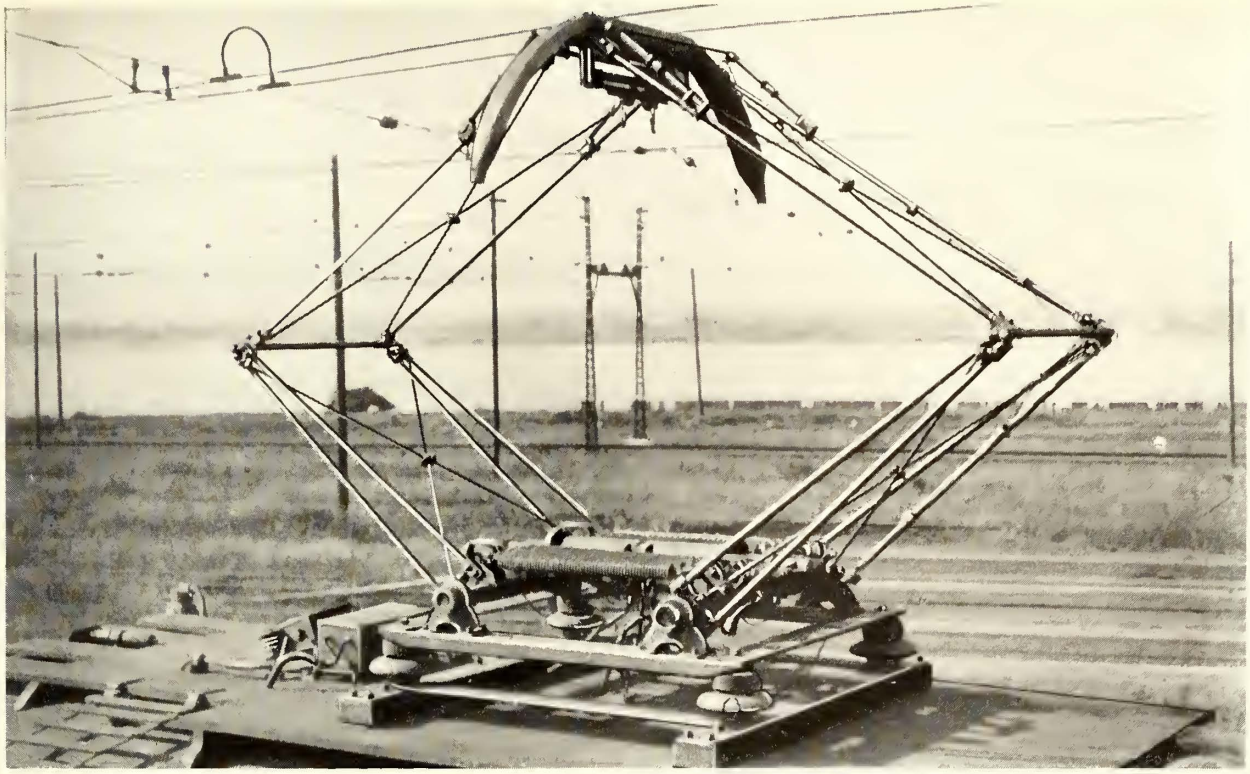
At the time these cars were placed in service opinions were expressed in some quarters that they might prove too light. Although they are operated in trains up to seven cars with maximum speeds of 40 m.p.h. and stops as frequent as three per mile on some runs, the construction has fully justified itself in four years' operation. To confirm this statement the following incident may be recounted:

On one occasion a towerman threw the switch between two trucks of a motor coach. This veered the car in such a way that a steel trolley pole of 8-in. to 10-in. diameter at the base was sheared off at the ground line without causing more than a slight camber in the side sills of the car. A like accident at this junction would have completely cut a wooden car in two. This car was sheathed with ⅛-in. steel up to the belt rail.

Generally speaking, our only car-body main-

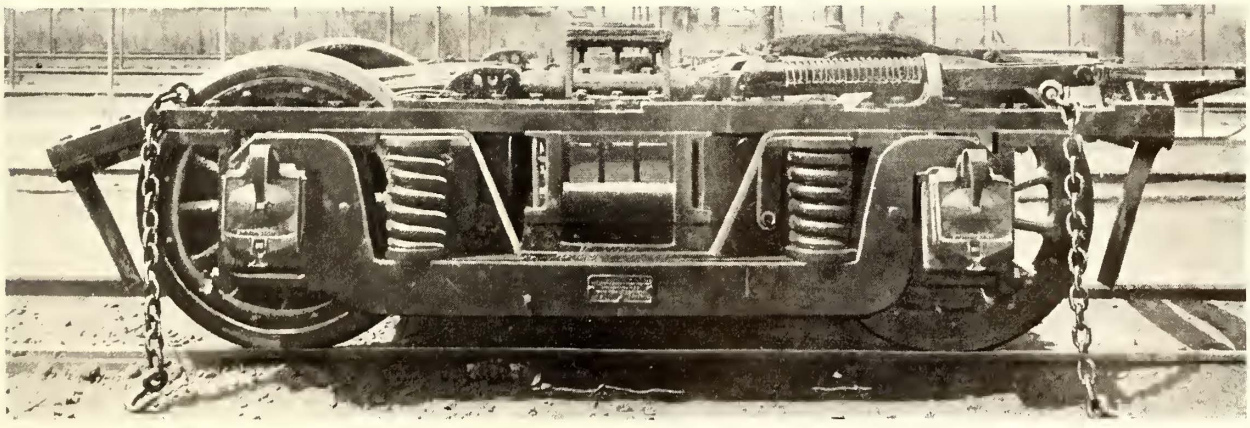


Southern Pacific Center-Entrance Car Used for Crosstown Service



Pantograph Equipped with Roller-Bearing Roller, Southern Pacific Standard Electric Motor Car

Motor Coach for Southern Pacific Electric Trains



Truck for Southern Pacific Motor Cars

tenance has been the occasional renewal of the composition flooring, especially in the aisles. The Flexolith renewals are made readily by troweling the mixture of cement and special liquid and allowing about thirty hours for the covering to set. The first renewals were not made until after three and a half years' service. There is nothing to show that any members of the framing have been pulled out of line, demonstrating that this pioneer lightweight type for heavy, high-speed service was correctly designed. All but the last fourteen cars, which are of Pullman make, were built by the American Car & Foundry Company, St. Charles, Mo.

Truck and Electric Maintenance

The trucks, which are of Baldwin manufacture, have required very little attention to date. Our principal work in under-car mechanical equipment has been confined chiefly to inserting case-hardened steel bushings in the pinholes of the brake rigging and the occasional renewal of Symington journal boxes.

The four motors per car are of GE-207-A 145-hp. rating, operated permanently two in series on 1200 volts with Sprague Type A-1 control. About 85 per cent of the trains comprise one motor car and one trailer.

For three years we never brought an armature into the shop except for the replacement now and then of string bands. More recently armatures are coming into the shop for the reslotting and possible turning down of commutators, but this we regard as the result of normal wear. Le Carbone brushes operated at 4-lb. to 5-lb. tension are standard. Some of these brushes have been in use for three years without renewal, which means that they ran for at least 180,000 miles. Furthermore, the commutators look as bright as the day they entered service.

Control renewals have been rare, the only work in that respect being the renewal of contactor tips and interlock posts. Circuit-breaker and reverser defects are virtually nil.

Improvements in Pantographs

When we began operation our current collectors were pantographs of the United States 121 type, equipped with a roller of 5-in. diameter, 24-in. length, and graphite bushing bearings. The original rollers were made of brass, but as they wore out after only 8000 miles aluminum was tried as the first substitute. This metal proved even less satisfactory than brass and was quickly discarded in favor of iron pipe. The second substitute was an iron pipe roller which gave a life of approximately 12,000 miles.

Before making any further change in rollers we set about to determine whether the life of the roller could not be lengthened by a change from graphite bushings to roller bearings. The initial set was tried with some trepidation in view of the opinions of many engineers that an anti-friction bearing would suffer so much from pitting and sparking due to the passage of current, that it would soon be destroyed even if it did conduct sufficient current. Our experience with the trial bearings did not bear out these pessimistic contentions. We soon found that the combination of the iron roller and the roller bearing would give a much longer life, and consequently the change to roller bearings was authorized before the pioneer pair had worn out. The latter was installed July 26, 1913, and was removed in May of this year after a service of 118,707 miles. During this time it wore out six contact rollers. This roller bearing for pantograph operation has since been patented by the writer.

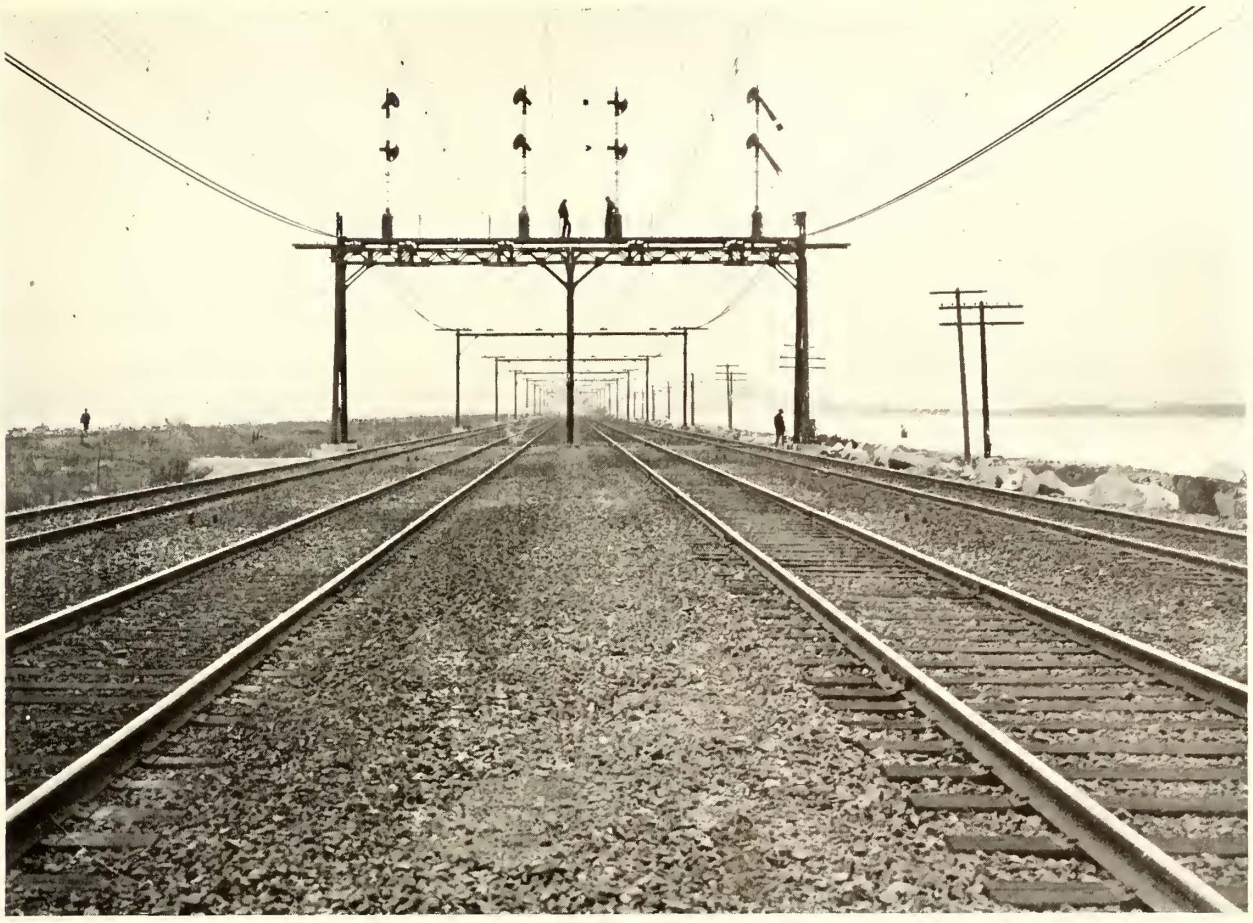
Although the iron pipe roller was giving good life, it did require a good deal of machining to prevent scoring of the trolley wire and for the installation of a suitable cage to carry the end castings in which the rollers are held. About July, 1914, we adopted a roller made of cold-drawn steel tubing. This requires no machining whatever, and as a current collector it is good for at least 18,000 miles with a possible maximum of 24,000 miles. On the lighter center-entrance crosstown cars, the same outfits had made 40,000 miles by July 1, without renewal.

The financial value of these improvements may be expressed by the following figures:

Old Rollers with Graphite Bushing Bearings	
Average mileage of 72-ft. cars, miles	12,406
Maintenance labor per month	$580.75
Maintenance material per month	97.60
Lubrication (Welsh oil) per month	13.00
Total	$691.35
224 new steel rollers made in 1913, at $5.47 each	$1,225.28
Roller-bearing Rollers	
Average mileage of rollers on 72-ft. cars, miles	18,000
Maintenance labor per month	$77.35
Maintenance material	34.00
Lubrication (graphite and vaseline) per month	3.62
Total	$114.97

Thus the monthly saving for ninety-one cars alone is $500 or more.

It will be noticed on comparing the lubrication item that we not only cut down its cost but were enabled to change the materials from Welsh oil and waste to a mixture of graphite and vaseline. This change has proved a boon to the car roofs and windows, which are no longer spattered and stained with oil, nor need trainmen and passengers worry about oil stains due to the current collectors. The car cleaning has been made easier, and complaints about splashing oil have been eliminated. It may be added that it was formerly necessary to lubricate the pantograph rollers twice a day; now one lubrication every regular inspection period of 1200 to 1500 miles suffices.



Catenary Bridge Suspension, Alameda Mole

Operation of a 1200-Volt Direct-Current Distribution System

Substation Operation at 1200 Volts, Direct Current, Has Proved an Unqualified Success, Even at Temporary Overloads of 125 Per Cent

By J. JOHANSEN
Chief Operator Southern Pacific Electric Lines

THE Southern Pacific electric lines which serve the towns of Alameda, Berkeley and Oakland were among the first 1200-volt d.c. systems in this country, operation having begun early in 1911. The high-tension end of the system is 13,200 volts, twenty-five cycles, three phase, and the low-tension end of the rotary converters is 440 volts with 630 volts at the d.c. end. Our adoption of 13,200 volts as the transmission potential was an advance of some 2200 volts over previous practice, but of far more importance was the use of 1200 volts for the contact wires.

Substation Equipment

In all we have three substations—Fruitvale, West Oakland and Berkeley. These contain respectively three, four and three pairs of 1500-kw. General Electric rotary converters, each pair made up of 630-volt d.c. machines permanently in series. Under ordinary operating conditions six rotaries, two at each station, are used during the morning and evening peaks which run up to 7000 kw. on an hourly-load basis. The momentary swings are very severe, ranging from 2000 kw. to 11,000 kw., as shown by the station-load curves. These swings affect particularly the Fruitvale and West Oakland stations, which are nearest the pier terminals. The rotaries in these stations consequently get overloads of 100 per cent to 125 per cent momentarily. Despite this we have not yet suffered a single breakdown or flashover from these machines. In fact, the rotaries in all stations show practically no signs of wear or deterioration.

After 10 p. m. the load drops to approximately 4500 kw. at the power plant buses, and upon this Fruitvale is cut out. At midnight the load drops to about 3000 kw., whereupon Berkeley is cut out, leaving West Oakland, in the center of the system,

to carry the entire load up to 5 a. m. With West Oakland so used, one station feeds as far out as Thousand Oaks, 10 miles distant. Under these conditions the drop in the line has not been found to exceed 100 volts at any time, the average being 50 volts. During the day the drop is too small to be considered.

PROVISIONS AGAINST SERVICE INTERRUPTIONS

Interruptions in service have been very few, and even these have been due to causes outside of the stations, such as breaks in strain insulators. In four years' operation, we have not had a power detention in excess of fifteen minutes as the result of trolley or substation troubles.

Should a heavy short occur near any one of the substations, the interruption would be only momentary as the length of cable between stations affords enough resistance to keep one or two stations feeding into the line.

When a breaker opens up on a short-circuit, the operator closes the breaker immediately three successive times. If the trouble is still on the line he will report to the chief operator, who then sends out the emergency crew to the section affected. However, the chief operator will ask that the triple closing test be repeated several times because linemen are supposed at all times to work with the 1200-volt lines alive. In other words, we do not wait for the report of the emergency crew before continuing operation.

MAINTENANCE CREWS

Our outside maintenance force comprises three gangs, each equipped with an auto-truck, as described by Jesse B. Nichols elsewhere in this issue. The substation personnel comprises the following: Fruitvale and West Oakland each have from 8 a. m. to 4 p. m. an operator, an assistant operator and a machine tender; each of the other two watches, 4 p. m. to 12 midnight, and midnight to 8 a. m., are taken by an operator and assistant operator. This makes a total of seven men per station. At Berkeley, one operator is on duty during the first watch from 8 a. m. to 4 p. m., another operator covers the second watch from 4 p. m. to 12 midnight, and the third watch is taken care of by an assistant operator, making three men in all.

Center-Pole Catenary Suspension

Transmission Line, Oakland Electrification

Combination Passenger and Baggage Car

Maintenance of 1500-Volt D.C. Cars by the Southern Pacific Company

Early Difficulties with Dynamotor Flashing, Brush Breakage and Pantograph Collectors Have Been Eliminated—Excellent Detention Records Now the Rule

By E. SEARS

Superintendent of Electrical Equipment Southern Pacific Company, Portland Division

ALL cars operated on the Portland division of the Southern Pacific Company are steel, the interior being trimmed with mahogany and the seats upholstered in green plush. These cars were built by the Pullman Company with the exception of three mail cars, which were built by The J. G. Brill Company.

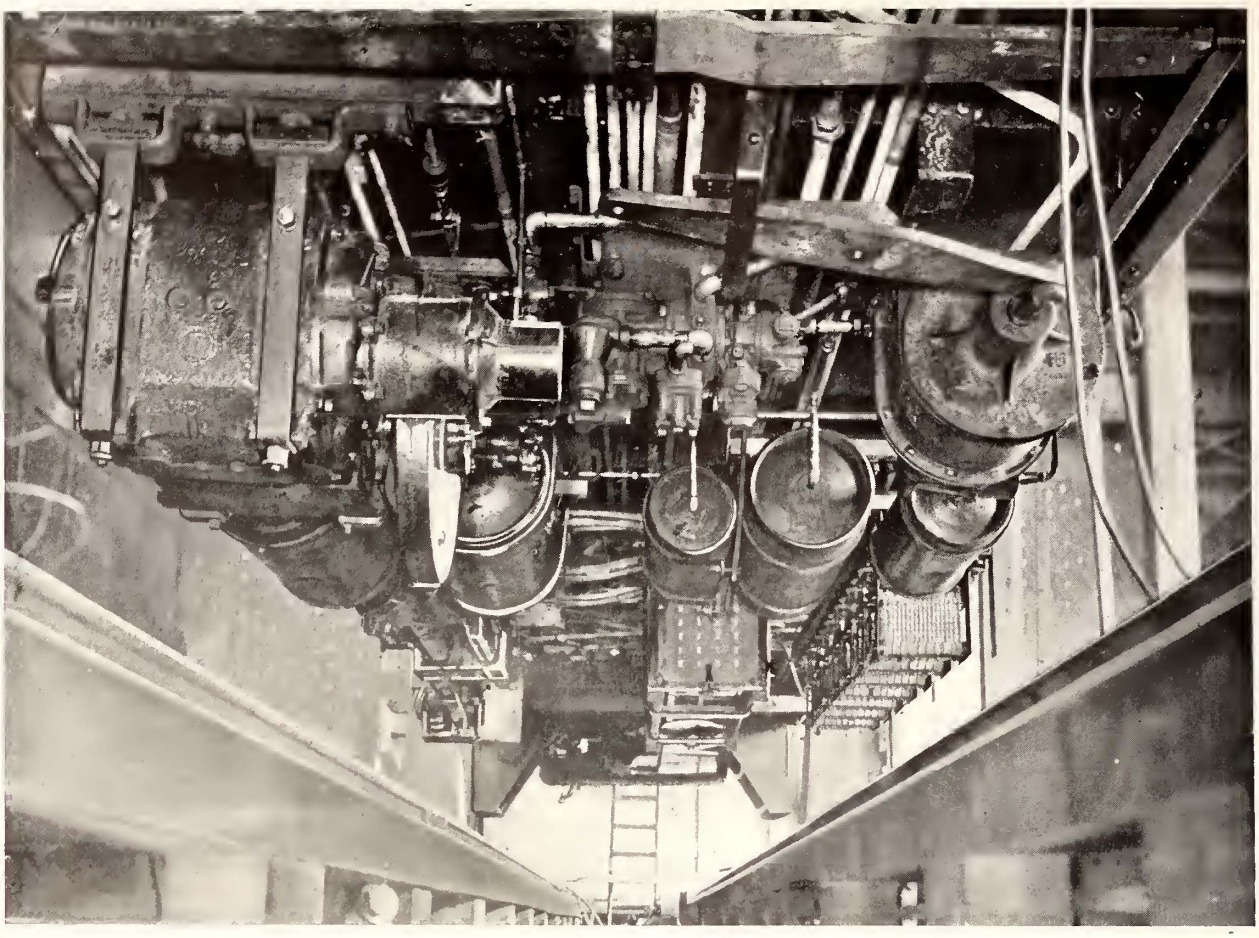
The equipment consists of seventeen single-end combination baggage and passenger motor coaches, with smoking compartment, total seating capacity fifty-two; thirteen double-end passenger motor coaches with smoking compartment, total seating capacity. sixty; eleven double-end control coaches, seating capacity sixty; five motor baggage and express cars, three motor baggage, express and mail cars, the mail compartment being a standard 21-ft. mail compartment. The length of cars over the buffers is 56 ft. 10 in., width of cars over the sills, 9 ft. 2 in.; wheelbase for car 42 ft., approximate weight of car, 51 tons, except control coaches, which weigh 32 tons each.

The electrical equipment for these cars was furnished by the General Electric Company, and the air-brake equipment by the Westinghouse Air Brake Company.

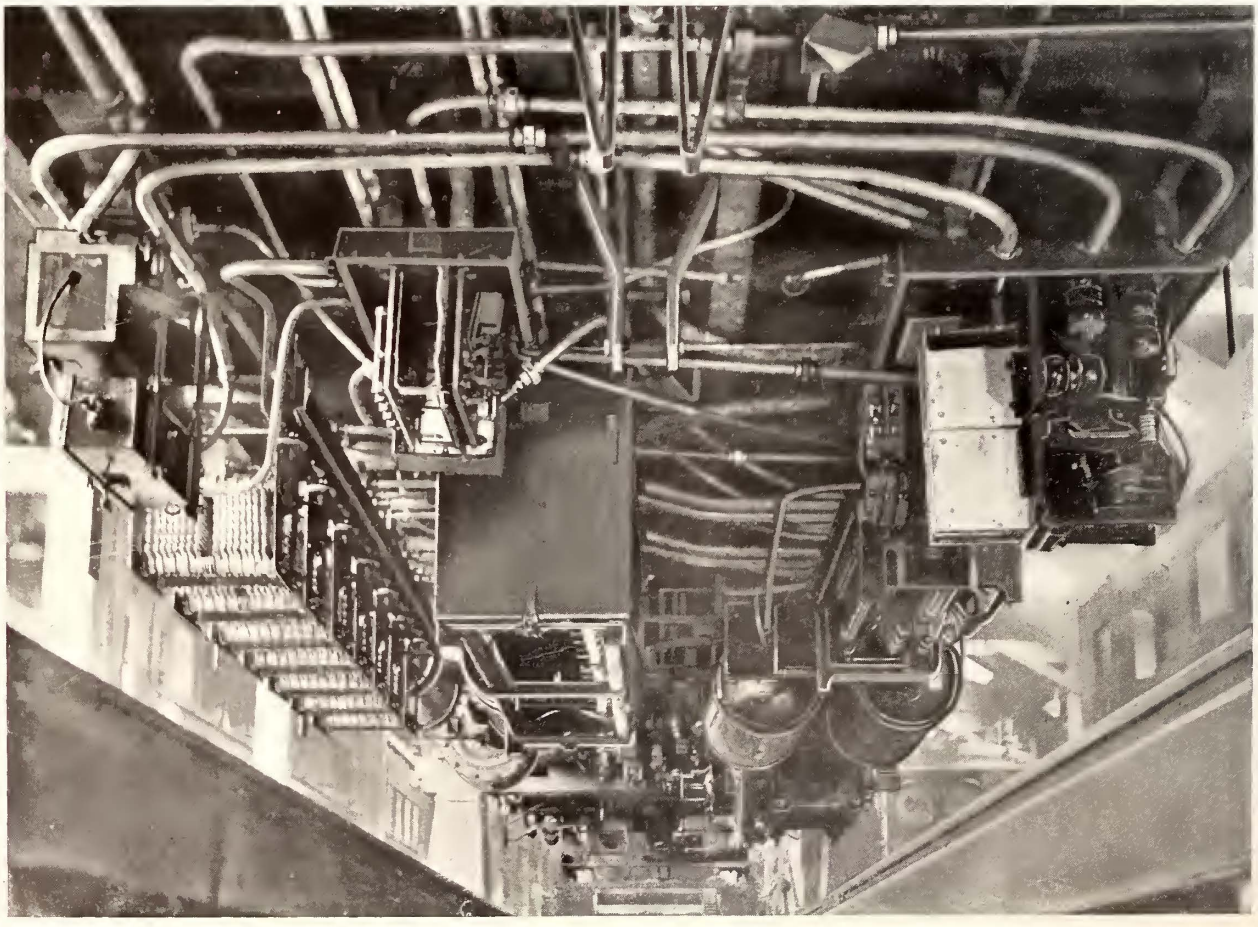
The equipment is arranged to operate on 600 volts and 1500 volts. The 600-volt operation at present consists of operation within the limits of Portland, the change from 600 volts to 1500 volts being accomplished automatically by electric-pneumatic operation. There is a 35-ft. grounded dead section between the 600-volt and 1500-volt sections. The head car is thrown by air while passing over the dead section. The air is operated from a valve switch in the motorman's cab, which also has electric contacts, so that, with the exception of the head car, which is thrown directly by air, the remaining cars are thrown electro-pneumatically, the valve switch being held in its proper relative position.

It is necessary to throw the controller off on the head car while changing it over. After this car has passed over the dead section, the controller can be replaced in the "on" position and each car can be operated on its relative voltage until it comes to the dead section, where it automatically changes over to the required voltage.

The potential relay drops out when on the dead section. It is so interlocked that the interlocks close the circuits necessary for operating the com-



View Underneath Motor Car, Air-Brake End, Showing Dynamotor and Universal Bracket in Foreground



View Underneath Motor Car, Electrical End, Showing Circuit Breaker in Right Foreground

mutating switches, for the 600-volt and 1500-volt positions. The commutating switch is operated by small air cylinders that are fed by the opening and closing of magnet valves, which are operated by the above-mentioned circuits. The commutating switch changes all dynamotor connections, as well as all motor connections, for the 600-volt and 1500-volt positions. The dynamotor furnishes lights and control on 1500 volts, but drives the air compressor on 600 volts. Lights and control on the 600-volt section are taken directly from the trolley.

The dynamotors gave considerable trouble due to flashing when first put in operation. The four shunt fields had been connected in series with a 400-ohm resistor; after they were connected in parallel, each with a 1000-ohm resistor, all trouble due to flashing was eliminated.

Relays

The control features, on account of 600-1500-volt operation, are somewhat complex because of additional relays.

A protective relay is used to protect the 600-volt wiring from 1500 volts, in case the car does not change over in going from 600-volt to 1500-volt sections; it also protects the dynamotor from receiving 1500 volts in the 600-volt position.

The current limit relay is the same relay as used on all General Electric 600-volt equipment.

The potential relay used is in at all times when the pantograph is on the energized trolley. It carries three interlocks, one for the control wire, one for the 1500-volt and one for the 600-volt position of the commutating switch. When on a dead section, the potential relay drops out, closing the circuit for operating the commutating switch.

The time-limit relay opens No. 4 wire and drops out on line contactors at section breaks. This does away with heavy flashes at these points. This relay is operated by means of an auxiliary contact rod on the pantograph, which is insulated from the pantograph frame. A brush or tickler is set a few feet ahead of the dead section. On coming in contact with the auxiliary rod on the pantograph the brush energizes the time-limit relay, causing it to open No. 4 wire.

A by-pass relay is used where grades prevent the current limit relay from picking up, thus keeping motors on resistance. This relay makes it possible to by-pass the current limit relay and not remain too long on any resistance point.

Other Control Features

The circuit breakers on this equipment are so arranged that they have a calibration for 600-volt and 1500-volt operation. The extra calibration for 600 volts is accomplished by a magnet which is energized by means of a contact on the commutating switch in the 600-volt position. Further, a calibrating spring is used for 1500-volt operation so that when the commutating switch is thrown to the 1500-volt position, the magnet coil is de-energized on the circuit breaker, leaving only the calibrating spring.

Another feature on this equipment is an automatic control cut-out switch, which opens the control wiring until the brake handle has been placed on the brake valve and the proper train-line pressure built up, so that the car cannot be started until after the brakes are properly charged.

The control features on this equipment have given us very little trouble. Each car is equipped with four GE 205-B motors, which have shown no defects, except for a few cases of armature coil trouble due to defective coils. We have had only one hot armature bearing since the beginning of operation, in January, 1914, and we have had no trouble from flash-overs.

The brush wear on the equipment is nominal. Some trouble was experienced when inaugurating operation, by the breakage of motor brushes, but this was corrected by getting suitable brushes.

On the whole we have not noticed that there is any particular difference between 600-volt and 1500-volt operation, as far as peculiarity of equipment is concerned. The only complexity is that in situations like ours it is necessary to have equipment that will operate on 600 volts and 1500 volts, a fact which causes numerous extra connections and pieces of apparatus.

Current Collection

A roller pantograph, U. S., Type 122, is used to collect current. Pantographs of all cars in a train can be operated electro-pneumatically by the motorman from the front car. It was found necessary to develop a different type of lubrication for the collector than that originally furnished. We now use a circulating oil system, which employs a hollow shaft with a deflector. The shaft is stationary and as the roller rotates about it the oil is collected from the inner outer edge of the collector shell by the deflector and conducted to the shaft, which in turn carries it to the roller bearings. This type of oiling was necessary due to the high speeds attained by our trains. The cost of lubricating these collectors is about 10 cents per 1000 miles. The cost of maintenance has been 64 cents per 1000 miles, much of the latter cost being due to broken shafts, resulting from broken collector frames (which the factory is now strengthening); also to the fact that our first collectors were made of iron pipe, which opened up in the seams. We are now using 5-in. steel tubing, from which we expect to get an average of at least 50,000 miles and possibly more, although it has not been in service long enough for

us to determine this fully. The oil in the roller is replenished at every third inspection, or after every 6000 miles.

The only thing unusual about the air-brake system is the universal valve. This has given no trouble to date, and we have had no detentions due to air-brake equipment. All air-brake parts are inspected on a 2000-mile basis. At the shop we have a Westinghouse test rack, on which all parts are tested before being put into service.

Painting was begun on cars in November, 1914, at the end of eighteen months' service. Our cars have now been out more than two years, and before all cars are painted some of them will have been out thirty months or more. The cars are cleaned at each inspection, or at the end of 2000 miles, using an oil cleaner only if necessary. Between inspection cars are dry wiped. If it is raining, a scrubbing brush and water are used to rinse off the body. Windows are cleaned with Bon Ami.

We have not given our cars a general overhauling. In fact, we do not intend to give them what can be termed a general overhauling, as the cars will be painted when it is found necessary, and motor repairs will be made when a gage shows that the bearings are worn sufficiently to be removed. Other parts on all of our equipment are handled in a similar manner.

DETENTIONS OF CAR EQUIPMENT, 600-1500-VOLT LINES—PORTLAND DIVISION

January, 1915

Mechanical, none.
Electrical, thirty minutes. Number of detentions, two.
Man failure, twenty-four minutes. Number of detentions, two.
Total miles operated, 112,372.

February

Mechanical, none.
Electrical, none.
Man failure, thirty-five minutes. Number of detentions, one.
Total miles operated, 100,702.

March

Mechanical, none.
Electrical, none.
Man failure, fifteen minutes. Number of detentions, one.
Total miles operated, 111,093.

April

Mechanical, none.
Electrical, none.
Man failure, none.
Total miles operated, 108,739.

May

Mechanical, none.
Electrical, none.
Man failure, none.
Total miles operated, 119,683.

June

Mechanical, none.
Electrical, fifteen minutes. Number of detentions, one.
Man failure, forty-three minutes. Number of detentions, two.
Total miles operated, 128,632.

Southern Pacific Repair Shop, Fruitvale

Train with Parlor Car at Salem, Oregon Electric Railway

Maintenance of 1200-Volt D.C. Cars by the Oregon Electric Railway

A Unique Feature Is the Successful Inter-Operation of Old 600-Volt and New 1200-Volt Motors in the Same Quadruple Sets

By D. I. CLOUGH
Master Mechanic Oregon Electric Railway

THE 1200-volt lines of the Oregon Electric Railway comprise 122 miles of single track over which a total of ninety passenger motor cars and ten locomotives are operated. In the city of Portland we operate at 600 volts, but elsewhere 1200 volts are used. The original line ending at Salem, 50.8 miles distant, had been operated at 600 volts, but when the line was extended in 1912 to Eugene, 122.4 miles from Portland, the change to 1200-volt operation was made.

The twenty-four original cars were changed only by the addition of 1200-volt type-M control and two GE-205 motors, two out of four 600-volt GE-73 motors being retained for 1200-volt operation by permanent series connection on the low side. These older motors are not changed in any way. The new cars carry four GE-205 motors and the same control and dynamotors already named. The locomotives are of General Electric type, four 50-ton locomotives carrying four GE-207 motors and six 60-ton locomotives carrying four GE-212 motors. The locomotives are used for freight only.

Cars are inspected every 1800 miles and locomotives every 1000 miles. Overhauling on both classes is made every 100,000 miles. Inspection is carried out at the Hoyt Street carhouse, but all overhauling and heavy repair work is done at the Porter Street shops, both at Portland. We also have a running inspection of journals and trolley wheels made by inspectors stationed at Salem and Eugene.

For current collection we employ a Holland-type trolley wheel with U. S. 13 base and Knutson retrievers. But one pole is in use at a time. The estimated life of these wheels is from 6000 to 8000 miles. Cup grease lubrication is used. The tension of the base springs is maintained at 30 lb. The maximum current passed by this wheel in regular service during the acceleration of a two-car train is 450 amp.

Despite the unusual combination of 600-volt and 1200-volt equipments the motors have given excellent service. Not more than two flash-overs occurred within the past year and these were caused by broken brushes. The latter, which are chiefly of General Electric grade-B type, are maintained at about 6.5-lb. tension, and aside from the two

breakages noted they have caused no other troubles. The only other motor defects have been the rewinding of two or three armatures of the older motors due to breakdown of insulation. Even here replacements have been made with factory-wound coils.

When the change to 1200-volt operation was made, we slotted the GE-73 motors 1/32 in. so that the same grade of brushes could be applied and also that other advantages of slotting might be obtained. Commutators have given us practically no trouble.

We attribute the good behavior of the motors to four causes: inherently good design, correct construction, frequent inspection and to reasonable operating conditions, as we do not attempt to make up trains with less than 50 per cent live equipment.

The control, which embodies automatic acceleration, has also made a creditable record.

Our delay statements tell the story of equipment reliability better than anything else. Some typical figures covering delays ascribed to mechanical trouble are shown in Table I.

Table I—Oregon Electric Railway Delay Record and Causes

	Miles Operated	Loss in Minutes			
		Mech.	Elec.	Air	Man.
June, 1914	251,386	28	25	0	0
July, 1914	235,477	0	0	120	0
August, 1914	247,567	15	5	35	0
September, 1914	254,172	0	30	0	0
October, 1914	242,221	0	5	20	0
November, 1914	212,816	0	20	0	0
December, 1914	218,513	30	0	20	0
January, 1915	219,635	40	0	0	0
February, 1915	195,029	19	20	0	0
March, 1915	208,821	0	0	0	0
April, 1915	197,901	0	0	0	0
May, 1915	266,774	50	0	0	0

Our lubrication cost for all equipment, exclusive of trolley wheels, has proved so low that some operators may even question the figures. For example, our costs per 1000 car-miles were as follows in the months named: June, 1914, $0.082; July, 1914, $0.92; August, 1914, $0.098; September, 1914, $0.1198; October, 1914, $0.141; November, 1914, $0.1046; December, 1914, $0.0449; January, 1915, $0.0685; February, 1915, $0.0595; March, 1915, $0.0601; April, 1915, $0.0621, and May, 1915, $0.0628. This lubrication is under the usual Galena guarantee.

These low figures are due to the economic reclamation of oil from used waste and the efficient oiling of the equipments.

The brakeshoes, which are of Love flanged type, also are showing very low costs, as illustrated by the figures in Table II.

Table II—Brakeshoe Record—Oregon Electric Railway

	Per Cent Wear	Miles Per Shoe	Cost Per 1000-Car-Miles
	August, 1914		
Passenger shoe wear	58.0	6919	$0.648
Locomotive shoe wear	61.0	2629	0.192
	September, 1914		
Passenger shoe wear	68.0	4181	1.240
Locomotive shoe wear	35.0	3182	1.344
	October, 1914		
Passenger shoe wear	60.0	5301	0.92
Locomotive shoe wear	62.3	2052	2.46
	November, 1914		
Passenger shoe wear	63.0	4186	1.13
Locomotive shoe wear	58.0	2258	2.43
	December, 1914		
Passenger shoe wear	63.5	4184	1.13
Locomotive shoe wear	61.0	3654	1.27
	January, 1915		
Passenger shoe wear	69.75	5348	1.26
Locomotive shoe wear	62.5	2304	2.06
	February, 1915		
Passenger shoe wear	63.5	4286	0.82
Locomotive shoe wear	55.0	2606	1.78
	March, 1915		
Passenger shoe wear	57.5	4605	1.27
Locomotive shoe wear	61.5	2659	2.22
	April, 1915		
Passenger shoe wear	58.2	4153	1.05
Locomotive shoe wear	66.5	2840	1.56
	May, 1915		
Passenger shoe wear	62.0	4115	1.00
Locomotive shoe wear	46.0	3205	1.27

Oregon Electric Limited Train with Observation Parlor Car Between Portland, Salem and Eugene

Top-Post Mechanism of A.C. Track Circuit Signals on Double-Track Section at Maplewood, Oregon Electric Railway

Signal Maintenance on the 1200-Volt Oregon Electric Railway

One-Fourth the Time of One Man Is Found Sufficient to Maintain 8.2 Miles of Block Signals on Double Track

By E. R. CUNNINGHAM
Electrical Superintendent Oregon Electric Railway

THE Oregon Electric Railway operates out of Portland approximately 200 miles of single track, of which the first 8.2 miles from Portland were double-tracked in 1913. This section was a part of the original 600-volt line built in 1907, and the second track was added and a number of curves were eliminated better to handle the increased business.

The cost of the double-tracking between the Jefferson Street station and the junction at Garden Homes, about 7 miles, of straightening tracks, reducing grades and eliminating curvature was about $750,000. In this work the street grade was abandoned in the approach to the station at Jefferson Street, and the tracks were placed part of the way on trestle work over private right-of-way. Increase of trains and traffic necessitated these improvements.

The principal work and the expensive portion was between Multnomah station and Garden Home. One big cut and two fills, one of which was about 95 ft. deep at the highest point in the ravine, were necessary to complete the cut-off. This improvement eliminated a reverse curve and a high trestle and altogether shortened the main line by about 1300 ft. The fills aggregate 2000 ft.

On this double-track section we operate trains on a minimum headway of five minutes; on the single-track sections beyond the Garden Homes terminus of the double-track sections the minimum headway is twenty minutes. Therefore we are operating what is practically a suburban service to Garden Homes and an interurban service beyond that point. All cars, however, are geared for the same speeds.

This service is protected with the General Railway Signal Company's three-position, left-hand upper-quadrant a.c. track-circuit signals installed in 1912. In connection with the double-tracking we changed relays for double-track operation and relocated posts where necessary. This was done without interruption to service.

The line is divided into blocks varying in length from 1.4 miles to $\frac{1}{2}$ mile, according to curvature and other conditions. Only one signal maintainer is required. His duties also include the care of about twenty Hoeschen crossing bells, two interlocking plants, track bonding, and tunnel signals on the United Railways division of this company.

Substation and Agent's Office Combined, Oregon Electric Railway

Concrete Substation at Orrville, Oregon Electric Railway

In fact, the maintenance of the block signals alone calls only for about 25 per cent of his time.

To facilitate quick movement over the line, the signal maintainer is provided with a Fairbanks-Morse gasoline car. Conditions as to repairs and replacements are reported to the electrical superintendent.

The most serious trouble has been the squeezing out of the insulation between rail ends because of extraordinary rail expansion during unusually warm weather. We have tried to correct this trouble by replacing the single piece of horn fiber with a set of alternate laminations of fiber and steel, but with no particular success.

The only change made in the signal mechanism is an improvement in the bearings of the Model 2-A signal-operating motor. This change was initiated by the General Railway Signal Company to forestall possible trouble from worn bearings.

The performance of the signals is indicated by the following record for the months of this year covering respectively the number of signal movements and the failures which are due to the signal mechanism:

STATEMENT OF SIGNAL MOVEMENTS FOR YEAR ENDED JUNE 30, 1915

Signal Number	Total Movements	Failures	Signal Number	Total Movements	Failures
1.5	39,395	5	5.6	20,491	0
1.8	19,251	4	6.1	23,189	1
2.1	21,857	6	6.4	20,209	1
2.2	28,352	7	7.1	22,358	2
2.6	21,007	4	7.0	21,261	0
2.9	21,734	3	7.7	31,624	2
3.6	20,699	1	7.8	22,238	3
3.9	19,217	0	7.9A	14,442	1
4.5	19,429	1	7.9B	9,325	6
4.8	21,130	0	8.4	7,462	9
5.5	20,140	0	8.6	11,450	2
Total				456,270	58

One failure to every 7867 movements of 45 deg. each.

Top-Post Mechanism of A.C. Track Circuit Signals at Cross-over on Double-Track Section, Oregon Electric Railway

Double-Track Tangent, Oregon Electric Railway, Between Portland and Garden Homes

How a Railway Helps the Farmer to Produce Bigger and Better Crops

In Conjunction with the Oregon Agricultural College the Southern Pacific Company Teaches the Farmers, on Both the Steam and Electric Lines, to Make the Most of Their Opportunities

By H. A. HINSHAW
General Freight Agent Southern Pacific Company

AS early as 1908 the Southern Pacific Company instituted a farming demonstration train in conjunction with the extension service of the Oregon Agricultural College. The subjects covered by these trains are horticulture, dairying, hog raising and poultry husbandry; and the exhibits include specimens of dairy cows and hogs to prove the points made by the demonstrators.

An Interested Audience of All Ages at Forest Grove

The railroad company furnishes the rolling stock and operates the trains on a rigid schedule, advance notice of which is sent direct to every farmer in the affected territory, to all newspapers, commercial bodies and the station agents. The merchants in the towns along the line are always particularly helpful in urging the farmers to attend.

The college, which is a State institution, furnishes all livestock and other demonstration material. It also supplies the faculty of agricultural and other professors who deliver lectures on their specialties, from silos to eggs. From the first the work attracted much interest among the farmers, and this interest has continued to this day.

While this work of the Southern Pacific Company extends over a zone of more than 1000 miles, it may be of interest to tell more in detail of what has been done in the territory immediately to the southwest of Portland. In this section, locally known as the "Loop," about 100 miles of route had been electrified in 1913 for 1500-volt d.c. passenger service in the name of the Portland, Eugene & Eastern Railway, now absorbed. This electrification introduced new conditions inasmuch as the more frequent service brought the farming communities closer to large masses of consumers. Thus a change in the character of products arose although the products themselves were still moved largely by steam trains.

Originally the loop territory was devoted almost entirely to grain. With the coming of the demonstration trains the farmers learned that dairying, hog raising and fruit would find a more profitable market. The electrification has made the latest change, for owing to the increase in the population of commuting towns, truck gardening has been inaugurated on a large scale.

In all of these developments the farmers have been guided largely by the demonstration service. They have been shown not only what classes of products were most desirable but what particular varieties of animals or plants were best adapted for this territory and the different soils thereof.

One result of this education is reflected in the fact that the highest prizes for milk at the Panama-Pacific International Exposition were awarded to the dairy interests of Portland and vicinity.

On the whole this work has proved gratifying not only in increasing the value of freight shipments, but in securing the good-will of the farmers and the country newspapers. The movement has made such headway that one demonstration train, run in February, 1914, was visited by 7000 people in one day and 36,000 people within two weeks. The interest shown by the children is so great that a "Children's Special" is a possibility of the future. In fact, the "college on wheels" should prove a potent factor in keeping the younger generation on the farm.

Effect of Publicity on the Jitney Movement in Portland

The Portland Company Finds that a Straightforward Statement of the Facts to the Public Is Helpful—A Weekly Pamphlet Distributed on the Cars Is One of the Best Mediums of Such Instruction

By F. W. HILD

General Manager Portland Railway, Light & Power Company, Portland

PORTLAND saw its first jitney in January of this year, although 10-cent auto-buses, in competition with our suburban trains to Vancouver Ferry, had already come into being a month or two earlier. With the arrival of the jitney, the 10-cent auto-bus went out of business because it lacked speed and frequent service and embodied an attempt to use in passenger equipment apparatus designed to handle freight. Evidently the rate of fare was not the real objection because the jitney buses also charge a 10-cent fare on the 7.5-mile line to Vancouver Ferry.

Publicity Mediums

Our first publicity concerning the jitney took the form of addresses by President Griffith and other officers of the company before the Chamber of Commerce and other public bodies. As the jitney's novelty then made it a matter of live news, accounts of the addresses received good space in the newspapers.

On Feb. 4 the employees of the Portland Railway, Light & Power Company, as represented by several organizations, including the Brotherhood of Electric Trainmen, circulated a petition addressed to the City Council. This petition, signed by 27,500 people of Portland, requested the City Commissioners to pass an ordinance requiring the jitneys to operate only under franchise. This petition did not lead to the desired result, as the commissioners believed that the public was not yet in the proper frame of mind to help a public service corporation constructively.

Pamphlets Effective

During the period that the petition was in circulation we put out a pamphlet on the jitney bus addressed to all employees, but with the suggestion that it be passed on to others. This pamphlet discussed the jitney in its various phases, particularly in its relation to the electric railway and its employees. This was followed by a pamphlet showing how much money the company paid to the municipality, both directly in taxes and bridge tolls and through the less obvious forms of paving charges and free transportation for city employees. This second pamphlet was widely distributed, and, from the voluntary comments received, it must have made a decided impression upon the thinking members of the community.

This pamphlet was supplemented and followed by display advertisements in the daily press. Each advertisement took up a definite aspect of the taxation problem, amplifying it enough to bring out all the pertinent points and yet not detailed enough as to prevent understanding the statement in one reading.

However, the most striking announcement proved to be a full-page display in the "house warming" issue of the *Evening Telegram*. This advertisement was entitled "Why Such Irresponsibility?" and told its own story in the form of a sheaf of clippings reproduced from daily newspapers. These clippings were grouped to show the menace of the jitney from the four standpoints of moral danger, thuggery, accident risk and service irresponsibility. This advertisement was not only reproduced in the Electric Railway Journal of March 27, 1915, but also attracted the attention of prominent magazines in other fields, such as the *Sunset*, the leading monthly of the Pacific Coast, and of *Printers' Ink*, the great advertising journal. Mats of this announcement were also sent to electric railways as far south as Texas, as far north as Canada and as far east as Maine.

Introduction of a House Organ

The fact that the public was showing a genuine interest in our statements accelerated the publication of a four-page weekly of pocket size which is now distributed in our cars to the number of 50,000 per issue. We purposely began its publication without a name, offering prizes amounting to $30 for the best title. About 10,000 suggestions were received from a population of 240,000, this indicating in itself that the public was already reading the pamphlets. In the opinion of the four city newspaper editors who constituted the jury of award, the best title submitted was the punning one of "*Watts Watt*."

The value of such a weekly publication as *Watts Watt* lies in keeping the company's side of important problems continuously before the public, and of concentrating on any particular topic that

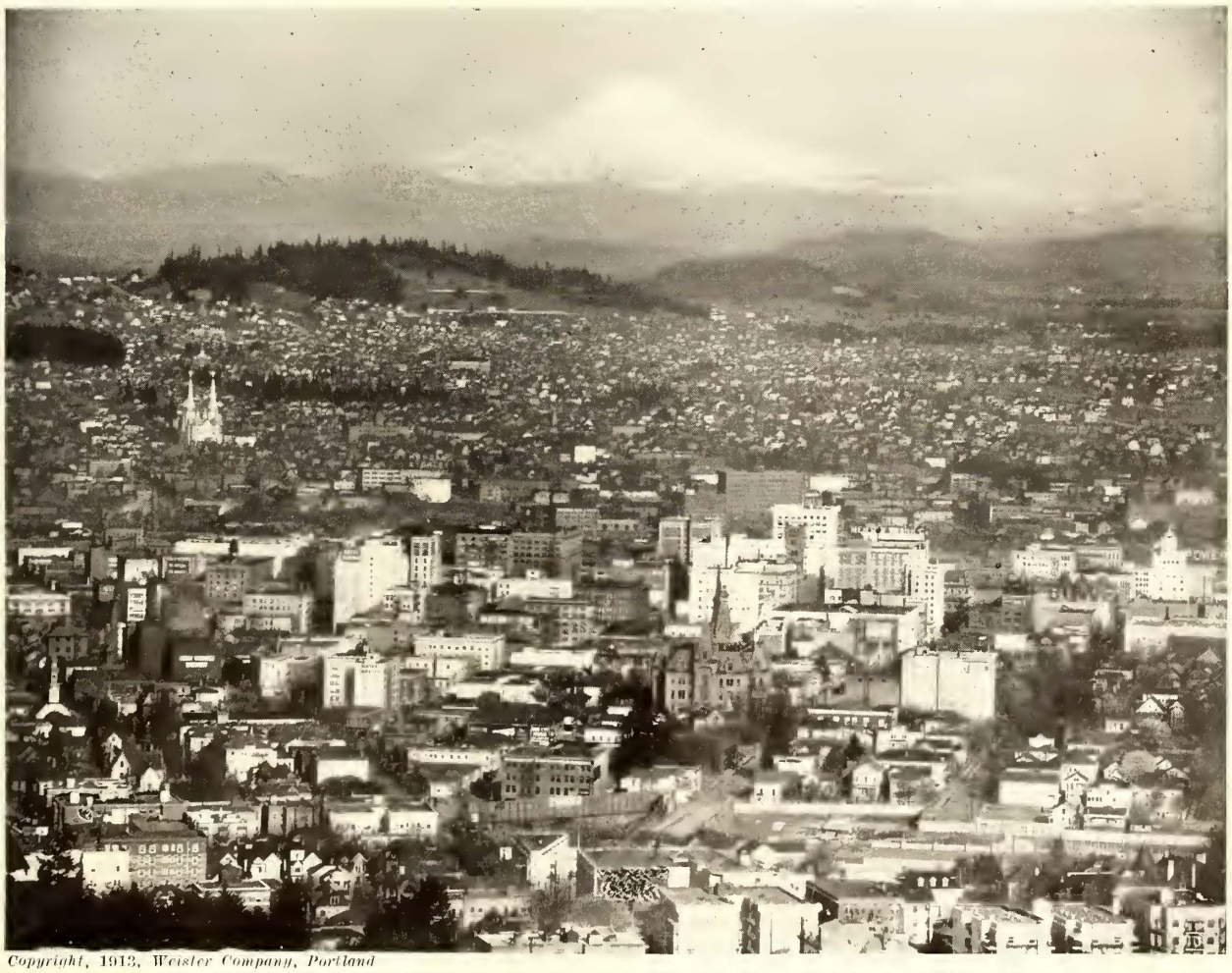
may happen to be in the foreground. The case of the jitney election is one in point.

The jitneyites had circulated a referendum petition but had so chosen the time of filing that the ordinance, as eventually passed by the Council on April 2, 1915, would have been held up for two years, namely until the municipal election of 1917, before the attitude of the electors could have been ascertained. However, under the Oregon law, legislative bodies may refer their own measures to the people for approval or rejection. This action was taken by the City Council in time for the election of June 7, 1915, at which time the voters indorsed, by a substantial majority, the principle of jitney regulation.

Two causes were potent in attaining this result: First, our publicity campaign, as outlined hereinbefore, supplemented by an aggressive display advertising propaganda in the public press for about one week prior to the election; second, the active interest and co-operation of the company's employees aroused by personal addresses made by President Griffith and the writer.

One lesson that the jitney experience has confirmed is the wisdom of going directly to the public with your side of the case. If a utility's publicity appropriation will permit a house organ, I would by all means favor its publication as a way of greatly improving the relations between the company and the employees and also as of interest to the more prominent stockholders. However, within the limits of a publicity appropriation, I would give priority to a pamphlet for circulation among the public. This conclusion may be due to a study of the local conditions as I find them in Portland and of similar conditions in other Pacific Coast cities where a very sad confusion of economic ideas is reflected in the encouragement to competition of utilities and of occasional unintelligent, hostile legislation against corporations in general.

My study has led me to the conclusion that a pamphlet of this nature should not exceed four pages, and that the size should not be large, in order that the subject may be perused within the duration of a street car ride. It is my further belief that the public will more readily absorb and digest the rather dry and heavy matter which must necessarily form a presentation of the facts relating to utility economies if such matter is accomplished by semi-humorous text. The principle, of course, is first to get the town good-natured to have it listen to you willingly.



Beautiful Portland, the "Rose City," with the Impressive Snow-Clad Peak of Mount Hood

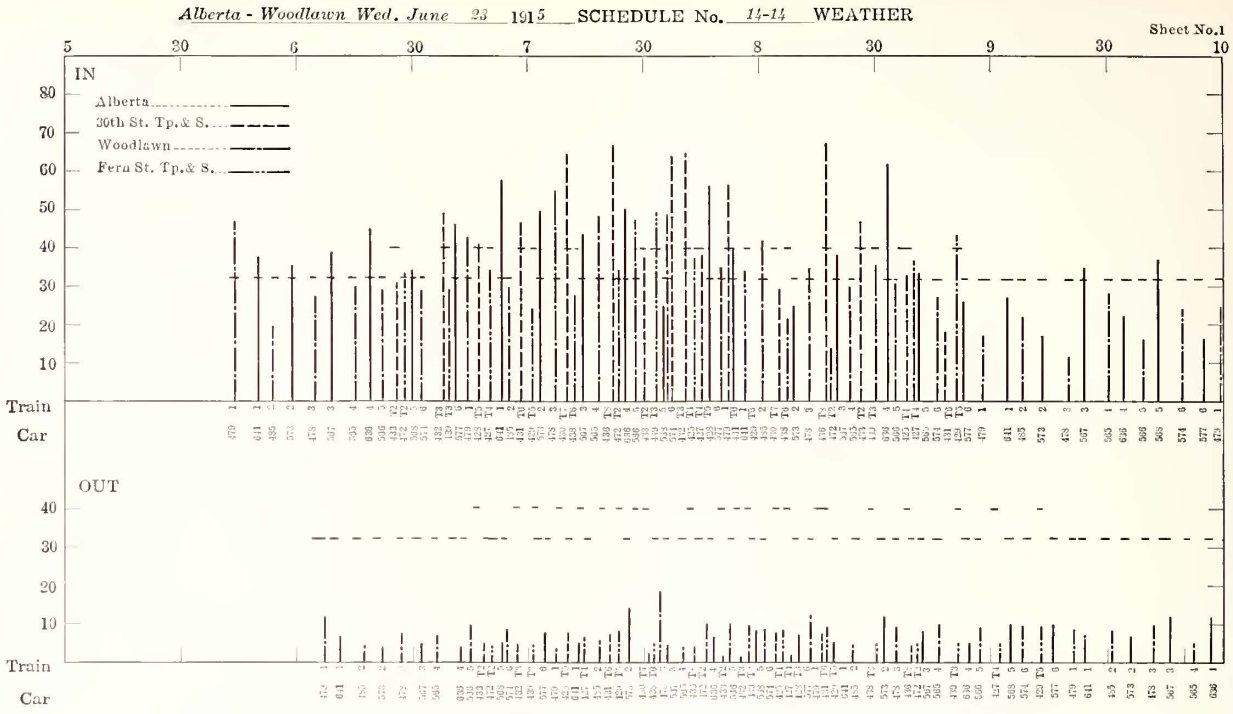


Chart Showing Conductors' and Inspectors' Peak-Load Slips Reduced to Graphic Form

Traffic Analysis and Schedule Planning at Portland, Ore.

Schedules Are Compiled from Data Supplied by Conductors and Inspectors —Standards of Car Service Have Been Established—The Assignment of Miscellaneous Duties Has Simplified the Question of Earnings for Extras

By FRED COOPER

Superintendent of Transportation Portland Railway, Light & Power Company

IN 1912 the Portland Railway, Light & Power Company inaugurated a system of traffic analysis and schedule planning in charge of a centralized schedule department. Previously, each division made up its own schedules, the principal guide being the experience of the local superintendent, modified by the pressure exerted by the public on the one hand and by the management on the other. We felt that this practice was too inexact to provide adequate service and to provide it economically.

The data upon which our schedules are built up are, first, the standards of service required by the public; second, the car-hours required to provide fairly satisfactory runs for the platform men; third, the standard of service laid down by the management.

To harmonize these three points of view it is essential to know exactly where the traffic originates and what volumes must be handled between different points.

I am aware that a number of Eastern companies employ special checkers and inspectors to make traffic counts. We do not have to go to this expense, however, partly because of the excellent platform personnel but even more owing to the fact that the density of population is much lower in a given area than in cities like Boston, Pittsburgh and Newark. It is, therefore, practicable for us to rely upon special reports from conductors covering the number of passengers at selected peak points on each trip.

This peak-load slip, which constitutes our fundamental form, is reproduced herewith. The instructions on the form are self-explanatory. Special attention, however, may be directed to the fact that this record also covers delays and their causes. Information on delays is very important inasmuch as it shows whether the cause of unusual congestion is permanent or accidental. Continued congestion which causes delay necessarily calls for a careful study of conditions, rerouting or other possibilities of traffic relief.

The peak-load checks are supplemented by the regular inspectors who devote their chief attention to checking variations in car spacing. Since they also note the number of passengers, their figures are a check on those supplied by the conductors.

The information collected from the conductors'

PORTLAND RAILWAY, LIGHT & POWER CO.

Peak Load and Delay Card

Line.....Woodlawn.....Car..484....Train..3....Run...3.
Cond....Simpson, D. P., No. 634....Date....6-2-15.....191....

Sufficient cars are operated on every line to carry all normal traffic without overloads. If all seats are taken and there are thirty passengers standing, your car will be considered overloaded.

Look at your watch and note exact time you arrive at peak load point. If space is too small to explain cause of delay or overload, make note*—and write explanation on back of this sheet.

Inbound at Union and Broadway				Outbound at Union and Broadway			
Time	Pass.	Min. Late	Cause	Time	Pass.	Min. Late	Cause
A.M.				A.M.			
6.04	25			6.31	08	5	Bridge delay
7.06	31			7.30	06		
8.13	34			8.35	08		
9.20	33			9.42	07		
10.22	18			10.44	14		
P.M.				P.M.			
1.28	44	4	Auto	1.46	21		
2.30	22			2.52	14		
3.32	31			3.54	19		
4.41	14			5.05	44		

PEAK LOAD CHECK

By.....J. A. D.....6-23....1915
At.....Union and Broadway.....In

Line	Train	Car	Time, A.M.		Pass.
			Due	Arrived	
W. L.	5	566	6.22	6.22	35
W. L.	72	472	6.28	6.28	36
W. L.	6	574	6.33	6.32	37
W. L.	73	439	6.39	6.35	30
W. L.	1	479	6.44	6.45	45
W. L.	74	427	6.50	6.50	30
W. L.	2	485	6.55	6.55	28
W. L.	75	429	7.01	7.01	29
W. L.	3	478	7.07	7.08	56
W. L.	76	438	7.12	7.12	29
W. L.	4	565	7.17	7.18	52
W. L.	72	472	7.23	7.23	34
W. L.	5	566	7.27	7.29	52
W. L.	73	439	7.32	7.33	50
W. L.	6	574	7.38	7.38	50
W. L.	74	427	7.43	7.44	36

Forms Used for the Compilation of Traffic Data

MT. TABOR SATURDAY SCHEDULE NO. 3 EFFECTIVE AUGUST 1ST, 1914
11th & Yamhill to E. 88th & Yamhill

Train 1		Train 2		Train 3		Tripper 1		Train 4		Train 5	
Barn	4:55	Barn	5:05	Barn	5:25			Barn	5:35	Barn	5:55
11-Y.	88th	11-Y.	88th	11-Y.	88th	11-Y.	88th	11-Y.	88th	11-Y.	88th
	5:30		5:40		6:00				6:10		6:30
6:07	6:45	6:17	7:00	6:37	7:15			6:47	7:30	7:07	7:45
7:22	8:00	7:37	8:15	7:52	8:30			8:07	8:45	8:20	8:55
8:40	9:15	8:50	9:25	9:10	9:45			9:20	9:55	9:30	10:05
9:50	10:25	10:00	10:35	10:20	10:55			10:30	11:05	10:40	11:15
11:00	11:35	11:10	11:45	11:30	12:05			11:40	12:15	11:50	12:25
12:10	12:45	12:20	1:00	12:40	1:15			12:50	1:30	1:03	1:45
1:21	2:00	1:38	2:15	1:53	2:30			3:08	2:45	2:23	3:00
2:38	3:15	2:53	3:30	3:08	3:45	Barn	4:07	3:23	4:05	3:38	4:20
3:53	4:34	4:08	4:47	4:21	5:00	4:33	5:13	4:46	5:26	4:59	5:39
5:12	5:52	5:25	6:07	5:38	6:22	5:51	6:30	6:04	6:37	6:17	6:52
6:30	7:08	6:45	7:23	7:00	7:38	Barn	7:07	7:15	7:53	7:30	8:08
7:45	8:23	8:00	8:38	8:15	8:53			8:30	9:08	8:45	9:23
9:00	9:38	9:15	9:53	9:30	10:08			9:45	10:23	10:00	10:38
10:15	10:53	10:30	11:15	10:45	11:25			11:00	11:45	11:15	12:00
11:30	12:07	13-H.		13-H.				13-H.		13-H.	
		11:55	12:32	12:05	12:42			12:25	1:02	12:40	
Barn 12:44		Barn 1:09		Barn 1:19				Barn 1:39		Barn 1:10	
19:49		20:04		19:54		3:00		20:04		19:15	

RUNS

Run 1 Train 1 4:50 to 10:43 and 12:28 to 4:52	10 Hours, 15 Minutes
Run 2 Train 2 5:00 to 10:53 and 12:38 to 5:05	10 Hours, 20 Minutes
Run 3 Train 3 5:20 to 11:13 and 12:58 to 5:18	10 Hours, 15 Minutes
Run 4 Train 4 5:30 to 1:08 Tpr. 1 B. 4:07 to 7:07	10 Hours, 40 Minutes
Run 5 Train 5 5:50 to 10:58 and 1:21 to 6:30 S. S. Tpr. 5 to 6:45	10 Hours, 30 Minutes

MINIMUM RUNNING TIME

Inbound		Outbound	
88th St. to 69th St	6 Minutes	13th & Hall to 11th & Yamhill	5 Minutes
to 48th St	12 Minutes	11th & Yamhill to 3rd St	5 Minutes
to 39th St	14 Minutes	to Grand Ave	11 Minutes
to 24th St	19 Minutes	to 24th St	16 Minutes
to Grand Ave	24 Minutes	to 39th St	21 Minutes
to 3rd St	30 Minutes	to 48th St	23 Minutes
to 11th & Yamhill	35 Minutes	to 69th St	29 Minutes

PEAK LOAD POINT
E. 6th & E. Morrison Sts.

Time from 88th St	24 Minutes
Time from 69th St	18 Minutes
Time from 13th & Hall	17 Minutes
Time from 11th & Yamhill Sts.	12 Minutes

PHONES: Water & E. Morrison, Grand Ave. & Morrison, 39th & Belmont and 60th & Belmont.

SITTING DOWN LIMIT: East of Grand Ave. and South of Yamhill St.

TOILET FACILITIES: Rear of Real Estate Office, E. 88th & Yamhill Sts.

NO STOP TRAINS:

Commencing with Train 5 leaving 11th & Yamhill Sts. at 4:59 p.m. to Train 5 leaving 11th & Yamhill at 6:17 p.m., inclusive, all trains and trippers will carry dash signs "No Stops West of 50th St."

Steam Road crossing East First and Morrison must be flagged by conductor when regular flagman is absent, 10:00 a.m. to 2:00 p.m. and 7:00 p.m. to 6:00 a.m. Reliefs made at 27th and East Morrison.

MT. TABOR SATURDAY SCHEDULE NO. 3
EFFECTIVE AUG. 1st, 1914.

Form of Schedule for Individual Lines

and inspectors' peak-load slips is converted into graphic form, a separate chart being made either for individual lines or for overlapping routes on which a certain combined headway is desired. In the latter case, as illustrated, different styles of dash and dotted lines are used to differentiate the routes.

The chart just referred to is made out on cross-section paper, on a scale of one cross-section to the minute horizontally and one cross-section to the passenger vertically. The seating capacity of different styles of cars is also shown by horizontal broken lines. Thus the schedule department can see at a glance whether the service is according to the standard set by the management. The traffic chart after preparation is sent to the division superintendents for comment, then to the schedule department for further comment, and finally to the superintendent of transportation for approval.

This standard briefly is: Seats for all passengers during the normal or off-peak hours, assuming no serious interruptions in schedules or unusual traffic conditions; sixty-seven seats for each 100 passengers at peak-load points during the morning rush hour; sixty-three seats for each 100 passengers at peak-load points during the evening rush hour.

To reconcile these standards with the requirements of the public and of the employees is the most important work of the schedule department. It is necessary, therefore, to make a detailed study of the traffic characteristics of each line and the habits of the riders. The peaks of some lines do not coincide with others, and again the crosstown main lines may be overloaded for the very short distances between transfer points. The frequency of the off-peak schedule is determined by the class of riders, for while we aim to give a seat to every passenger, it would be poor policy to space the cars with the expectation of getting a full seated load for each. Furthermore, in a well-to-do district frequent service which will insure freedom from crowding will discourage a lot of walking and increase shopping travel.

In the Business Heart of Portland

In taking care of the men we are fortunate in being able to supplement the earnings of the tripper men, especially, by assigning them to other duties during the off-peak period. This outside work includes the distribution of lighting bills, at a saving over mail, the cleaning of cars, the taking of Ohmer register readings, removal of transfers from transfer boxes, and other miscellaneous duties.

This plan of handling the tripper problem serves two important purposes: It is no longer necessary to run cars for no other end than to give a platform man a reasonable day's work, and we attract and retain in the service a higher grade of men. The result is reflected by the fact that 31.3 per cent of the men in the employ of this company at the present time receive the maximum rate of pay.

A schedule covering a given line is divided vertically to show the following data in order: Sets of double columns show the starting time from each terminal for the train number which is written horizontally above and across the time figures. These double columns of assigned regular and tripper trains are continued to the end of the day's schedules. Below these columns the assignment of runs is shown. This states clearly when the crews holding the runs listed are to report, the figures being five minutes in advance of the time they are to take out their first car of the day. The relief time is also shown, together with the total working hours of each crew. Below the list of run numbers is miscellaneous information such as minimum running time between time points; peak-load points for the use of the conductor; location of private telephones for use in case of emergency; limits in which motormen are permitted to sit; location of toilet facilities (as arranged for by this company); location of all flagging crossings; period in which certain cars will operate as no-stop cars.

The reference to minimum running time is explained by the fact that a little more leeway is allowed during the congested periods than during the off-peak hours, when traffic conditions are such as to permit operation with the least possible delay.

Departmental Work Planning System at Portland

Self-Devised Modifications of the Taylor System Have Been Successfully Applied to Several Departments—Complete Records of All Work Instantly Available

By F. P. MAIZE

Master Mechanic Portland Railway, Light & Power Company

IN February, 1914, the Portland Railway, Light & Power Company, at the suggestion of our general manager, F. W. Hild, introduced a self-devised modification of the Taylor system in its car maintenance line, power and transportation departments. The company is also planning to inaugurate similar methods in the line and track department.

Time Clerk Answering Telephone, Stamping Time Card and Putting It in Pigeonhole

As master mechanic of this company, the writer was assigned the task of working out the general details of the system so far as car maintenance was concerned. After conference with the executive and clerical staffs, the first step was to examine a number of Taylor systems in manufacturing shops with a view to seeing how we could take advantage of their experiences. We then prepared the forms necessary to cover the change in the system of working.

Under the old system, the individual foremen had entire charge of the assignment of work. The only absolute check on the men was the time clock record of "in" and "out" type. The details of the jobs done were made out on a separate time card by the men themselves. Under the present system all work is planned at the office of the master mechanic, the responsibility of the foreman being limited to general supervision of the work and to the instruction of new men.

The routeing of a given car overhauling job is now as follows: When the car has made its mileage it is called in by the notification of the chief clerk to the foreman of the carhouse affected. Upon delivery of the car with the foreman's defect slip, the latter is turned in to the master mechanic's office as a notification of delivery. Next the chief clerk orders the car to be placed on a specified track.

FORM 878

PORTLAND RAILWAY, LIGHT & POWER CO. — MECHANICAL DEPARTMENT

INSTRUCTION CARD

SHEET NO. 89

FOR GE58 Armature Bearings-Pinion End P-114 SKEM-SGE58 — Turn Off —

SHOP ORDER NO.

DEPARTMENT 1

DATE APR 17 1915

No.	OPERATION	MACH.	SPEED	CUT	FEED	No. MEN	TIME ALLOWED HRS	TIME ALLOWED TENTHS
	Adjust Machine	L-5				1		
1	Chuck Bearing							
2	Set tool #30							
3	Turn off - Roughing Cut		42		60			
4	" " Finishing "		80		60			
5	Adjust tool							
6	Face off end		80		60			
7	Set tool #31							
8	Face off under collar		80		Hand			
9	Set tool #44							
10	Bore to 3¼" ϕ		80		60			
11	Set tool #19							
12	Turn end to 4 3/16" ϕ - ¼" Long		80		Hand			
13	File finish							
14	Take out & repeat operations 1 to 13							
	Tools required							
	Tool #30							
	" 81							
	" 44							
	" 19							
	Sample Bearing							

Instruction Card Showing How to Turn Off a Specified Bearing

FORM 878

PORTLAND RAILWAY, LIGHT & POWER CO. — MECHANICAL DEPARTMENT

INSTRUCTION CARD

SHEET NO. 512

FOR Trucks — Overhaul —

SHOP ORDER NO.

DEPARTMENT 3

DATE

No.	OPERATION	MACH.	SPEED	CUT	FEED	No. MEN	TIME ALLOWED HRS	TIME ALLOWED TENTHS
1	Jackup Car & remove trucks							
2	Remove motors							
3	Dismantle trucks							
4	Repair truck material							
	a - Electric Welder							
	b - Blacksmith Shop work							
	c - Machine " "							
	d							
	e							
	f							
5	Assemble Trucks							
6	Replace Motors							
7	" Trucks - Let car down							

Instruction Card Showing Order of Work in Truck Overhauling

Cars are overhauled according to a standard schedule, which comprises air brakes, body, trucks, motors, and electrical equipment (control, contactors, etc.). These are subdivided into operations which have proved to be most efficient. Thus, in overhauling a truck the work is done as follows:

Operation 1—Jack up car and remove trucks.
Operation 2—Remove motors.
Operation 3—Dismantle trucks.
Operation 4—General repair to truck. This is subdivided in turn as follows:
  Operation 4a—Spot-weld and plug truck material (as specified on instruction card).
  Operation 4b—Forge new parts and repair truck material (as per instruction card).
  Operation 4c—Drill and machine truck parts (as per instruction card).
Operation 5—Assemble the trucks.
Operation 6—Replace motors.
Operation 7—Replace trucks under car.

Instruction sheets of the type described are kept by the routeing clerk as a guide and check on the work performed and in making out time cards and instruction cards. Both of these cards are distributed to the individual workmen by placing them in numbered pigeonholes. When a workman takes out his time card he telephones the time clerk, who makes a record of the time on his duplicate of the time card. The time card, if the job is a simple one, carries the instructions directly in words; if it is not a simple one, the card carries the numbers of the appropriate instruction cards. For accessibility, these instruction cards are kept in pigeonholes directly under those which hold the time cards.

To avoid waste in the use of instruction cards those regularly used by the men are shellacked and

P. R., L. & P. CO. — MECHANICAL DEPARTMENT

INSTRUCTION SHEET AND COST RECORD

FOR _____

SHEET NO. _____

SHOP ORDER NO. _____

DISTRIBUTION _____

DATE _____

	NO	OPERATION	MACH	SPEED	CUT	FEED	ESTIMATE HRS	ESTIMATE AMOUNT	ACTUAL COST HRS	ACTUAL COST AMOUNT

ORDERED BY ORDER NO. DATE

DATE WANTED DATE FINISHED

REMARKS

TOTALS	ESTIMATE HRS	ESTIMATE AMOUNT	ACTUAL HRS	ACTUAL AMOUNT
LABOR				
MATERIAL				
PERCENTAGE				
TOTAL				

LABOR

DATE	EMP	HRS.	AMT	DATE	EMP	HRS.	AMT	DATE	EMP	HRS	AMT	DATE	EMP.	HRS.	AMT	DATE	EMP	HRS	AMT	DATE	EMP	HRS.	ANT.

MATERIAL

DATE	QUAN	ARTICLE	AMOUNT	DATE	QUAN.	ARTICLE	AMOUNT	DATE	QUAN.	ARTICLE	AMOUNT

Front and Back of Instruction Sheet and Cost Record

Tools required as per Instruction Card #89

Tool # 30 - Round Nose - for Turning Cast Iron
" 81 - Side Facing - Right Hand
" 44 - Round Nose - for Boring Cast Iron
" 19 - Square Nose -

Schedule of Tools Referred to by Number

varnished to insure long life. Outside of those in general use, one set is kept by the routeing clerk and the master set is kept on file in the office of the master mechanic.

When the workman has completed the job assigned he calls up the time clerk again to give his time for the given shop order number. The clerk then stamps this finishing time on his own copy of the time card with a Calculagraph which prints the elapsed time directly in hours and tenths as reproduced.

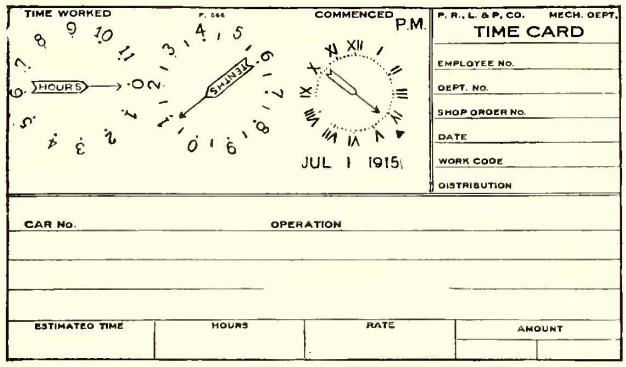
Should a car damaged in an accident be sent in for repair, the record will begin with the report of the local carhouse foreman to the chief clerk. The latter will then order the delivery crew to place the car in the shop as in ordinary overhauls. Each foreman is then notified to inspect the car and make a report of the repairs necessary. Upon this combinations of regular cards are made out to cover the case. A similar procedure is in vogue for painting jobs.

In case the job to be handled is manufacture, the chief clerk will receive an order from the purchasing department for the parts wanted. For such jobs we also have regular instruction cards. If, for example, the order is for 100 cast-iron armature bearings, pattern 114, the workman will get a time card with the appropriate instruction card reference number. The first instruction is the adjustment of the machine, the latter being identified by its number. The steps of the work are then specified as follows:

1—Chuck bearing.
2—Set tool No. 30.
3—Turn off—Roughing cut (with speed and feed).
4—Turn off—Finishing cut (with speed and feed).
5—Adjust tool.
6—Face off end (with speed and feed).
7—Set tool No. 81.
8—Face off under collar (with speed and feed).
9—Set tool No. 44.
10—Bore to 3¼ in. (with speed and feed).
11—Set tool No. 19.
12—Turn end to 4 3/16 in.-¼ in. long (with speed and feed).
13—File finish.
14—Take out and repeat operations 1 to 13.

TOOLS REQUIRED

Tool No. 30. Tool No. 44.
Tool No. 81 Tool No. 19.
Sample bearing (for information of new man).



Time Card with Calculagraph Record

Our methods as shown by the instruction cards are the results of stop-watch tests continued until the best way had been found. Therefore, the individual workman loses no time in determining what to do next.

To be fair to the men, the possibility of exceptions to the rules must be taken into consideration. Should a workman, for instance, find that a casting is too hard to be handled efficiently at the designated speeds and feeds, he is privileged to call the attention of the foreman to that fact. The foreman will then decide upon the proper speed and feed, notifying the chief clerk accordingly.

Since the ability of the men is gaged by the time they require for specific operations, it is desirable to provide workers on like jobs with exactly the same tools. Therefore, all grinding is done by one man in the toolroom and according to standard instructions.

Perhaps the largest saving in time is made by the system of routeing supplies. When the men begin a job they make a list of everything to be repaired and all material to be ordered. This list, after being checked off by the foreman, goes to the routeing clerk who calls for the necessary requisitions and makes out the routeing. Therefore, the men do not start to assemble a job until all the material is at hand. Comparison of time cards has also shown us what losses in time occur when the work is not properly laid out, such as putting too many men on one job and assigning men to jobs in which they are not at their best; or again, that the machine used is not suitable for the work.

In view of the fact that efficiency systems are often accompanied by a large increase in the clerical staff, it is interesting to point out that we had to add only one clerk, whereas the shop forces were reduced from 130 to 92 men for the same output. This result was due, in part, to the transfer of clerks from the individual departments to a central office and to the addition of a Calculagraph, but the principal cause was a detailed preliminary study which extended over five months.

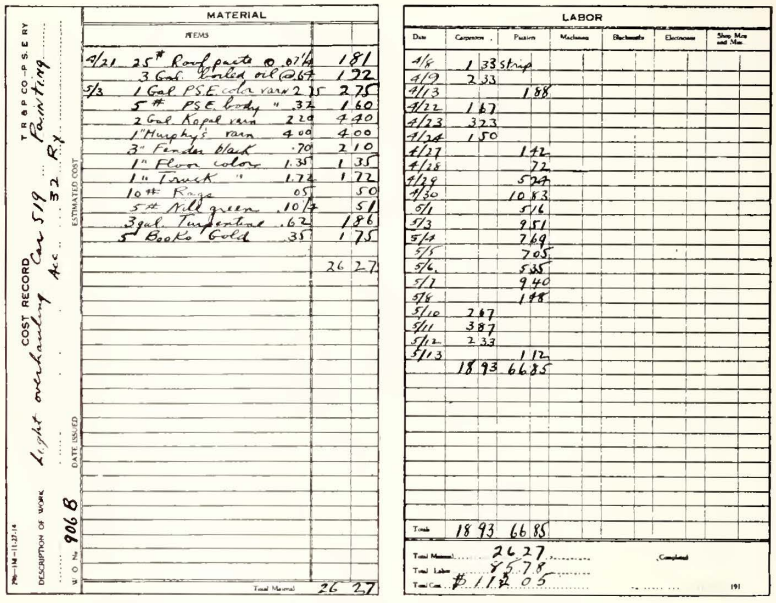
Car Maintenance on a Definite Cost Basis

A Central Feature of the Maintenance Records Is the Practice of Showing All Labor and Material Costs for Each Car Overhauled

By K. C. SCHLUSS

Superintendent of Power and Equipment Puget Sound Electric Railway, Tacoma

THE primary purpose of car maintenance records is to secure knowledge of the behavior of equipment and the cost of upkeep, but such records are also of value in many other ways. They help to maintain the morale of the shop force by presenting a readily accessible record which acts as a check on the thoroughness of the work performed by each branch of the maintenance staff; they afford to the claim department information which may be worth thousands of dollars; they give many data of value in making appraisals, either by the company or commissions, because they show the cost of betterments and renewals, and they make it possible to forecast with reasonable accuracy the cost of maintenance and renewals for the ensuing fiscal year.



COST RECORD — Car 519 — 32 — Ry.

DESCRIPTION OF WORK: Light overhauling & painting — W. O. No. 9068 — DATE ISSUED — ESTIMATED COST

TRAP CO-PSE RY

MATERIAL

Date	Items		
4/21	25# Roof paste @ .01¼		1 81
	3 Gal Boiled oil @ .67		1 72
5/3	1 Gal PSE color varn	2 25	2 25
	5# PSE body "	.32	1 60
	2 Gal Kopal varn	2 20	4 40
	1 Murphy's varn	4 00	4 00
	3# Fender black	.70	2 10
	1# Floor color	1 35	1 35
	1# Truck "	1 74	1 72
	10# Rope	.05	50
	5# Mill green	.10¼	51
	3 gal Turpentine	.62	1 86
	5# Books Gold	.35	1 75
			26 27

Total Material 26 27

LABOR

Date	Carpenter	Painter	Machinist	Blacksmith	Electrician	Shop Man and Misc.
4/5	1 33	Strip				
4/9	2 33					
4/13		1 88				
4/22	1 67					
4/23	3 23					
4/24	1 50					
4/27		1 42				
4/28		72				
4/29		5 24				
4/30		10 83				
5/1		5 16				
5/3		9 51				
5/4		7 69				
5/5		7 05				
5/6		5 85				
5/7		9 40				
5/8		1 88				
5/10	2 67					
5/11	3 87					
5/12	2 33					
5/13		1 12				
	18 93	66 85				
Totals	18 93	66 85				

Total Material 26 27 — Completed

Total Labor 85 78

Total Cost $ 112 05

Detail of Painting Material and Labor, Constituting One of a Set of Cost Record Cards (Front and Back)

We do not treat a car as an entity, but as made up of separate units such as car body, trucks, painting, air, light and heat wiring, all electrical squipment except motors, motors and, finally, air equipment.

Car Inspection and Overhauling

City cars are inspected every 900 miles and interurban cars every 1200 miles. All inspection that is carried out at the Tacoma shops is done during the day time, the only night work being the setting-up and releasing of brakes and the correction of minor defects reported for immediate attention. Motormen on turning in their cars must also submit a statement on the carhouse register that their cars are either O. K. or defective. In the latter case, each defect must be specified. The practice of reporting O. K. acts as a check on the motorman should he make a false report in an accident case concerning the previous condition of the car. The car inspection reports are filed in calendar order for reference only as they have no connection with the maintenance records.

Cars are overhauled about every 80,000 to 100,000 miles or at approximately two-year intervals. If in overhauling a car we find that certain parts are not due for overhauling, because of transfers from one car body to another, we simply give these parts a casual inspection. Since individual records are kept, however, it is feasible to bring the car in later for the purpose of replacing such parts only.

To identify such parts in our records, every truck, as well as air compressors, wheels, gears, pinions, etc., receives a number. Individual record cards for the parts named are kept to show the numbers of the successive cars on which the part has been used, the dates "in" and "out," the reason for removal and the character of repair.

System of Work Order Numbers

Independent of these equipment card records, all body work, painting, air, light and heat wiring, trucks, electrical equipment except motors, motors, and air equipment are handled under a general master work order number which covers all car overhauling for the year. Each job is differentiated, however, by the addition of the car number. A placard bearing both numbers is posted on the car and orders are issued to all the foremen concerned. The overhauling work charged against the car as such does not include traction armatures,

wheels, axles, air compressors and controllers. Should the cost records be used for appraisals or maintenance estimates, the excluded items enumerated would be cared for by taking their average value for any class as a whole.

It will be seen, therefore, that we do not saddle on the car the cost of maintaining equipment which is changed and overhauled at frequent intervals. For example, if a gear is replaced on account of wear we would not charge it against the overhauling cost of the car, but if the gear ratio is changed we would do so. All of the work done which is done in the shop for the mechanical department and outside departments of the company, except running repairs, is charged to standard or special work orders.

Cost of Car Overhauling

The data covering the cost of a car overhauling are compiled from time and material slips turned in by the workmen, who state the nature of the work done, the work order number, and the car number.

The prices of material received by the workman for a given car are extended on the storeroom requisitions by the storekeeper and turned over to the cost clerk for entry on cost cards. The cost card for overhauling any car, when completed, shows the cost of all material and labor. It also bears a summary of the work performed. At present we file these cost cards consecutively by car number.

It will be understood, of course, that the records mentioned above bear no relation to the standard classification of accounts, although the postings for each account are taken from the same labor and material slips.

Work Order 906 Car No. 519 Light Overhauling

	Material	Labor	Total
A—Body	$91.11	$126.86	$217.97
B—Painting	26.17	85.78	111.95
C—Trucks	10.87	31.36	42.23
D—Air, light and heat wiring	9.40	11.35	20.75
E—Electric equipment	2.94	12.90	15.84
F—Air equipment	.42	2.89	3.31
Total	$140.91	$271.14	$412.05

Complete May 14, 1915.

A—Body had light overhauling. Following new material used: four steps complete, twelve metal step plates, two side vestibule doors, all vestibule window stops, roof canvas on upper deck, twenty-four pieces siding, eight iron grab handles, water drip over end doors, 12-ft. apron, flooring in toilet, four hooks on vestibule door. Following repairs: lowered sign rack, removed end toilet window and filled space with siding and panel inside, straightened No. 1 iron bumper, installed Ohmer register.

B—Car revarnished.

C—Trucks not overhauled. Light repairs to brake rigging, new bolster No. 2 truck.

D—Inspected all wiring and moved light switch. Installed new receptacles.

E—New third-rail beam.

F—Air equipment inspected.

Summary of Work Done on a Car During Light Overhauling

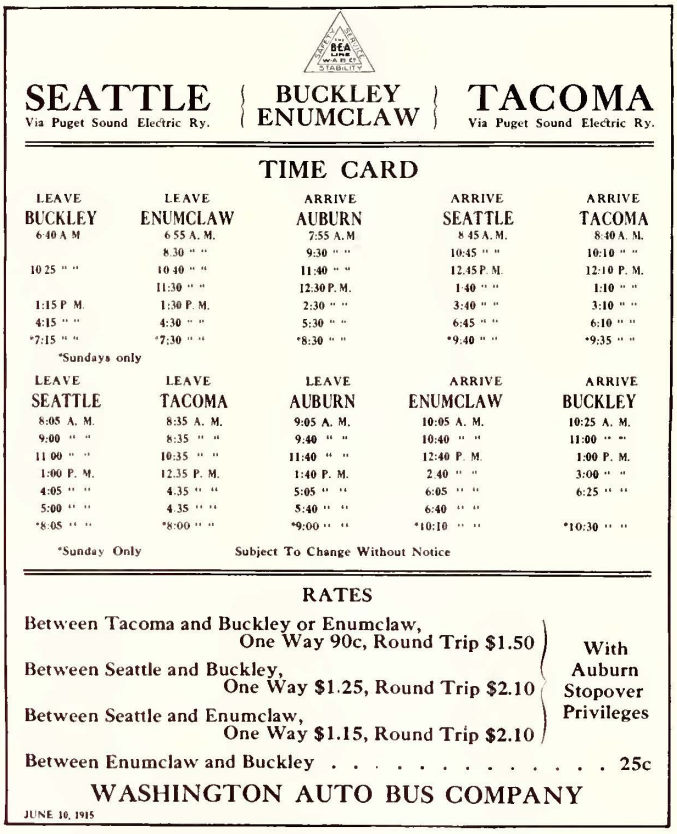
To my mind this practice of showing exactly what is done on a car during an overhaul is the only fair way for making comparisons with the overhauling costs of other railways. If a superintendent of equipment is not obliged to show the work in detail it is very easy for him to make a record for economy that will prove very costly for the company in the end. Aside from this feature, such detail of cost keeping permits forecasting the cost of overhauling from year to year, and has other advantages which are mentioned earlier in this article.

Mount Ranier, Regarded by All Good Tacomans as Their Personal Property

The Auto-Bus as an Auxiliary to Interurban Railways

Three Auto-Bus Lines Have Recently Been Established as Feeders to Existing Interurban Railways at a Fare of 3 Cents Per Mile

By A. W. LEONARD
President Puget Sound Traction, Light & Power Company, Seattle



SEATTLE (Via Puget Sound Electric Ry.) — BUCKLEY / ENUMCLAW — TACOMA (Via Puget Sound Electric Ry.)

TIME CARD

LEAVE BUCKLEY	LEAVE ENUMCLAW	ARRIVE AUBURN	ARRIVE SEATTLE	ARRIVE TACOMA
6:40 A.M.	6:55 A.M.	7:55 A.M.	8:45 A.M.	8:40 A.M.
	8:30 " "	9:30 " "	10:45 " "	10:10 " "
10:25 " "	10:40 " "	11:40 " "	12:45 P.M.	12:10 P.M.
	11:30 " "	12:30 P.M.	1:40 " "	1:10 " "
1:15 P.M.	1:30 P.M.	2:30 " "	3:40 " "	3:10 " "
4:15 " "	4:30 " "	5:30 " "	6:45 " "	6:10 " "
*7:15 " "	*7:30 " "	*8:30 " "	*9:40 " "	*9:35 " "

*Sundays only

LEAVE SEATTLE	LEAVE TACOMA	LEAVE AUBURN	ARRIVE ENUMCLAW	ARRIVE BUCKLEY
8:05 A.M.	8:35 A.M.	9:05 A.M.	10:05 A.M.	10:25 A.M.
9:00 " "	8:35 " "	9:40 " "	10:40 " "	11:00 " "
11:00 " "	10:35 " "	11:40 " "	12:40 P.M.	1:00 P.M.
1:00 P.M.	12:35 P.M.	1:40 P.M.	2:40 " "	3:00 " "
4:05 " "	4:35 " "	5:05 " "	6:05 " "	6:25 " "
5:00 " "	4:35 " "	5:40 " "	6:40 " "	
*8:05 " "	*8:00 " "	*9:00 " "	*10:10 " "	*10:30 " "

*Sunday Only — Subject To Change Without Notice

RATES

Between Tacoma and Buckley or Enumclaw, One Way 90c, Round Trip $1.50
Between Seattle and Buckley, One Way $1.25, Round Trip $2.10
Between Seattle and Enumclaw, One Way $1.15, Round Trip $2.10
} With Auburn Stopover Privileges

Between Enumclaw and Buckley 25c

WASHINGTON AUTO BUS COMPANY

JUNE 10, 1915

Schedule Card of Auburn-Enumclaw Bus Line Showing Connections with Seattle-Tacoma Interurban Railway

THE Washington Auto Bus Company, a subsidiary of the Puget Sound Traction, Light & Power Company, has recently begun the operation of auto-buses as feeders of the interurbans operated by some of the railway subsidiaries of the Puget Sound Company. At this time we are operating three lines of buses as follows:

Between Auburn and Enumclaw, 22 miles, running at right angles to the Seattle-Tacoma Interurban Railway, making connections at Auburn. Three twelve-passenger Studebaker cars are used to give the service which is laid out to make connections with the interurban trains. Two-part coupon tickets are sold to cover combination interurban and auto-bus trips, each ticket showing the name of the issuing company. The bus fares are invariably figured at 3 cents per mile, whereas the interurban straight railway fare is sometimes as low as 2 cents per mile, and commutation rates are even less.

Between Edmonds and Seattle Heights, 3 miles, feeding the Seattle-Everett line of the Pacific Northwest Traction Company, making connection at Seattle Heights, two eleven-passenger Studebaker cars are operated. Tickets and rates of fare are on the same plan as the Auburn-Enumclaw line.

Of course, all of the vehicles enumerated are for one-man operation. The chauffeur acts as ticket seller as well as collector. International neck registers are used for the collection of cash fares.

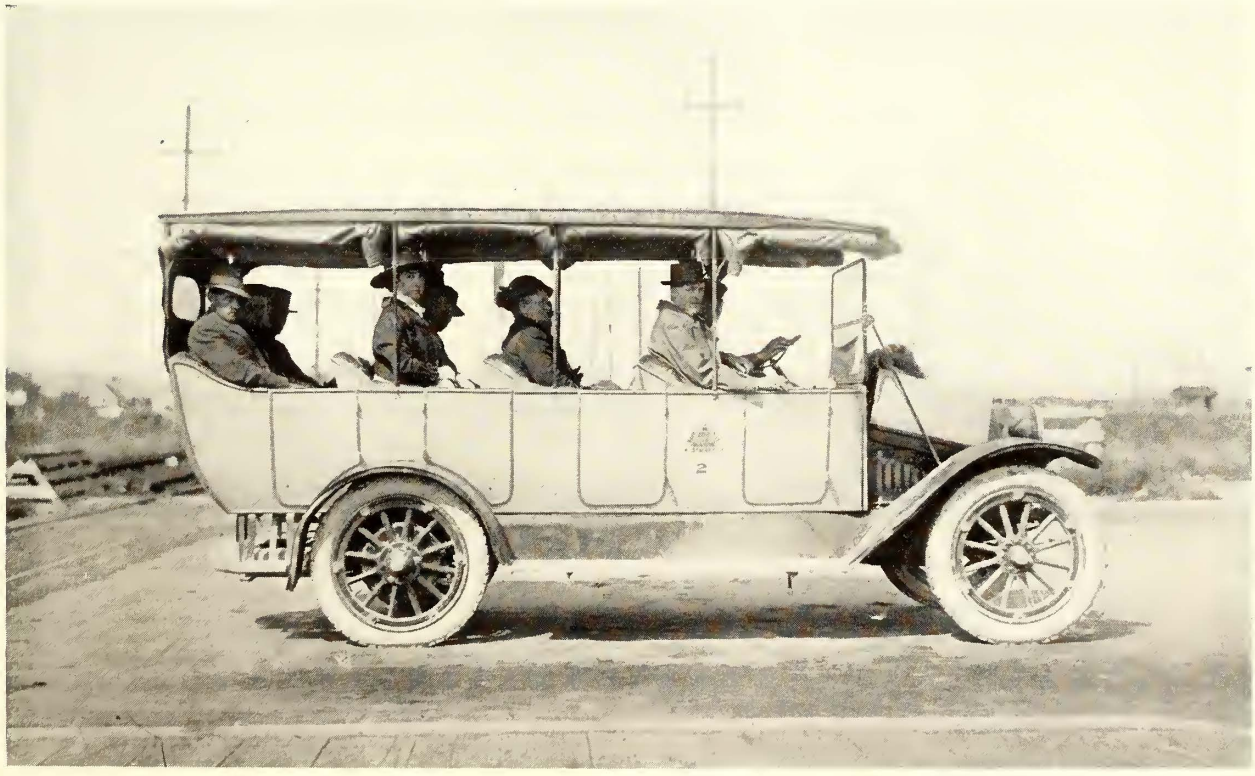
In addition to the foregoing two lines, we have several other routes in prospect, but will do nothing with them until further experience is gained.

We look upon the auto-bus as the only practicable means for developing communities adjacent to but not served by the interurban railways. Such service is the direct result of improvement in automobiles and highways. We feel, too, that it is not only proper to give the public all possible transportation service, but also to do it before the revenues of existing lines are jeopardized by the competition of independent auto-buses.

The Auto-Buses of the Washington Auto-Bus Company Feeding the Electric Railway Are Handled by One Man

Auto-Buses as Feeders of the Puget Sound Traction, Light & Power Company

Auto-Bus with Pneumatic Tires in Service Between Buckley, Enumclaw and Auburn



The One-Man Car as an Effective Means of Reducing Headway

The Author Suggests the Possibility of Interpolating Short-Line, Short-Headway, One-Man Cars on Through Routes

By G. A. RICHARDSON

Superintendent of Railway Puget Sound Traction, Light & Power Company, Seattle Division

Second Avenue, Seattle

THE one-man car is not a new proposition in itself, for first we had the bob-tail car of horse days, and in very recent years electric cars have been designed specially for such operation. The general idea has been that the one-man car was particularly suitable for small towns where the difference between one and two men on a car is the difference between profit and loss. However, it is the writer's belief that there is also a field for the one-man car in cities of medium size not only for shuttle, crosstown and feeder service but for short-line or turn-back cars on trunk lines. For example, if eight cars are operated on a line on a seven and a half minute headway over the entire length of a route which takes sixty minutes for the round trip, two of these through cars might be taken off, leaving six cars for the through service and releasing four trainmen for one-man car short-line service operation. The result would be six-car ten-minute headway over the entire route, with four-car ten-minute headway over the business section of the route, giving a combined headway of five minutes against seven and a half minutes with the present form of operation, with no additional cost in platform expense. A frequent short-line service is the most effective way to meet the jitney.

This proposition is doubtless a radical one, but radical diseases call for radical remedies. Hitherto electric railway operating men have been obliged to look very closely at the item of platform cost because two-men operation often made the cost of a short headway prohibitive.

The operation of jitneys has shown that many people are likely to take the first transportation means offered because they want short-headway operation. It has also been shown in the case of the larger or bus units that the traveling public has no intrinsic objection to public vehicles being operated by one man.

A transition period, during which we must modify some of our former standards, is now upon us, and if the jitney accelerates the use of the one-man car its coming will not have been in vain.

We now have one shuttle line operated with the one-man car, and are considering seriously its gradual extension into the field outlined above. Our present one-man car is a single-truck type with folding gates, the only change for one-man operation being the locking of the doors on the rear platform. As has already been announced, the Stone & Webster Management Association has designed a light one-man car particularly suitable for the conditions described.

The Use of Coasting Recorders Results in Economies at Vancouver

Although the Saving of Electrical Energy Is Not a Vital Point on This System, the Use of Coasting Recorders Has Been Found Advantageous for Operating and Maintenance Reasons

By W. G. MURRIN
General Superintendent British Columbia Electric Railway, Vancouver, B. C.

One Girl Using Adding Machine and One Girl Recording Coasting Records

OUR preliminary studies with Rico coasting recorders were made on both city and interurban lines early in 1913. Altogether seven clocks were used, and their records were supplemented with watt-hour meters and ammeters, in addition to which one man rode each test car simply to check the running time. The cars were operated by our regular motormen subject to the instruction of the engineers of the Railway Improvement Company, but the records were taken by our own engineers. After several days' run on one group of cars, the instruments were placed on a second group and so on until all important local lines had been tried. We did not make any tests on our long interurban lines as we did not believe that their operating conditions, involving the use of heavy trains, would permit the most effective use of recorders.

As a result of these tests it was decided to equip the Vancouver city lines, numbering about 200 cars. We also installed the Rico terminal clocks on the same lines. This work was completed in the fall of 1913.

In addition to special instruction in coasting, the motormen were invited to meetings at which the coasting clock was fully explained.

At first the records of coasting were maintained by a separate department, numbering five girls, an outside traveling inspector who examined clocks, and the head of the department. This department has since been merged with the transportation department under the superintendent. The only employees who give their time exclusively to this work are two girls, this being made possible through their increased experience and the use of a Comptometer and slide rule. Instead of employing a special inspector, the mechanical department looks after the clocks like any other piece of equipment, special investigations being made only on daily reports from the transportation department that certain clocks require attention. The traffic inspectors now do the coaching formerly done by the coasting clock inspector.

The coasting records of the individual men are posted every two weeks at each carhouse. In addition, educational bulletins are posted from time to time. Men who show poor records are subject to personal interview with the superintendent.

Comparisons and Benefits

In February, 1914, the company, for its own satisfaction, made tests on eight different routes with recorders checked by watt-hour meters. A special inspector with a stop-watch rode on each run to get the actual running time. When averaged these tests showed conclusively that the least energy was

used by the best coasters, and that the drop in energy was proportional to the gain in coasting. A summary of the test is appended.

As experience with the clocks increased and the follow-up work was pursued, the coasting for the entire system rose to 31.2 per cent during the summer of 1914, and we were hopeful that an average of 35 per cent was attainable, although our stops are exceptionally frequent because of very short blocks. Late in 1914, however, about 650 jitneys made their appearance on the streets of Vancouver, and this made it desirable to speed up the lines as much as practicable. Consequently, coasting has been cut down to an average of 22.3 per cent, but at the same time we are giving many more car-miles without any appreciable change in the power bill and at a reduction in platform expense per car-mile from 8.27 cents (June, 1914) to 7.31 cents (June, 1915).

In short, the use of coasting recorders revealed the possibility of higher speeds and therefore of greater ultimate economies than the mere saving of energy where coasting is worked to the limit.

The disciplinary value of the coasting recorder would appear from the fact that despite an increase of speed, front-end accidents are no more numerous than at the lower speed.

Maintenance per car-mile has decreased about 40 per cent during the period since the coasting recorders were installed. Of course, we cannot credit the recorder alone with this reduction because our

RELATION OF COASTING TO ENERGY USE

Tests of Feb. 2 to May 12, 1914

Number of cars in test	4
Number of routes	8
Number of days	22
Four days on two lines	—
Two days on others; and some odd trips	—
Number of motormen in test	45
Total number of individual runs	63

Average of All High Men vs. Low Men

Difference in coasting percentage	11.868 per cent
Difference in kilowatt-hours per car-mile	12.542 per cent
Or approximately in the ratio of	1:1
Average coasting	30.3 per cent
Average energy consumption in kilowatt-hours	3.27
Three cars with quadruple Westinghouse 101-B equipments geared	15.69
Two cars with quadruple GE-67 equipments geared	17:67
Average weight of cars in tons	23

cars are now inspected at shorter intervals, brake-shoes have been changed from plain iron to the reinforced steel-back type, much equipment has been standardized and other improvements have been made. At the same time we feel satisfied that skillful coasting does not injuriously affect the maintenance of equipment.

TERMINAL CLOCK

The terminal clock has proved a most useful auxiliary of the coasting recorder and also as an aid to inspection service. We do not place the terminal clocks at the terminals but at points five to seven minutes therefrom. This practice eliminates both running ahead of time and loafing at the terminal so that the men naturally try to get over the line in exact time. The result has been that we have been able to reduce our staff of inspectors to half the original number and yet operate at higher speed and efficiency than before.

Use of Terminal Clock

Removing Coasting Slip