

SOME PRACTICES ON THE SCIOTO VALLEY TRACTION SYSTEM

The property and operating methods of the Scioto Valley Traction Company, whose headquarters are in Columbus, form one of the most interesting subjects for study presented anywhere to builders and operators of interurban railways. Few traction lines have been so widely discussed, and perhaps so little understood, as this property. The first and only third-rail property in the great interurban district embracing the two States of Ohio and Indiana, it was built on lines which at the time were deemed by many to be too elaborate and too expensive for the territory and the character of business apparently in sight.

The system, at present embracing about 80 miles, extends from Columbus in a southerly direction with double track 6 miles to Obetz Junction, the main line continuing almost due south to Chillicothe, 48 miles, and a branch extending southeasterly from the junction to Lancaster, 25 miles. The populations of towns, exclusive of Columbus, which has a population of 160,000, according to the latest estimates, is as follows:

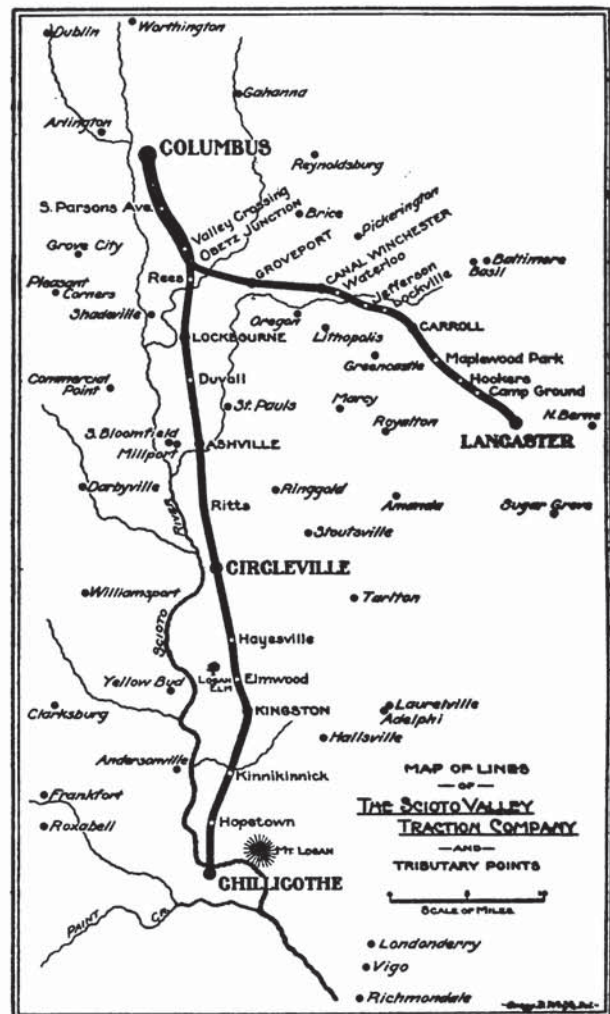
CHILICOTHE DIVISION	
Chillicothe	14,000
Kingston	900
Circleville	7,500
Ashville	1,000
Intermediate	1,500
	24,900
LANCASTER DIVISION	
Lancaster	10,500
Carrol	500
Winchester	800
Groveport	750
Intermediate	1,000
	13,550
Total	38,450
Columbus	160,000

The road was built entirely on private right of way, away from the highway, through the country districts and through a number of the small towns, whereas a number of the roads in this district used pike location or were built at the side of the highway, where land was cheaper and easier to obtain. All railroad crossings at grade were eliminated by the use of expensive over-grade or undergrade crossings, a precaution not considered necessary by many. Grades were kept down to 1½ per cent, and all curves can be taken at full speed. This is true even at an over-grade crossing, where it was necessary to construct an enormous S-shaped fill to secure the desired result. The cars weigh 44 tons and are equipped with four 125 hp motors. In addition to having much heavier capacity per mile of track and per car operated than the majority of roads, the power station was equipped with a fuel and ash conveyor, fuel crusher, automatic stokers and other accessories not usually considered necessary by the majority of roads in the district. Handsome little station buildings were built in towns, and in a number of instances the sub-stations were separated from the passenger and freight stations, it being the opinion of the company that sub-station attendants should attend exclusively to the sub-station, forming another departure from accepted practice. In brief, the road in all its details was built on a broader gage and more liberal policy than was usually considered necessary for a road of this character.

It should be stated here that the enterprise was financed and built by local people, who had lived in the district all their lives

and were thoroughly familiar with the conditions. Frank A. Davis, president and general manager, and E. R. Sharp, secretary and treasurer, with their associates, control the property and still hold the bonds, preferring not to market them until the property has developed its full earning power. For an operating man they selected L. C. Bradley, then superintendent of the Seattle-Tacoma Interurban Railway, in Washington. In addition to being an experienced operator under the third-rail system, Mr. Bradley was in accord with the ideas of the owners in matters of high-grade service and maintenance of equipment.

After two years of operation, the property has fully justified the policy of its builders, and the financial results have been gratifying. It may be said the road earns more per mile of track than the majority of roads in the district, which have been in operation for a longer period, and its earnings per capita of popu-



MAP SHOWING SYSTEM OF SCIOTO VALLEY TRACTION COMPANY

lation in the country are considerably larger than the average road in this vicinity.

It appears that, as the builders foresaw, the territory is better than the average. The valley of the Scioto is the oldest and most fertile portion of Ohio. Chillicothe was one of the first settlements in the State, and was its first capital. While both divisions of the road are closely paralleled by steam roads, the

latter have not catered to the local business and have given infrequent service, with slow and poorly equipped trains. By giving the frequent service with fine, high-speed cars, which actually make better time between terminals than the steam trains, then by giving a fast and efficient freight service at low rates, and finally by maintaining the track and equipment from the start, the company secured the bulk of the business in the territory and gained the good-will of the people.

It has not been the policy to force the operating expenses below the usually sought for 50 per cent, but rather to keep the equipment up to a high stage of efficiency and to make many needed improvements out of earnings.

Last year the company spent \$216 per mile for track maintenance, including ballasting, painting bridges, fences and cattle guards, salaries of section foremen, etc. The road is divided into six sections of 12 miles each, having a force of five to eight

passengers could be handled to advantage. The station is three blocks from the State Capital, so located on the interurban loop that it is not necessary to traverse the loop, and at the same time the cars of all other lines pass the door. The building, a large two-story house, formerly used as a school, was thoroughly rebuilt, to provide ample facilities for passengers and freight, baggage room, ticket office, etc., the second floor being fitted up for the executive and operating officers and train dispatcher.

Superintendent Bradley differs from many operating men in the belief that the operating office should be in the large terminal city, instead of being located on the line. The greater portion of the business originates in the large city, the majority of purchases are made there, and he prefers to keep in close touch with the executive officers. While he believes in making frequent trips over the road and keeping an eye on all that is going on, he believes that better and more efficient service is secured from heads of departments where they are not under constant supervision and are taught to take their own initiative in every-day matters.

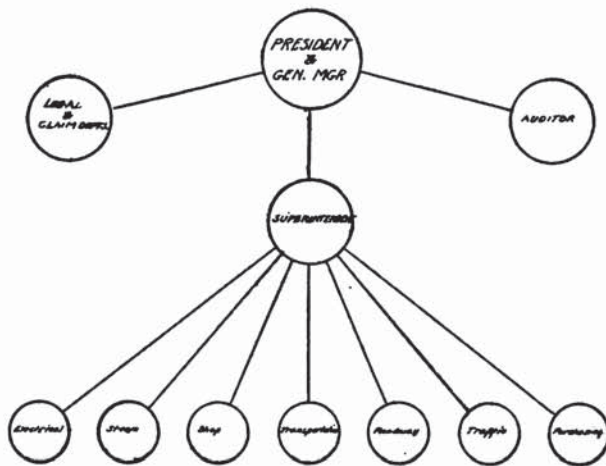
For very similar reasons, he believes that the train dispatcher should not be out on the line. He reasons that a dispatcher can keep closer watch of his train sheet and the position of the trains if he is at one end of the line. The superintendent aims to keep the crews away from the dispatcher, rather than have him hand orders directly to the men, as is done by many roads.

In addition to handling the trains, the dispatchers figure train mileages and keep a record of the number of passengers on each car, the conductor making this report each trip. In this way the dispatcher can order out more cars if needed and regulate the service to better advantage.

The trip reports are compiled and weekly and monthly report sheets are computed. The daily earnings are computed in two ways; by taking the actual earnings as reported for each trip and by multiplying the average earnings per passenger over a considerable period by the number of passengers handled.

The management does not believe in more frequent service than hourly headway. The two divisions are operated separately, the main line cars leaving Columbus on the hour and the Lancaster division on the half hour. It is claimed that when half-hour service is put on in the summer months people just become accustomed to the half-hour cars when the added cars are taken off. It is claimed that the half-hour cars are always lighter, for the reason that people are not familiar with the half-hour leaving time. Instead, the company runs two-car or three-car trains. Its cars are all equipped with Type M train control, and have both straight and automatic air brakes. They have a special coupler with 9-ft. beam, so that they make the right angle curves in the city without difficulty. With train operation the labor cost is, of course, reduced, although it is the practice to have a conductor on each car, which not only increases the safety of operation, but insures getting all the fares.

Freight service on this line was started on Dec. 1 of last year. The freights also operate in trains, but trailers are used in this service. The company has three motor express cars, which are fitted with the same electrical equipment as the passenger cars. There are also two trailers which were rebuilt from mail cars purchased from a steam road. The doors were made larger and the cars were fitted with automatic air brakes. They have a somewhat larger capacity than the motor cars. There are two regular trips a day in the freight service over each division, and usually a trailer is used on one of these trips. In computing the operating expenses of freight cars, it has been found that a loaded freight, with trailer, consumes 2 kw-hours per car-mile more than the passenger cars. Before the freight service was started, it was found that the consumption for passenger cars over a period of a year was 3.1 kw-hours per car-mile in summer and 3.5 kw-hours per car-mile in winter, the large power consumption in winter being due to the presence of snow and the



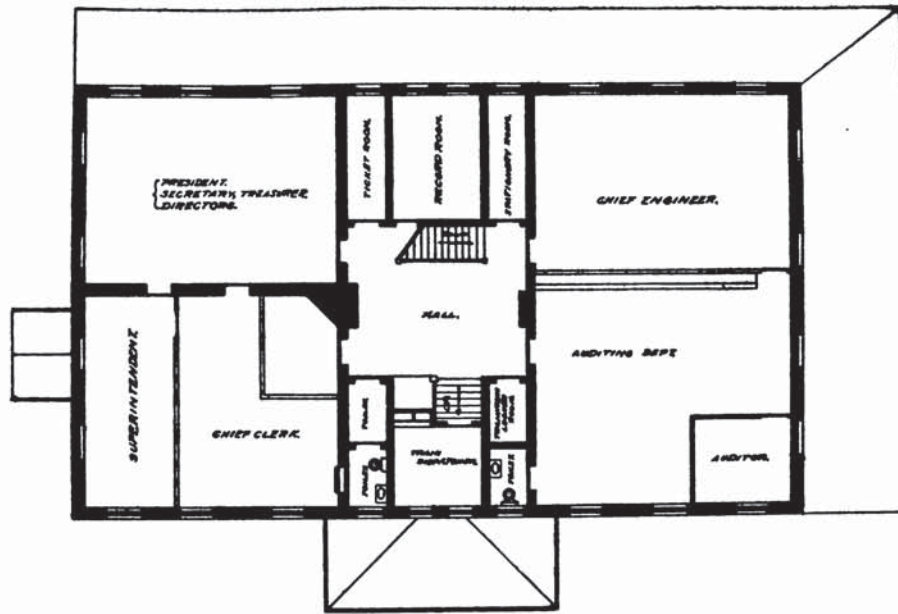
THE SCIOTO VALLEY TRACTION CO.
Plan of Organization - Operating Department

PLAN OF ORGANIZATION, OPERATING DEPARTMENT, SCIOTO VALLEY

men, according to season. Each sectionman must cover his track daily. The track is kept free from weeds by cutting off the roots with scuffle hoes as often as they grow up. There are twenty iron bridges, ranging from 30 ft. to 480 ft. in length, and these have been repainted this year, although but two years old.

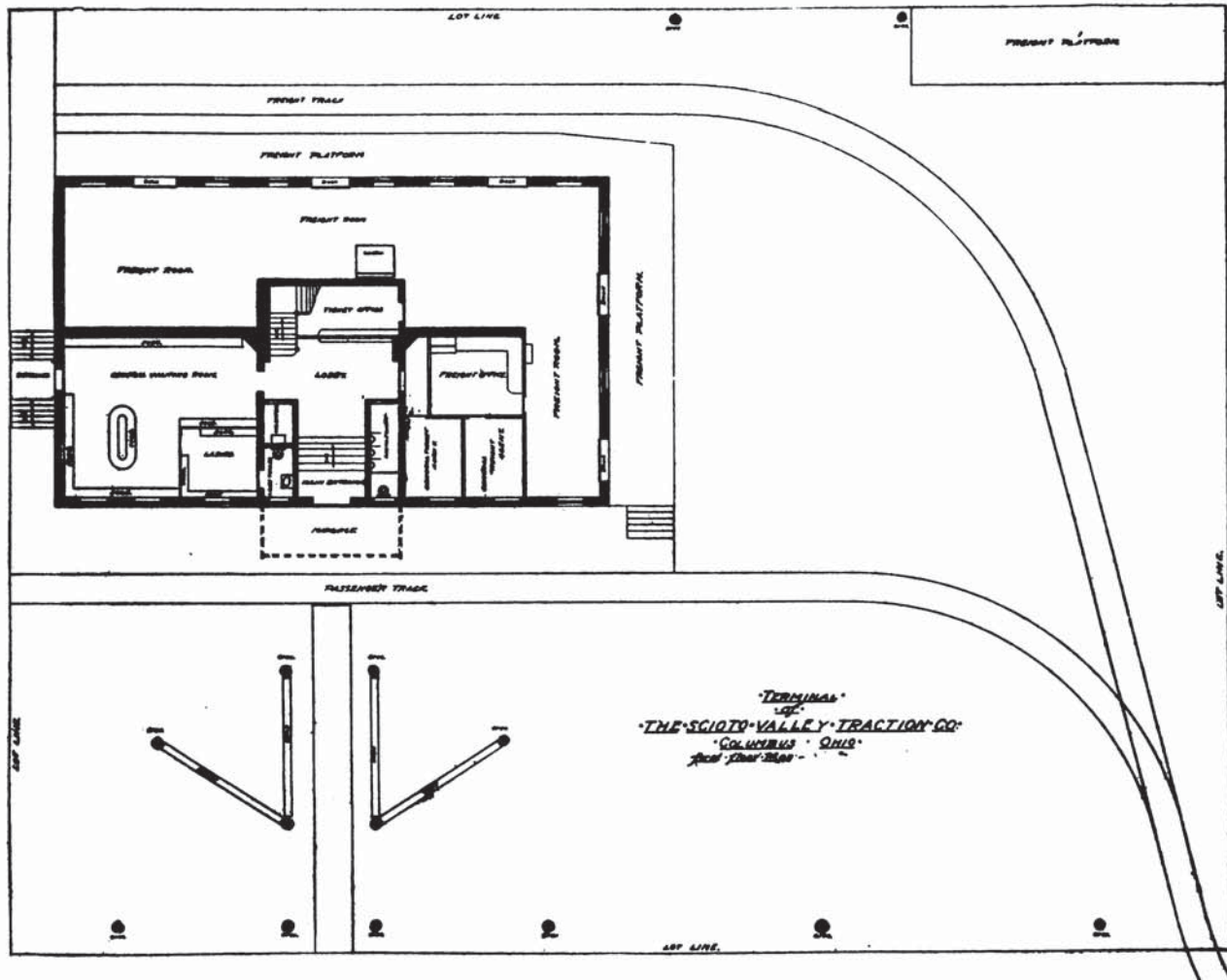
This year stations have been erected at all stopping points. Those in the larger towns are artistic brick buildings with concrete foundations and floors and tile roofs, with ticket office, passenger room, baggage and freight room and covered platform. It was figured that it was economy to erect buildings of this character and carry no insurance on them rather than to build frame buildings. In two or three instances the stations are combined with sub-stations, but separate attendants are provided for the two departments. In small towns there are neat frame stations of the type illustrated on one of the plates herewith, while at country stops, which average about 1 mile apart, shelter stations are provided with gravel platforms 100 ft. long and 8 ft. wide. Each station is illuminated, and is provided with a semaphore for flagging trains, displaying a green arm by day and a green light by night. One of these crossing stations, showing the semaphore and signs and the method of entering the right of way to the platform, is also shown in this issue.

For a time the company used the union waiting room in Columbus, but the inadequate facilities and the delays in passing around the interurban loop caused it to abandon this arrangement and establish a station of its own, where both freight and



SECOND FLOOR PLAN

SECOND FLOOR PLAN, TERMINAL AT COLUMBUS, SCIOTO VALLEY



GROUND-FLOOR PLAN, TERMINAL AT COLUMBUS, SCIOTO VALLEY



STEEL BRIDGE OVER SCIOTO RIVER AT ENTRANCE TO CHILLICOTHE SCIOTO VALLEY TRACTION COMPANY



VIEW AT BIG WALNUT CREEK, SHOWING STANDARD BRIDGE CONSTRUCTION, POWER HOUSE IN BACKGROUND—SCIOTO VALLEY



UNDERCROSSING WITH THE N. & W. RAILWAY AT KINSKINICK, SCIOTO VALLEY



THE "BIG FILL" AT OVERCROSSING WITH H. V. RAILWAY,
SCIOTO VALLEY



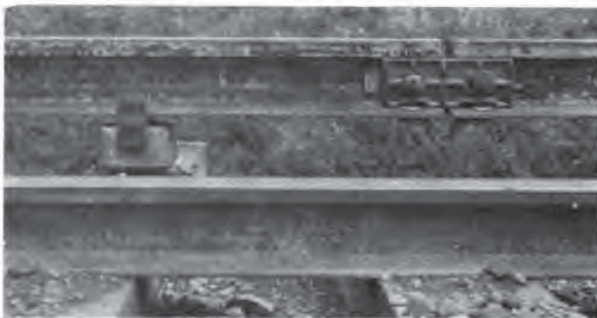
TYPICAL CROSSING, SHOWING CROSSING SIGNS AND
GUARDS, SCIOTO VALLEY



JOINT AND METHOD OF APPLYING SOLDERED BOND,
SCIOTO VALLEY



OBETZ JUNCTION, THE JUNCTION POINT OF LANCASTER
AND CHILLICOTHE DIVISIONS. THE PASSENGER STA-
TION PLATFORM EXTENDS OVER THIRD RAIL—
SCIOTO VALLEY



THIRD-RAIL INSULATOR, JOINT AND BOND, SCIOTO VALLEY



STANDARD OPEN WAITING STATION AND TRAIN-SIG-
NALING DEVICE, SCIOTO VALLEY



STANDARD TURNOUT, SHOWING SWITCH STAND, TELE-
PHONE BOOTH AND THIRD-RAIL CONSTRUCTION AND
CONNECTIONS, SCIOTO VALLEY



FREIGHT AND PASSENGER STATION AT LANCASTER,
SCIOTO VALLEY



FREIGHT AND PASSENGER STATION AT LOCKBOURNE,
SCIOTO VALLEY



SUB-STATION AND TEMPORARY FREIGHT AND PASSENGER STATION AT CHILLICOTHE, SCIOTO VALLEY



COMBINATION FREIGHT, PASSENGER AND SUB-STATION AT KINGSTON, SCIOTO VALLEY



REMODELED STORE BUILDING USED AS FREIGHT AND PASSENGER STATION AT CIRCLEVILLE, SCIOTO VALLEY



FREIGHT AND PASSENGER STATION AT CANAL WINCHESTER, SCIOTO VALLEY



FREIGHT AND PASSENGER STATION AT GROVEPORT, SCIOTO VALLEY



SUB-STATION BUILDING, SCIOTO VALLEY



FREIGHT AND PASSENGER STATION AT ASHEVILLE, SCIOTO VALLEY



INTERIOR BAGGAGE CAR, SCIOTO VALLEY



INTERIOR PASSENGER CAR, SCIOTO VALLEY



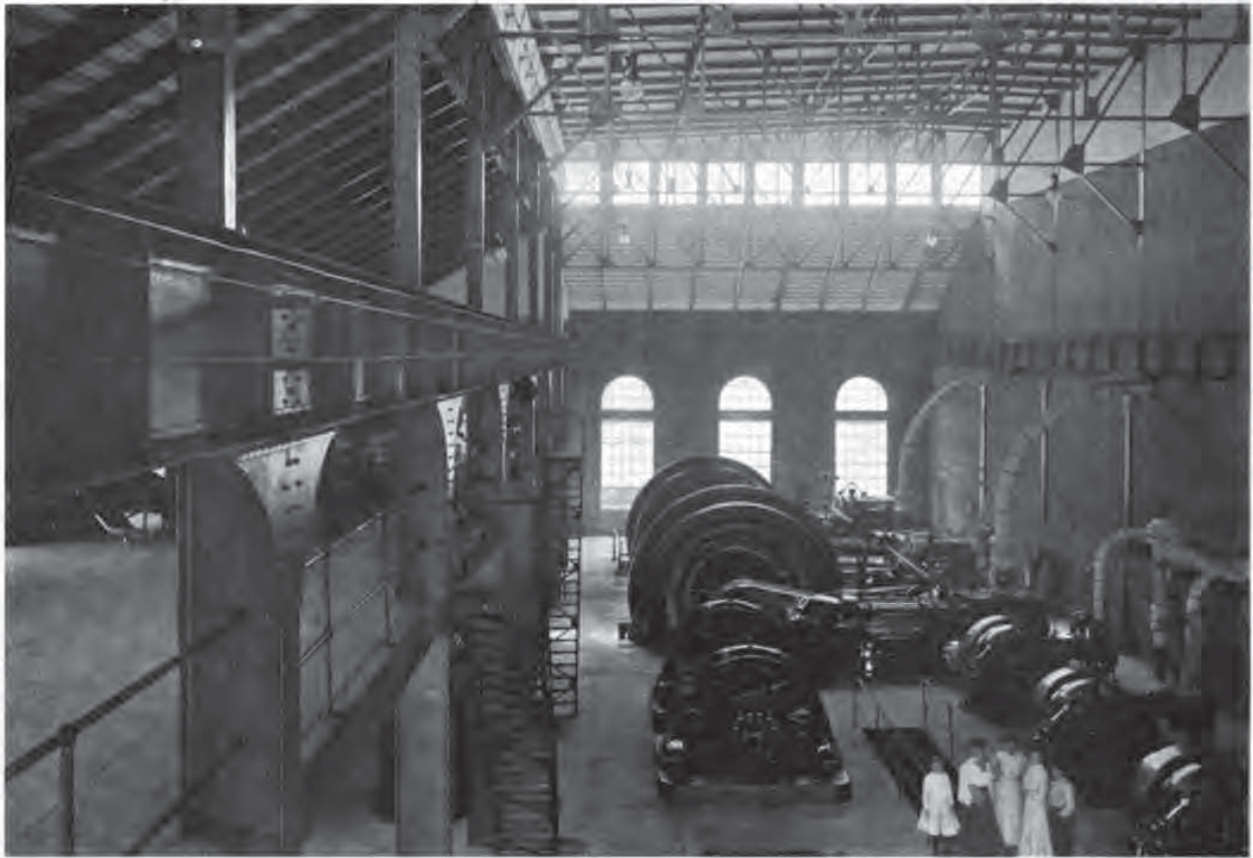
STANDARD CAR, SCIOTO VALLEY



BAGGAGE CAR, SCIOTO VALLEY



THREE-CAR TRAIN USED FOR HANDLING HEAVY TRAFFIC, SCIOTO VALLEY. THIS TRAIN HAS SEATING CAPACITY OF 210 PASSENGERS



INTERIOR POWER STATION, SCIOTO VALLEY



EXTERIOR POWER STATION, SCIOTO VALLEY

use of heaters. Thus the company is enabled to make a very close estimate of the cost of freight operation, which is something the majority of roads have not been able to do.

Although the freight service has been operated but a short time, it has exceeded the expectations of the management. The freight cars have averaged 36.5 cents receipts per car-mile for several months, which is considerably better than the passenger car earnings. Rates are in strict competition with the parallel steam roads, the official classifications being used. Of course, the cheaper classes of heavy freight are not handled, nor are standard steam freight cars hauled. About 25 per cent of the business is in small packages, with a minimum charge of 25 cents. The average rate on all freight is about 11 cents per hundred pounds, so that a train with 10 or 15 tons makes a very good showing. The average mileage of each freight car

year. These, with individual 30-day commuter books giving a rate of 1 1-5 cents per mile, are sold largely to the country people, and as tickets are sold in all towns there are comparatively few cash fares on the trains.

In computing daily earnings on ticket sales, only the actual earnings are considered; that is, only such portions of round-trip tickets, coupon books, etc., as are actually collected on that day are considered in the earnings for the day, and the tickets sold and not redeemed are carried on a balance sheet as a liability. This liability is not computed each day, but in the monthly balance sheets the liability for outstanding tickets is taken into consideration. It is believed that this is the only method to keep a uniform record of earnings per car-mile and per month.

This is illustrated by a condition existing on this road recently.

THE SCIOTO VALLEY TRACTION COMPANY
DAILY REPORT OF EARNINGS.

	Date _____ 190__											
	LANCASTER DIVISION				CHILLICOTHE DIVISION				TOTAL BOTH DIVISIONS			
	PASSENGER	FREIGHT	MISCEL.	TOTAL	PASSENGER	FREIGHT	MISCEL.	TOTAL	PASSENGER	FREIGHT	MISCEL.	TOTAL
Earnings this day												
Earnings same day last year												
Increase or decrease												
Previous days this month												
Total from first of month												
Same period last year												
Increase or decrease												
Per cent of increase or decrease												
Receipts per car mile this day.												
OPERATING DATA.												
Number of regular cars operated												
Number of regular trips												
Car mileage (regular cars)												
Special cars run												
Special car mileage												
Number of paid passengers carried												
Number of free passengers carried												
Average number of miles per car												
Aver. No. of paid passengers per car.												
Aver. No. of paid passengers per trip.												
Weather this day									Events this day			
Weather same day last year									Events same day last year			

FORM USED FOR MAKING DAILY REPORT OF EARNINGS, SCIOTO VALLEY

is 121 miles, as compared with 407 miles a day for passenger cars. The advantage of the service is that it is practically express service at freight rates, and the cars are unloaded in the business district convenient for the commission houses, who receive and originate a considerable portion of the business. The traffic is about equally divided between goods shipped from Columbus to the country merchants and produce and manufactured articles originating in the towns along the lines. There is considerable interchange with other interurban roads, and foreign cars frequently run into the company's yard to make transfers.

All agents are on a salaried basis. The company has a freight solicitor, and agents solicit business in the towns. All blanks, records and claim adjustments follow closely those used on steam roads.

Passenger rates are 2 cents a mile, but they are usually about 5 cents under the steam road rate at each point, because the steam road mileage is longer to reach the same points. The interurban gives a reduction of 10 per cent from double the one-way rate for round trips, which is not done by the steam roads. Baggage to the extent of 150 pounds is carried free. Mileage books with a reduction of 16 2-3 per cent are sold with practically no restrictions, except that they must be used within a

During August the round-trip ticket sales were very heavy, due to county fairs, for which special rates were made with a return limit of 15 days. The round-trip ticket sales may be stated as approximately \$40,000, of which about \$4,000 worth of tickets were used both going and coming that month. Of the remainder, \$36,000, the going coupon was used in August and the returning in September. Assuming that the service and operating expenses were equal both months, and with only the average number of round-trip sales in September, the crediting of the whole of the \$40,000 for the round-trip sales above mentioned to August would show an enormous gain in earnings for that month and probably a deficit for September, and the car mileage earnings would go to opposite extremes, although the mileage and traffic were practically the same.

TRAIN SERVICE

As the operating conditions on this road are practically equivalent to those on steam roads, it was considered necessary to adopt equivalent precautions for the safe and prompt handling of trains, and to that end the train service rules in effect upon steam roads were adopted and are strictly adhered to.

This made it necessary to employ trainmen familiar with such rules, and the company adopted the policy of securing loco-

tive engineers as far as possible. About 90 per cent of the motormen are experienced locomotive engineers and the balance are experienced conductors, any one of whom is competent to handle a train in any district on any steam railway in this country.

In the preparation of this article, Mr. Bradley was asked if it was possible to secure the better class of locomotive engineers, or if, as has often been intimated by other traction operators who do not favor the employment of steam men, the engineers that can be obtained for the wages paid are the off-scourings of the steam service, who cannot secure a job because of incompetence.

Mr. Bradley stated emphatically that this was not the case. In the first place, his company pays the highest wages in the district, the motormen receiving 25 cents an hour, and the runs are arranged so that they work ten hours. A number of the men came from the competing steam roads, and were anxious to secure the positions because they were enabled to be home with their families every night and did not have to pay for lodgings at distant terminal points.

Mr. Bradley does not consider that because a man is discharged for carelessness by a steam road, he will not make a

to handle trains. He is then assigned to the shop department for a period usually ranging from seven to ten days, where he is given thorough and practical instruction upon the equipment and its care and maintenance. After having been given a certificate of competency by this department, he is then assigned to regular service. As a rule, four weeks are required in this training and "breaking in" before his application is formally accepted and he is assigned to regular service.

The requirements for employment of conductors are not so strict, although great care is used to select men thoroughly competent for this work. Conductors are in line for promotion as motormen, when they prove themselves competent to pass the examinations and fill the requirements of the more responsible position, and this will probably require from two to three years' experience.

Reproductions of train orders, forms "19" and "31," clearance cards and registering tickets are shown in this connection. A portion of the time card is also shown.

Columbus, Obetz Junction, Lancaster and Chillicothe are registering stations, at which points all trains, regular and extra, are registered in a book provided for the purpose, showing num-

TRAINS SOUTH											CHILICOTHE DIVISION										TRAINS NORTH																																																																																																																																																																																																																																																																																																																																											
No.	Dep. P.M.	Arr. P.M.	Dep. P.M.	Arr. P.M.	Dep. P.M.	Arr. P.M.	Dep. P.M.	Arr. P.M.	Dep. P.M.	Arr. P.M.	Station	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Station	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.	Dep. A.M.	Arr. A.M.																																																																																																																																																																																																																																																																																																																																
100	7:00	7:05	7:10	7:15	7:20	7:25	7:30	7:35	7:40	7:45	COLUMBUS	7:50	7:55	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	101	8:00	8:05	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	102	8:10	8:15	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	103	8:20	8:25	8:30	8:35	8:40	8:45	8:50	8:55	9:00	9:05	104	8:30	8:35	8:40	8:45	8:50	8:55	9:00	9:05	9:10	9:15	105	8:40	8:45	8:50	8:55	9:00	9:05	9:10	9:15	9:20	9:25	106	8:50	8:55	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	107	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45	108	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45	9:50	9:55	109	9:20	9:25	9:30	9:35	9:40	9:45	9:50	9:55	10:00	10:05	110	9:30	9:35	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15	111	9:40	9:45	9:50	9:55	10:00	10:05	10:10	10:15	10:20	10:25	112	9:50	9:55	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:35	113	10:00	10:05	10:10	10:15	10:20	10:25	10:30	10:35	10:40	10:45	114	10:10	10:15	10:20	10:25	10:30	10:35	10:40	10:45	10:50	10:55	115	10:20	10:25	10:30	10:35	10:40	10:45	10:50	10:55	11:00	11:05	116	10:30	10:35	10:40	10:45	10:50	10:55	11:00	11:05	11:10	11:15	117	10:40	10:45	10:50	10:55	11:00	11:05	11:10	11:15	11:20	11:25	118	10:50	10:55	11:00	11:05	11:10	11:15	11:20	11:25	11:30	11:35	119	11:00	11:05	11:10	11:15	11:20	11:25	11:30	11:35	11:40	11:45	120	11:10	11:15	11:20	11:25	11:30	11:35	11:40	11:45	11:50	11:55	121	11:20	11:25	11:30	11:35	11:40	11:45	11:50	11:55	12:00	12:05	122	11:30	11:35	11:40	11:45	11:50	11:55	12:00	12:05	12:10	12:15	123	11:40	11:45	11:50	11:55	12:00	12:05	12:10	12:15	12:20	12:25	124	11:50	11:55	12:00	12:05	12:10	12:15	12:20	12:25	12:30	12:35	125	12:00	12:05	12:10	12:15	12:20	12:25	12:30	12:35	12:40	12:45	126	12:10	12:15	12:20	12:25	12:30	12:35	12:40	12:45	12:50	12:55	127	12:20	12:25	12:30	12:35	12:40	12:45	12:50	12:55	1:00	1:05	128	12:30	12:35	12:40	12:45	12:50	12:55	1:00	1:05	1:10	1:15	129	12:40	12:45	12:50	12:55	1:00	1:05	1:10	1:15	1:20	1:25	130	12:50	12:55	1:00	1:05	1:10	1:15	1:20	1:25	1:30	1:35

SECTION OF TIME-TABLE FOR GOVERNMENT OF EMPLOYEES, SCIOTO VALLEY

safe man for an interurban road. A man is frequently discharged for the good of the service and the incident proves a warning to him, so that he is not likely to repeat the act on some other road. In matters of discipline, he has no fixed rule for demerits or layoffs. Usually in cases of carelessness the attention of the man is called to the incident, and only after the second or third offense is he given a layoff for five to ten days. It is not considered desirable to give a longer layoff than this, as the loss of pay usually falls on the innocent family and it makes the man unfriendly against the company. Only for continued carelessness or for an error on the rights of a train is a man discharged. The smell of liquor on the breath or visiting a saloon or taking a drink while on duty are also causes for instant dismissal, and a man guilty of these offenses or of dishonesty will not be recommended to another road.

To secure positions, motormen are required to pass written examinations on train service rules, and must show an absolutely clear understanding of all the rules. The examination includes some seventy-five questions, which are designed to develop the man's knowledge as to the import and meaning of the company's rules and regulations. The questions are not reproduced here, owing to lack of space, but they are well worth the attention of interurban operators.

After having successfully passed the required train service and physical examinations, the applicant is put on the road to "break in" with regular motormen, until he is judged competent

number of train, direction, number of car, name of conductor and motorman, time of arrival and departure, and whether carrying signals for sections or not. The crews of all trains consult this register for the purpose of ascertaining if all trains due have arrived and departed. No train may leave or pass a registering station except upon clearance from despatcher.

From Columbus to Obetz Junction, a distance of 7 miles, is double track. The latter station is the junction point of the Lancaster and Chillicothe divisions.

Yard limits extend from Obetz Junction to Rees, at which point the repair shops and storage yards are located. Between these points extra cars in switching, etc., are moved by clearance from despatcher.

Train order signal boards are located at all points where agents are assigned and are used for stopping trains for orders. No train may pass a train order board, which is displayed against them, without obtaining orders or clearance stating that there are no orders for that train.

To illustrate the movement of regular or time-card trains, reference may be made to illustration of time card and to the following explanation:

Take, for example, train No. 106, from Columbus, southbound for Chillicothe. This train is given clearance at Columbus, upon which it proceeds on its time card rights to Obetz Junction, the first registering station and end of double track. At or north of this point this train is due to meet No. 105,

north-bound. All trains are required to register at this station, by "registering ticket." After registering his own train and consulting the register to ascertain that all trains due on his division have arrived and departed, the motorman calls the despatcher and obtains a clearance for his train.

This train may then proceed on its time card rights to Rhoads, which is the next meeting point.

All crews are required by rule to call despatcher by telephone immediately upon arrival at meeting points, if opposing train has not arrived.

Another rule requires that when a train becomes five minutes late the crew must notify despatcher from first telephone station. These telephone stations are located at each passing track, with permanent wall telephone in each booth.

After having met train No. 107 at Rhoads, No. 106 proceeds on its rights to next meeting point, and so on to destination.

Upon arrival at Chillicothe, the motorman of this train notifies despatcher by telephone of his arrival, and also registers his train in train register provided for this purpose. Before proceeding north under another train number, he is again required to obtain clearance from despatcher.

All train orders given to crews upon the road are transmitted to motormen, who make two copies at one impression, and upon repeating the written order to despatcher and obtaining "Complete" for same, he retains the original copy, giving carbon copy to his conductor, who repeats it aloud in his presence.

When orders are transmitted to operators, motormen and conductors are both furnished copies of the order, or orders, together with clearance giving the numbers of all orders for their train.

All freight trains are operated as "Extras"; that is to say, by train order only, and are not represented on time card.

For example, a freight train leaving Columbus for Lancaster would be given an order, "Motor No. 14 will run extra, Columbus to Lancaster." The same rules regarding clearances and registering apply to extras as to regular trains. All extra trains are required to clear time of regular trains five minutes, both in following them out of switches and also in making meeting points, unless meeting point is fixed by train order. Ordinarily an extra train proceeds as far as possible to clear a regular train five minutes at a siding, and, after the train to be met has arrived, proceeds again in the same manner.

The following extracts are made from the "Book of Rules" of this company:

TRANSPORTATION RULES

DEFINITIONS

84. Train: A motor, with or without trailers, equipped with train signals.

Regular Train: A train represented on time-table. It may consist of sections.

Section of a Train: A portion of a regular train which either carries signals or for which signals are carried, as per rule 106.

Extra Train: A train not represented on the time-table, designated as: Extra: For freight or passenger-train extra.

Work Extra: For work train.
Superior Train: A train having precedence over other trains. A train may be superior to another train either by right or by class.

Right is superior to class.
Train of Superior Right: A train given precedence by train order.

Train of Superior Class: A train given precedence by time-table.

Schedule: That part of a time-table which prescribes the movement of a regular train, its direction, class, number, days when run, times at stations, stopping, meeting and passing points.

Single Track: A track upon which trains are operated in both directions by time-table or by train orders.

Siding: An auxiliary track for meeting or passing trains.

Yard: A system of tracks within defined limits, provided for the making up of trains, storing of cars and other purposes, over which movement not authorized by time-table or by train order may be made, subject to prescribed signals and regulations.

Pilot: A person assigned to a train when, in the judgment of the proper authority, motorman or conductor, or both, are unacquainted with the

physical characteristics or running rules of the road, or portion of road, over which the train is to be moved.

The responsibility of a pilot is the same as that of the motorman or conductor, or both, whom he pilots.

Station: An assigned location at which times for trains are stated on the time-table.

STANDARD TIME.

85. Central standard time, obtained from Western Union Telegraph Company, will regulate clocks hourly.

86. Watches that have been examined and certified to by a designated inspector must be used by conductors and motormen. The certificate in prescribed form must be filed with the superintendent before assignment for duty, and must be renewed and filed on the first of each quarter. Watches must be submitted to inspector monthly for comparison.

TIME-TABLES

88. Each time-table, from the moment it takes effect, supersedes the preceding time-table. A train of the preceding time-table shall retain its train orders, and take the schedule of the train of the same number of the new time-table.

A train of the new time-table, which has no corresponding number on the preceding time-table shall not run on any district until it is due to start from its initial point, on that district, after the time-table takes effect.

Trains in each district date from their initial point on such district.

89. Not more than two times are given for a train at any point; where one is given it is, unless otherwise indicated, the leaving time; where two, the arriving and the leaving time are given.

90. Regular meeting or passing points are indicated on the time-table by figures in full-faced type.

Both the arriving and leaving time of a train are in full-faced type when both are meeting or passing times, or when one or more trains are to meet or pass it between those times.

When there are more trains than one to meet or pass a train at any point, attention is called to it by special note.

In all cases trains are required to clear and follow as per rules 118, 120 and 121.

Special rules published on a time-table, at variance with those rules and regulations, are effective only during the continuance of such time-table.

SIGNAL RULES

91. Signals must be used strictly in accordance with the rules, and trainmen and all concerned must keep a constant lookout for signals. Those giving signals must locate themselves so as to be plainly seen, and make them so as to be plainly understood.

The utmost care must be exercised by trainmen to avoid taking signals that may be intended for other trains. Unless conductor and motorman are positive that signals given are for them, they will not move their trains until communication is made by words. In backing a train, the disappearance from view of trainmen, or lamp by which signals are given, will be construed as a stop signal.

Employees whose duties may require them to give signals must provide themselves with the proper appliances, keep them in good order and ready for use.

92. Flags of the prescribed color must be used by day, and lamps of the prescribed color by night.

93. Night signals are to be displayed from sunset to sunrise. When weather or other conditions obscure day signals, night signals must be used in addition.

VISIBLE SIGNALS

94. Color Signals:	Indication
(a) Red	Stop.
(b) White	Proceed, and for other uses prescribed by the rules.
(c) Green	Proceed with caution, and for other uses prescribed by the rules.
(d) Blue	See rule No. 108.

95. A fuse on or near the track burning red must not be passed until burned out.

96a. Fuses must not be thrown off on or near bridges or trestles.

96. HAND, FLAG AND LAMP SIGNALS

Manner of Using	Indication
(a) Swung across the track.....	Stop.
(b) Raised and lowered vertically.....	Proceed.
(c) Swung vertically in a circle across the track, when the train is standing.....	Back.
(d) Swung vertically in a circle at arm's length across the track, when the train is running.....	Train has parted.
(e) Swung horizontally in a circle, when the train is standing	Apply air-brakes.
(f) Held at arm's length above the head when train is standing	Release air-brakes.

97. Any object waved violently by anyone on or near the track is a signal to stop.

AUDIBLE SIGNALS

98. Air-whistle signals.
Note.—The signals prescribed are illustrated by "O" for short sounds; "—" for longer sounds. The sound of the whistle should be distinct.

with intensity and duration proportionate to the distance the signal is to be conveyed.

Sound	Indication.
(a) O	Stop. Apply brakes.
(b) — — — — —	Release brakes.
(c) — — — — —	Flagman return from south.
(d) — — — — —	Flagman return from north.
(e) O O O O O	Flagman go back and protect rear of train.
(f) O O	Answer to any signal not otherwise provided for.
(g) O O O	When train is standing, back. Answer to signal to back.
(h) O O O O	Call for signals.
(i) — O O	To call attention to signals carried for a following train.
(j) — — — O O	Approaching highway crossings and obscure places.
(k) — — — — —	Approaching stations, railroad crossings and junctions.
(l) — — — — —	Train parted, when running.
(m)	A succession of short sounds of whistles is an alarm for danger ahead.

99. A torpedo, placed on the rail, is a signal in addition to the usual signals. The explosion of one torpedo is a signal to stop immediately; the explosion of two not more than 200 ft. apart is a signal to reduce speed immediately, and look out for a stop signal. See rule No. 133 (H).

100. BELL-CORD SIGNALS

Sound	Indication
(a) One.....	When train is running, stop at once.
(b) Two.....	When train is standing, go ahead.
(c) Three.....	When train is running, stop at next station.
(d) Three.....	When train is standing, back the train.
(e) Four.....	Next siding is meeting point.

TRAIN SIGNALS

103. The headlight will be displayed to the front of every train by night, but must be concealed when the train turns out to meet another and has stopped clear of main track, or is standing to meet trains at the end of double track or at junction points.

104. Two (2) red-marker lamps must be displayed at the rear of every train by night.

105. Two (2) green flags by day, and two (2) green lights by night, displayed in the places provided for that purpose on the front of a train, denote that the train is followed by another train, under the same schedule. All sections except the last must display these signals.

Motormen, when carrying green signals, should invariably call attention to conductors and motormen of trains met or passed, as per rule 98 (i), which must be acknowledged, as per rule 98 (f). When the response is not given, the train giving the signal must stop and give notice.

106. Motormen will similarly call attention of section men and bridgemen to signals carried. When trains being met or passed also have signals, they will acknowledge signals called, and then call attention to their own signals, which will be acknowledged by the opposing train. The train being met or passed is not relieved from responsibility for not noticing signals or passing trains.

106. Two (2) white flags by day, and two (2) white lights by night, displayed in the places provided for that purpose on the front of a train, denote that the train is an extra. These signals must be displayed by extra trains of all kinds.

107. One flag or light displayed as provided in rules 105 and 106 indicates the same as two; but the proper display of all train signals is required.

109. A signal imperfectly displayed or the absence of a signal at the place where a signal is usually shown, must be regarded as a stop signal and the fact reported to the superintendent.

Where lights are not used at night on day office telephone signals, all trains will positively ascertain position of signal before passing.

111. When a signal (except a fixed signal) is given to stop a train or reduce speed, it must be acknowledged, as provided for in rule 98 (f).

CLASSIFICATION OF TRAINS

113. Trains of the first class are superior to those of the second; trains of the second class are superior to those of the third, and so on. Extra trains are of inferior class to regular trains of whatever class.

On single track, all southbound trains have the absolute right of track over all northbound trains of the same class.

For time-table purposes the direction of trains is made arbitrary, either north or south, such direction being specified on time-table.

Note.—See rule 127.

MOVEMENT OF TRAINS

114. A train must not leave its initial station on any division or junction, or pass from double to single track, until it has ascertained that all trains due, which are superior to it, have arrived or left.

115. A train leaving its initial station on each division, or leaving a junction, when a train of the same class running in the same direction is overdue, will proceed on its own schedule, and the overdue train will run as provided in rule 121.

116. A train must not start until the proper signal is given.

117. An inferior train must keep out of the way of a superior train.

118. At meeting points between trains of the same class, the inferior trains must clear the main track before the leaving time of the opposing train, and must pull into the siding when practicable. If necessary to back in, the trains must first be protected as per rule 121, unless otherwise provided.

119. Trains must stop at schedule meeting or passing points, if the train to be met or passed is of the same class, unless the switches are right, the track clear and trains are positively identified to each other.

120. The place at which a train should stop is the switch used by the train to be met or passed in going on the siding. If the expected train of the same class is not found at the schedule meeting or passing point, the superior train may proceed on its rights, the inferior train thereafter clearing the superior train at least five minutes.

At meeting points between trains of different classes, the inferior train must take the siding and clear the superior train at least five minutes, and must pull into the siding when practicable. If necessary to back in, the train must first be protected as per rule 133 (a) unless otherwise provided.

An inferior train must keep at least five minutes off the time of a superior train moving in the same direction.

121. Trains moving in the same direction must keep at least five minutes apart, except in closing up at stations or at meeting and passing points.

122. A train failing to clear the main track by the time required by rule must be protected as provided in rule 133 (a).

123. A train must not arrive at a station in advance of its scheduled arriving time.

A train must not leave a station in advance of its leaving time.

124. A regular train which is delayed, and falls back on the time of another train of the same class, will proceed on its own schedule.

125. A train which overtakes a superior train or a train of the same class so disabled that it cannot move, will pass it if practicable, and, if necessary in order to proceed, will assume the schedule and take the train orders of the disabled train, proceed to the next open telephone office, and there report to the superintendent. The disabled train will assume the schedule and take the train orders of the last train with which it has exchanged, and will, when able, proceed to, and report from, the next open telephone station.

126. Should a train be held by another between telephone stations, the conductor of the train thus delayed may require the first train passing him to carry signals or a flagman on the train to the next telephone station, if an important train will not thereby be delayed. Precautions must be taken to stop in such manner as to block the switch until the opposing trains are notified that they are flagged and held for following trains.

127. Regular trains, two hours or more behind their schedule time, lose both right and class.

128. A train must not display signals for a following train, nor an extra train be run, except as per rule 126, without orders from the superintendent.

129. When signals displayed for a following train are taken down at any point before the following train arrives, the motorman must inform the operator, if there be one at that point, unless there be some other provision to that end. The operator—or, if there be no operator, the switch-tender; or, in the absence of both, a flagman left there for the purpose—must, unless otherwise directed by the superintendent, notify all opposing trains of the same or inferior class leaving such point that the train for which the signals were carried has not arrived.

130. Work extras will be assigned working limits. When protected as provided by rule 133 (a) they may occupy main track until arrival of second class and inferior trains, clearing them after arrival with the least delay.

131. All trains must approach terminals, the ends of double tracks, junctions, railroad crossings at grade and drawbridges, prepared to stop, and must not proceed until switches or signals are seen to be right, or the track seen to be clear. Where required by law, all trains must stop.

(b) Speed of all trains over junction switches, railroad crossings at grade, drawbridges and trestles must be under such control as to insure safety.

(c) Trains must not stop on grade crossings of other railroads except to prevent accident.

(d) Unless protected by interlocking signals and derails, all trains before passing over railroad crossings or drawbridges will come to a full stop, and in all cases the flagman or conductor will precede the train to the crossing or bridge.

132. (a) Cars will not be left on main track at night without placing lights on them or taking other precautions to make them conspicuous to other yardmen, motormen and trainmen. (b) When a train is occupying the main track between switches at stations, no signal will be sent out except where delay is unusual, view is obstructed or when weather is such as to prevent seeing far enough ahead to avoid accident, in which case both trains are equally responsible in case of rear collision. Inferior-class trains must protect against superior-class trains.

It must be understood as a general rule that responsibility for rear collisions at stations rests with the approaching train.

(c) Trains doing work at commercial spur located at other than regular stations must be protected as per rule 133 (a).

(d) Extra trains, unless running on schedule order or definitely advised of position of preceding trains by telephone train orders, will look out for fully rated freight trains ahead.

Speed of all trains will conform to special rules; will be so reduced depending on braking power and distance of vision at all points where slides or obstructions may be expected as to insure absolute safety, and at no place exceed a rate which, in the judgment of motorman, is safe and proper.

133. (a) When a train stops or is delayed under circumstances in which it may be overtaken by another train, the flagman must go back immediately with danger signals a sufficient distance to insure full protection. When recalled, he may return to his train, first placing two torpedoes on the rail when the conditions require it. The front of the train must be protected in the same way when necessary.

(b) The general rule for protecting a train or obstruction by flag requires that the flagman proceed back rapidly with danger signals for a distance of one-quarter to one-half mile (15 to 25 telephone poles), the distance increasing for descending grades, and until he can have an unobstructed view of an approaching train for at least one-eighth of a mile beyond, where he must remain until called by the whistle of his train, as per rules 98 (c and d), or if an approaching train is within sight or hearing, until it has stopped.

(c) At the point to which it is required to proceed, or on the approach of a train before that point is reached, he will display proper danger signals, and, in addition, place two torpedoes on the rails opposite each other, so as to make one report.

(d) Should he be recalled before the arrival of an approaching train, he will take up the torpedo on one side and place it on the rail on the other side, 60 ft. (two rail lengths) from the other, and will, when the view is obstructed by fog or otherwise, place a lighted red fuse on the track and one or more, as may be necessary, to fully protect his train while he is returning. If first-class train is due within five minutes, flagman will remain until train arrives, and motorman should not till then give signal to call in flagman.

(e) Should a flagman be recalled before reaching the required distance, he must, before returning, place two torpedoes, 60 ft. apart, a sufficient distance from his own train to protect it while he is returning. When it is necessary to protect the front of a train, or if any other running track is unsafe or obstructed, the same precautions will be observed.

(f) Should the speed of a train be reduced or its rear endangered, making it necessary to check the following train before a flagman can get back, lighted red fuses shall be thrown to the track at intervals.

(g) Responsibility for the protection of a train rests with conductor and motorman, and they must know that their trainmen and flagmen are conversant with and fully understand the application of all rules relating to the protection of train, and comply therewith.

(h) Motormen, hearing one torpedo, will at once bring their trains to a full stop, and then for a distance of 1 mile proceed only with extreme caution. Should there be two explosions, they will immediately reduce speed, proceeding for a distance of 1 mile with trains under full control. Failing to find flagman or obstructions within a distance of 1 mile, they will assume that line is clear, and resume usual speed.

134. Trains will not be backed, or detached cars run over public crossings or highways except at slow speed, and when there is a trainman on or in advance of the leading car, with light at night, who will protect those using the crossing.

135. Messages or orders respecting movement of trains or condition of track or bridges must be in writing.

136. Caution must be used by motormen of trains approaching stations where any train is receiving or discharging passengers, and will approach same under full control.

137. (a) Switches must be left in proper position after using. Conductors will be held responsible for the position of switches used by them and their trainmen, except where switch tenders are stationed.

(b) Whoever opens a switch shall remain at it until it is closed, unless relieved by some other competent employee.

(c) When there is more than one train to use a switch, it must not be left open unless one of the trainmen of the following trains is there and takes charge of it.

(d) At meeting and passing points, in case train backs off of a main line, motorman will personally see that switch is properly returned to main track.

(e) At meeting or passing points the employee attending switch will, after locking it to main track, take position of at least ten (10) ft. from switch stand, remaining there until train has passed.

(f) The employee who opens a switch must see that there is no obstruction between switch points and stock rail, and when switches are closed the same precaution must be taken. The employee who locks a switch must pull the chain to see that the lock is securely fastened.

(g) Flying switches must be avoided whenever possible. When absolutely necessary, the utmost precaution is required, motor to be given the straight track when practicable.

138. Both conductors and motormen are responsible for the safety of their trains, and, under conditions not provided for by the rules, must take every precaution for their protection.

139. In all cases of doubt or uncertainty, the safe course must be pursued and no risks run.

140. (a) Motormen of all trains will register their trains in the train register, at points designated by time-table.

(b) At points designated by the superintendent, motormen will not consult register, but will be furnished (on blank form) a copy of register, over the signature of the operator, showing register of trains affecting the right of his train.

(c) No train will leave a registering station which has telephone service without an order or clearance.

(d) Bulletins will be posted in books or on boards provided for the purpose.

(e) Conductors and motormen will consult bulletins before departing, receipting for the last and all previous bulletins by recording the number

of the last bulletin in the place provided, and will be held accountable for all bulletins posted prior to their departure.

(f) Time posted will be endorsed on face of each bulletin, and officer issuing advised that bulletin has been posted. Telephone bulletins affecting safety of trains will be repeated to insure accuracy.

141. In case several trains meet at a station, and it is found necessary to "saw by" or do other work, directions will be given, in order to expedite preference train by the senior conductor.

142. Trainmen will not leave cars standing alone on main line or on grades. One man must remain with cars under such conditions.

143. Work trains, when laying up, will take down classification signals, and after dark will indicate their position by blue signal or signals, displayed conspicuously for approaching trains from all directions.

On arrival of a work extra at destination or on quitting use of road when authorized to run back and forth, prior to the expiration of its orders, motorman will notify superintendent to that effect in writing, using the following form:

"Tied up at.....M,".....after which all rights expire. Operator will forward to despatcher, who will copy in train order book, and repeat back to operator, who, if correctly repeated, will give "O. K.," which will be recorded with time by despatcher. Operator will file with office copies of train orders.

144. Except within yards, no cars will occupy main line until position of all regular trains is ascertained by train register, telephone order, or register ticket form....., and its rights to main track are determined.

145. Whenever trains are run over any portion of road without a conductor, the motorman will be regarded and act both as motorman and conductor, and will make and return the conductor's running reports.

146. Except as provided in rule 125, motormen will not assume rights or take time of another train without special orders from the superintendent. In case motormen or conductors change off before completion of trip, they must exchange all unexpired orders that they may have, and know that they are fully understood by the parties with whom they are changing. Trainmen will not be permitted to change off on road without authority from the superintendent.

147. When trains meet by special order, each train must be positively identified to the other.

148. Care must be taken in handling all trains to avoid rough usage of equipment or contents.

149. On doing work in cities and villages, all ordinances or laws must be observed, and where, by city ordinance, fines are imposed for blocking crossings, trainmen are personally liable, unless they can show that blocking was unavoidable.

150. Freight trains authorized to carry passengers will be designated by bulletin or by special order of superintendent.

151. When two trains pass at a siding or leave any point on the line at the same moment, the south-bound train shall have the right of way in starting, and the north-bound motorman shall not throw his motors into full multiple until the south-bound train has been in motion at least twenty-five (25) seconds. In other words, no two motors shall start at the same moment from the same place.

If current should cease, lights will go out. When lights are again perfectly bright, wait for several seconds before proceeding.

When current ceases, all trains must be brought to an immediate standstill, and in no case permit train to coast until current returns.

152. Trains running on double track will keep to the right.

MOVEMENT OF TRAINS BY TRAIN ORDERS

153. For movements not provided for by the time-table, train orders will be issued by authority and over signature of the superintendent. They must contain neither information nor instructions not essential to such movements. They must be brief and clear; in the prescribed forms when applicable, and without erasure, alteration or interlineation.

154. Each train order must be given in the same words to all persons or trains directly affected.

155. Train orders will be numbered consecutively each day, beginning with No. 1 at midnight.

156. Train orders must be addressed to those who are to execute them, naming the place at which each is to receive his copy. Those for a train must be addressed to the conductor and motorman and also to anyone who acts as pilot. Conductors must acquaint their trainmen with all orders.

Annulment and cautionary orders may be addressed to all trains, specifying direction. Annulment orders must also be addressed to agent at initial station of the train annulled.

157. Each train order issued must be written in full in a book provided for that purpose at the superintendent's office, and with it recorded the names of those who have signed for the order, the time and the signals which show when and from what offices the order was repeated, and the responses transmitted.

These records must be made at once, and never from memory or memorandum.

Transfers of orders from one despatcher to another will be made in writing, in a book provided for that purpose, dated and timed, with a complete statement of unexpired orders, addressed to the relieving despatcher, and over the signature of the relieved despatcher.

If for any cause a change is desired in any order already sent, and before "X. O. K." or "complete" has been given, the order must be destroyed and another order under another number sent in its stead.

158. Regular trains will be designated in train order by their schedule numbers, as "No. 10" or "2d No. 10;" extra trains by motor numbers, kind of extra as per definition and direction, thus "Extra 204 east," "Work extra 351," and all other numbers by figures; time will be stated in words

FORM 19
The Scioto Valley Traction Company
 TRAIN ORDER No. _____
Superintendent's Office, _____ 190_

TO CONDUCTOR AND MOTORMAN
 Train _____ At _____ Station _____

Form 31X
THE SCIOTO VALLEY TRACTION CO.
 TRAIN ORDER No. _____
Superintendent's Office, _____

TO CONDUCTOR AND MOTORMAN
 Train _____ At _____ Station _____

X _____ Opr. I. O. K. M _____ Supl.

Superintendent
 CONDUCTOR AND MOTORMAN MUST BOTH HAVE COPY OF THIS ORDER

Rec'd _____ M Made _____ At _____ M. _____ Opr _____

Superintendent
 CONDUCTOR AND MOTORMAN MUST BOTH HAVE COPY OF THIS ORDER

Made _____ At _____ M _____ Opr _____

TRAIN-ORDER FORM "19," SCIOTO VALLEY

CONDUCTOR	TRAIN	CONDUCTOR	TRAIN

The Scioto Valley Traction Company.
CLEARANCE CARD.

TRAIN-ORDER FORM "31," SCIOTO VALLEY

_____ 190_

Conductor and Motorman No. _____

ORDERS FOR } Form "19"
 YOUR TRAIN ARE } Form "31"

(If any order form "31" all order Numbers will be checked by Dispatcher and)

MADE _____ BY _____

(If no order form "19" or "31" endorse "NONE" in space provided for order numbers and if none of either form state.)

SIGNAL IS OUT FOR _____

_____ M _____ OPR.

This does not interfere with or countermand any orders you may have received.
 Conductors must sign orders form "31" before accepting from Operator.
 Conductors and Motormen must each have a copy, and see that their train is correctly designated in the above form.

REGISTERING TICKET.

CLEARANCE CARD, SCIOTO VALLEY

FORM 246B
 THE SCIOTO VALLEY TRACTION COMPANY.

_____ 190_

DAILY WATCH REGISTER.

I have compared time with clock in this office, and find my watch:

SECONDS FAST	SECONDS SLOW	WATCH TIME	NAME

Rule: When watch shows a variation of thirty (30) seconds - fast or slow - train-men are required to take his watch at once to watch inspector, for inspection and adjustment.

Train No. _____

Signals _____

Arr. Obetz Jct. _____

Dep. Obetz Jct. _____

Conductor _____

Motorman _____

FORM FOR REGISTERING CONDITION OF WATCHES, SCIOTO VALLEY

TRAIN-REGISTERING TICKET, SCIOTO VALLEY

and figures, except in schedule orders. When train is handled by motor belonging to another company, initial will be used in addition to number.

Form "31" must be used for orders restricting the rights of trains. Form "19" may be used for orders assisting trains of inferior right or making meeting points between trains.

169. When a train is named in the train order, all its sections are included unless particular sections are specified, and each section included must have copies addressed and delivered to it.

A train, or any section of a train, must be governed strictly by the terms of train orders addressed to it, and must not assume any right not conferred by such orders.

171. Train orders once in effect continue so until fulfilled, superseded or annulled. Any part of a train order specifying a particular movement may be superseded or annulled. Train orders held by or issued for a regular train become void when such train loses both right and class, as provided by rules 88 and 127, or is annulled.

172. (2) A fixed signal must be used at each train-order office, except district terminals, which shall display red when there are orders for trains. When there are no orders the signal must display white. The signal must not be changed to white until the object for which red is displayed is accomplished. When red is displayed no train will proceed without receiving a clearance card of the prescribed form addressed to such train, stating over the operator's signature that he has no orders for it, or stating that he has orders, the numbers of which will be shown thereon, together with all of the orders, the numbers of which are so shown. No train will depart from registering station which has telephone service without orders or clearance.

Note.—On account of space, the standard forms of train orders governing movement of trains under all conditions, together with detailed instructions for same, are omitted in this article.

194. (a) Despatchers will issue orders for the movement of trains in the name of the superintendent, in full compliance with the rules herein contained, and see that they are transmitted in the order prescribed. In addition to the records otherwise provided herein, they must keep a record showing the time of arrival and departure of trains at open telephone stations, such record to be carefully filed for subsequent reference.

(b) They must not move a train of inferior right, relying upon motorman of a train of superior right to report for clearance.

(c) They must not depend on train order signal to stop trains for orders at any station during a snow storm, blizzard or other severe storms.

(d) They must not go off duty until relieved by another despatcher, to whom they will give a written transfer of all train orders outstanding, and all other information necessary for his guidance.

(e) When two or more sections of a train are running on a road, and one of the following sections is going only to a junction or non-registering station, notice to that effect must be sent to all trains of the same or inferior class, running in the opposite direction.

The company has also worked out a complete set of instructions for the use of multiple-unit control; and in view of the increasing use of train operation, these rules are reproduced here as being of interest to other interurban operators.

SPECIAL RULES AND INSTRUCTIONS FOR OPERATION OF CARS EQUIPPED WITH SPRAGUE-GENERAL ELECTRIC SYSTEM OF MULTIPLE-UNIT TRAIN CONTROL.

DESCRIPTION OF SYSTEM

The Sprague-General Electric type "M" system of train control is used, and is such that cars may be operated singly, or that two or more cars may be coupled together as a train and operated simultaneously. When combined as a train, the circuit connections are so arranged that the motors on each or all of the motor cars may be controlled from either end of any motor car.

CONTACTORS

The train control apparatus consists in general of two parts.

1. (2) The electrically operated switches, or contactors, which are suspended under the cars, for the purpose of controlling the speed of the cars by effecting the various combinations of motors, and varying starting resistance. There are twenty-six contactors under each motor car, comprising two sets of thirteen each; each pair of motors having its own set of contactors. The contactors in each set are numbered from 1 to 13, inclusive. Following are the numbers of the contactors which are cut in on the respective notches on the master controllers:

First Notch—Nos. 1, 2, 3 and 11.

Second Notch—Nos. 1, 2, 3, 5 and 11.

Third Notch—Nos. 1, 2, 3, 5, 6 and 11.

Fourth Notch—Nos. 1, 2, 3, 5, 6, 7 and 11.

Fifth Notch—Nos. 1, 2, 3, 5, 6, 7, 8, 9, 10 and 11.

Sixth Notch—Nos. 1, 2, 4, 12 and 13.

Seventh Notch—Nos. 1, 2, 4, 5, 6, 12 and 13.

Eighth Notch—Nos. 1, 2, 4, 5, 6, 7, 12 and 13.

Ninth Notch—Nos. 1, 2, 4, 5, 6, 7, 8, 12 and 13.

Tenth Notch—Nos. 1, 2, 4, 5, 6, 7, 8, 9, 10, 12 and 13.

REVERSERS

1. (b) The electrically operated reversers, one located on each side of car, between the contactors and the motors they control (the reverser nearest each set of motors is the one which controls that set). These reversers control the direction of movement of the cars by changing the direction of flow of current through the motors.

MASTER CONTROLLERS

2. Two master controllers, one located in cab at either end of motor cars, by means of which the contactors and reversers are operated.

TO PREPARE TRAIN FOR SERVICE

175. Ends of cars will be numbered 1 and 4, respectively. Motors Nos. 1 and 2 are on the No. 1 end of car, and motors Nos. 3 and 4 are on No. 4 end of car. This is to avoid confusion between No. 2 motor and end of car usually known as No. 2 end.

(a) Close main power switches (No. 1) on all motor cars.

(b) If running on third rail, third-rail switches (No. 2) should also be closed. Always open third-rail switches when running on trolley.

(c) Close main control circuit switches (No. 3) on all motor cars.

(d) Close master controller switch (No. 4) in No. 1 end of car, or No. 5 in No. 4 end of car (according to end from which car is to be operated) on motor car from which the train is to be controlled.

ELECTRICAL CONNECTIONS BETWEEN CARS

(e) Great care must be taken in making the electrical connections between cars when making up trains. Always be sure that perfect connection is made by these couplers, and see that plugs are fastened securely into sockets.

The electrical connections between cars consist of the following: (1) One bus-line connection for feeding power from one car to another. (2) One for control circuit.

AIR COMPRESSORS

(f) The air compressor feed-wire is connected to open side of main power switch. This is done to insure the starting and operation of compressor as soon as the cars are cut in for service. When main power switch (No. 1) is closed air compressor should immediately start if main reservoir pressure is below eighty (80) pounds. If air compressor does not start, the cause must be determined before starting car. After closing main power switch (No. 1) air compressor will continue to pump until train line pressure reaches seventy (70) pounds (indicated by black hand), and main reservoir pressure reaches ninety (90) pounds (indicated by red hand). Do not start car or train until main reservoir pressure reaches eighty (80) pounds.

AUTOMATIC AIR GOVERNORS

(g) Pressure in main reservoir is regulated by an automatic governor. Should governor fail to start compressor when main reservoir pressure falls below eighty (80) pounds, or fail to stop compressor when main reservoir pressure has reached ninety (90) pounds, and trouble with governor cannot be remedied, motorman should govern the compressor by pulling out and replacing air compressor fuse (No. 35), as pressure falls below or exceeds the amounts at which the governor should operate.

BRAKE VALVES

(h) Always see that automatic brake valve on end from which car is to be operated is on release position when compressor is pumping. Always cut out train line pipe on opposite end from which car is to be operated, by means of cut-out cock under automatic brake valve.

TO TEST BRAKES

(i) To Test Brakes: Motormen will apply brakes by moving handle to graduated application notch until a reduction of 10 lbs. has been made in train line; then, after placing handle on lap position, motorman or conductor will proceed throughout the train, and see that cylinder piston of every car has moved out to such distance as to indicate that brakes are properly applied on all cars of the train; then release brakes and be careful to see that the cylinder pistons on all cars have moved back to full release, thus indicating that all brake-shoes hang free. This test must be made with both automatic and straight air-brakes.

RULES FOR OPERATION

There are two running positions on the controller, series (fifth notch) and multiple (tenth notch). Short notches on controller are for acceleration only, and must not be used for running points. There are five graduation points on steps from "off" position to series running point, and five more from series running point to multiple running point.

ACCELERATION

176. In regular service, after having received "go ahead" signal, press down controller handle, which closes automatic cut-out device; then move handle to first notch and continue moving from notch to notch until controller is either on series or multiple running point. Acceleration from "off" position to multiple running point should require at least fifteen (15) seconds.

177. Motorman must keep his hand on the controller handle at all times, except when it is on "off" position. This prevents the automatic cut-out device from operating. Motormen must never allow automatic cut-out device to operate unless necessary to quickly stop the train to prevent accident, such as collision, or to save life.

SHUTTING OFF CURRENT

178. In shutting off current, move the controller handle quickly back to "off" position.

179. Motorman are required to give close attention to coasting. To save power, shut off the current as soon as possible after full acceleration is obtained, and still keep your train on time; in other words, coast as much as possible. Under ordinary conditions, when train is up to speed

and on time, the train should be allowed to coast from 800 ft. to 1500 ft. after the controller is thrown to "off" position, before applying brakes in making station stops. Judicious coasting will effect a great saving in power, wear and tear on machinery, and will prevent overheating of motors.

SWITCHING AND YARD MOVEMENTS OF TRAINS

180. Great care must be taken in yard movements of train or cars, in switching or coupling, or in other shifting movements around yards, or over switches, in order to avoid overheating resistance. The controller handle should be moved one or two notches toward series running point, and then back to "off" position, this being repeated until the required movement is made. Controller handle must never be kept on resistance points longer than three or four seconds.

REVERSING MOTORS

181. Motormen must never reverse motors except as a last resort to prevent collision or to save life. Under no circumstances must motors be reversed while brakes are applied, as this would simply blow the main power fuses and make the motors inoperative.

182. Always shut off current at road crossings unless the shoes bridge the gaps in third rail without a break.

183. In accelerating after having thrown off current for gap in rail, when train is up to speed, controller handle may be moved directly from "off" position to sixth notch, and about two or three seconds' time should be used in feeding from sixth notch to multiple running point.

184. Shut off current while passing under sectional insulators and insulated trolley cross-overs.

BRAKES

185. Never leave air-brakes applied when train is standing at terminals or for any length of time at other places; if necessary, set hand-brake to hold cars.

HEATING AND LIGHTING OF CARS

186. Conductors will regulate the heating and lighting of all cars. Thermometers have been installed in all passenger cars, and temperature should be kept as nearly as possible at from 55 degs. to 60 degs., and must not exceed 65 degs. at any time.

187. All motor cars have been equipped with "insulating boards" and "third-rail" circuit breakers

INSULATING BOARDS

(a) Location of insulating boards is as follows: Passenger cars, two in closed seat box in each end of car, making four on each car; baggage cars, two in center of each car. These insulating boards are to be placed between third rail and third-rail shoes in case of electrical fire on the car, or for cutting off all current from the car for the purpose of making repairs while on the road.

THIRD-RAIL CIRCUIT BREAKERS

(b) Third-rail circuit breakers are made of flat bar iron, with wooden handle, and are suspended underneath cars, near the brake cylinders. These circuit breakers are to be used in case of serious electrical fire on or near the car, or in case of wrecks, when the safety of car or passengers is in any way endangered by the third rail. The circuit breaker is to be placed in such cases, with the point under the ball of the running rail, and on top of third rail, and held firmly so as to give good contact. In all cases the circuit breaker should be placed between the car and the main power station, at Reeses, and removed as soon as fire is extinguished or danger removed. When through with the circuit breaker it must in all cases be replaced in the holders provided on the car.

LIST OF SWITCHES AND FUSES

- No. 1 Main power switch.
- 2 Third-rail switch.
- 3 Main control circuit switch.
- 4 Controller switch, No. 1 end.
- 5 Controller switch, No. 4 end.
- 6 } Light switches.
- 7 }
- 8 Vestibule light switch, No. 1 end (passenger cars only).
- 9 Vestibule light switch, No. 4 end (passenger cars only).
- 10 Headlight switch.
- 11 }
- 12 } Heater switches (passenger cars only).
- 13 }
- 14 }
- 15 Motor cut-out switch, No. 1 motor circuit.
- 16 Motor cut-out switch, No. 4 motor circuit.
- 17 Main fuse (600 amp.), No. 1 motor circuit.
- 18 Main fuse (600 amp.), No. 4 motor circuit.
- 19 Main control circuit fuse (25 amp.)
- 20 }
- 21 } Branch control circuit fuses (4 amp.), No. 1 control circuit.
- 22 }
- 23 }
- 24 }
- 25 } Branch control circuit fuses (4 amp.), No. 4 control circuit.
- 26 }
- 27 }
- 28 Light fuse (4 amp.)
- 29 Light fuse (4 amp.) (passenger cars only).
- 30 Headlight fuse (4 amp.)

- 31 } Heater fuses (15 amp.) (passenger cars only).
- 32 }
- 33 }
- 34 }
- 35 Air compressor fuse (5 amp.) (passenger cars only).
- 36 Air compressor fuse (15 amp) (baggage cars only).
- 36 Contactor box containing contactors Nos. 1, 2, 3, 4 and 5 for No. 1 control circuits.
- 37 Contactor box containing contactors Nos. 6, 7, 8, 9 and 10 for No. 1 control circuits.
- 38 Contactor box containing contactors Nos. 11, 12 and 13 for No. 1 control circuit.
- 39 Contactor box containing contactors Nos. 1, 2, 3, 4 and 5 for No. 4 control circuits.
- 40 Contactor box containing contactors Nos. 6, 7, 8, 9 and 10 for No. 4 control circuits.
- 41 Contactor box containing contactors Nos. 11, 12 and 13 for No. 4 control circuits.
- 42 Reverser for No. 1 circuit.
- 43 Reverser for No. 4 circuit.

TOOLS AND SUPPLIES

The following tools and supplies will be furnished on each motor car before leaving shops:

- 1 Hammer.
- 1 Combination pipe and monkey wrench.
- 1 Pair pliers.
- 1 Screw-driver.
- 1 Cold chisel.
- 2 25-amp. main control circuit fuses.
- 2 15-amp. heater fuses (except baggage cars).
- 2 4-amp. headlight fuses.
- 2 5-amp. air compressor fuses (except baggage cars).
- 2 15-amp. air compressor fuses (baggage cars only).
- 2 4-amp. branch control circuit and light fuses.
- 2 600-amp. ribbon fuses for main motor circuits.
- 1 Van Dorn coupling link.
- 1 Double-heading coupling link.
- 2 Van Dorn coupling pins.
- 1 Ordinary coupling link (baggage cars only).
- 1 Ordinary coupling pin (baggage cars only).
- 3 Incandescent light globes.
- 1 Switch rod.
- 1 Broom.
- 1 Motorman's stool.
- 2 Destination signs (passenger cars only).
- 1 Headlight (for each train).
- 1 Headlight dimmer.
- 1 Headlight globe.
- 2 Marker lamps.
- 2 Classification signal lamps (extra trains only).
- 2 Red flags.
- 2 White flags and holders.
- 2 Green flags and holders.
- 4 Insulation boards, to place between third rail and third-rail shoes in case of electrical fire, or for cutting off all current from car for the purpose of making repairs while on the road (baggage cars, two each).
- 1 Third-rail circuit breaker, made of flat bar iron, with wooden handle, to be placed under ball of running rail and on top of third rail, in case of serious electrical fire, or to deaden third rail in case of wrecks, etc.
- 1 Pad, form 19, train orders.
- 1 Pad, "report of condition of cars."

INSPECTION OF CARS

188. (a) Motormen taking cars from shop will make inspection of cars as early as possible after received, and report on "report of condition cars" any article missing. Motormen of relief crews must note carefully the reports turned over to them by the crews relieved, and will check same at the earliest opportunity. Responsibility for brooms carried on cars will rest entirely with conductors. Shop foreman will see that hostler checks each car turned into shops, as per above list, making report of such inspection to the master mechanic.

(b) Motormen will, upon arrival at each terminal examine each bearing and the entire brake rigging and other equipment of cars, and make any necessary repairs.

This must be done under all conditions, whether train is on time or not. If anything is found which you cannot repair properly, report same by telephone to the shop department before leaving terminal. The responsibility for proper working condition of cars while upon the road rests entirely upon the motormen.

189. Under no circumstances must blown fuses, burned-out lamps, or damaged supplies of any kind, be put back in tool boxes. Blown fuses must be marked to show number of circuit and car on which they are blown, and left with despatcher, who will forward them to master mechanic, with advice regarding name of motorman by whom they are turned in.

190. (a) When it is necessary to change a brake-shoe while upon the road, put a tag on the shoe removed, and leave shoe under seat inside of car by the side of tool box. This tag should show plainly the wheel from which the shoe was removed and whether from gear or commutator side of motor.

(b) All other damaged supplies will be left in closed seat box.

REPORT OF CONDITION OF CARS

191. Report of condition of cars will be filled out by all crews, on form provided for that purpose. Crews turning cars over to relief crews will fill out this report and turn same over to relief crews. Relief crews will leave this report, together with their own report, in the tool box. This report must cover all damage, defects or trouble with cars, their equipment and supplies, including fuses blown, lamps burned out, brake-shoes renewed, etc.

TO RETIRE TRAIN FROM SERVICE

192. When retiring a car or train from service at terminals or at other points, when car or train is not turned over to hostler or shop force, the following instructions will be observed:

- (a) Set hand-brake securely on all cars.
- (b) Pull down trolley or break third-rail contact by putting third-rail insulating boards between third rail and third-rail shoes.
- (c) Open switches Nos. 1, 2 and 3.
- (d) Remove controller reversing handle and straight and automatic brake-valve handles, and place same in switch cabinet No. 1, end of car.
- (e) During the winter months, open the drain-cocks on main, auxiliary and whistle reservoirs, and thoroughly drain same.

One very radical departure is made in the handling of train crews. All crews change runs every two weeks from day runs to night runs and from one division to another. In this way all trainmen become familiar with the operating conditions at day and at night, and it entirely eliminates disputes as to seniority, which sometimes occasion considerable trouble. Another rather novel practice is to require all trainmen to submit a letter every sixty days asking five or more questions relative to matters in connection with their duties, or to make suggestions of improvement in operating conditions. These are answered in writing and copies of questions and answers are sent to all trainmen.

SHOP PRACTICE

The company adopted the policy of thoroughly inspecting and keeping up the maintenance of its rolling stock from the start. It is claimed that an immense amount of trouble has been saved by this method. A temporary frame shop building was erected, but the equipment of tools includes a list of machinery which is well up to that of the average interurban road in the State. The company is preparing to erect a very elaborate shop layout, which will follow the lines of a locomotive roundhouse.

It is the practice to keep six cars in the shop every day for inspections and repairs. In this way the passenger cars are in the shop every other day. Usually sixteen men are employed in various kinds of work about the shop. The work is divided up so that each man attends to a certain duty. One man and an apprentice attend to the electrical equipment. One man cares for the air brake equipment. One man, who is a carpenter, attends to any necessary carpenter work and takes care of the trolleys, which on this line is, of course, a small duty. Another man, who is a blacksmith, inspects motors and trucks, running gears, third-rail beams and shoes, in addition to any necessary blacksmith work. Five men attend to the cleaning of cars. Cars are cleaned thoroughly, inside and out, every second day. This work costs \$1.08 per car. Oiling of all the bearings is done by the leading man at night. A card record is posted on the wall, showing the numbers of cars as they come in, and each man must designate by signature in the proper column that he has completed his work before the car can go out.

As showing the difference between the cost of maintaining the third-rail and trolley systems, it is stated that the seven miles of trolley wire costs more than twice as much to maintain as the entire third-rail section. Third-rail shoes and installing cost \$19.49 for the past six months, and about half a dozen trolley wheels were used up in that time. In periods of severe snow or sleet, it has been quite a problem to keep the third rail clear of ice. Calcium chloride, lamp black and oil, and several kinds of preparations, besides a large number of varieties of metal cutters, have been tried, but without much success. Fortunately, the weather in this valley is comparatively moderate and the trouble is not serious. Altogether, last year, the company lost

seven hours from this cause, the longest period being two hours.

In case of trouble with cars on the road, both the motorman and conductor turn in to the superintendent and the train master reports of damages, and a record of troubles is kept against the motorman. Special attention is paid to the record of fuse circuits blown out. The motorman is allowed only two fuses for any one circuit. If the two go out in succession, the motorman is required to lay up the car to determine the trouble.

Actual mileages are kept on motors, axles, brasses, armature bearings, brake shoes, third-rail shoes and steel-tired wheels. Each article is numbered, and a book is kept showing the number of each article and a record of all changes. Similar records are being started on gears and pinions. Recently the master mechanic adopted a flangeless brake shoe. These shoes weigh 26 pounds when new and scrap at 8 pounds. They show a life of 5600 miles. It was found that the life of steel-tired wheels, especially with the flanges, has increased surprisingly since this change. Formerly wheels were run four to

The Scioto Valley Traction Co.

EMPLOYEES TICKET.

Name

From

To

Date 190....

Good only when officially signed and stamped on cover hereof for one continuous passage on trains stopping at last named station

- G. E. No 635

VOID IF DETACHED. L. C. BRADLEY, SUPERINTENDENT.

FACE AND REVERSE OF EMPLOYEES' TICKET, SCIOTO VALLEY

CONDITIONS.

This ticket is not transferable and is void if presented by any other than the person named, or if any alteration or addition is made upon it. The person accepting and using this ticket, in consideration of receiving the same, voluntarily assumes all risks of accidents and damages and expressly agrees that The Scioto Valley Traction Company shall not be regarded as a common carrier, nor as liable to him for any injury to his person which may occur while using this ticket, whether caused by negligence of the Company's agents or otherwise.

five months before turning; now they run eight months. Motormen are required to inspect all bearings, brake shoes and brakes at the end of each trip, there being a 10-minute layover at each terminal. They are also required to lubricate and put new brake shoes if necessary.

Special attention is paid to lubrication. The company uses the best grade of oil at 20 cents a gallon, and the entire car lubrication for journal bearings, motor bearings and armature bearings is 22 cents per thousand miles, not including waste. In oiling the bearings, the attendant is required to be sure that the oil gets to the proper place by removing the packing cover to see that the waste touches the bearing. All the parts must be wiped off carefully, so that the dirt does not get into the bearings.

In two years the road has never changed a journal bearing, a condition that is due to careful inspection, ample power and careful acceleration. Nor has any trouble been experienced with armatures from electrical causes, and it has not been necessary to turn a commutator in two years. If an inspector allows a commutator to get down onto the pole pieces, it is cause for dismissal. The road has never broken or reset a car spring, which speaks well for the track. Gears and pinions are numbered in pairs as they are put on, and when any changes are made they are kept together, which insures an even mesh. The gear ratio is 25 to 53, the gear being 22 inches in diameter, the cars having a speed of 60 miles an hour.

It is the practice to paint and varnish cars once a year

throughout, except the head linings. Floors are painted every four months.

The company is very liberal in the matter of transportation to employees. Trainmen and shopmen have passbooks unlimited as to time, and good between certain points. Linemen, general office employees and heads of departments have passbooks good over the entire road. Section foremen have books good between certain points, and they detach slip for the laborers. Each employee is entitled to two passes a month for any member of a family dependent upon him. This is not limited to wives of employees, as with many roads, the management believing that it is better to be liberal on this point than to have conductors deadhead members of their family.

The third rail on this line is unprotected, except at station platforms and highway crossings, where it is broken. Great care is used to see that fences and cattle guards are properly maintained. The fencing used is fine mesh to keep out small animals. When the road was first built, there was considerable anxiety on the part of farmers for fear that the third rail would be dangerous to pedestrians and stock. In two years' operation but one man has been killed, and he was an employee who fell across the rail while running to switch a car. It was found that he had heart trouble, which was undoubtedly the cause of his falling. About eight or ten animals of various descriptions have been killed, but the company has never had a lawsuit due to a third-rail accident.

