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DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

Letter
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(December 4, 1924)

GENERAL REPORT OF THE WORK OF THE RAILROAD TRACK SCALE TESTING SERVICE OF THE BUREAU OF STANDARDS JULY 1, 1923, to JUNE 30, 1924.

INTRODUCTION

The Bureau of Standards is in receipt of numerous inquiries regarding its activity in the testing of railroad track scales and investigation of weighing conditions throughout the country. In response to this demand a general resume, which follows, has been prepared covering the work of the Bureau along these lines during the fiscal year ending June 30, 1924, and including all pertinent information that can be furnished to the general public.

In order to make the investigation of the greatest utility and to secure the maximum improvement in weighing conditions, an individual report on each test is made which details the performance found and contains complete recommendations for necessary improvements. These reports are furnished to owners and sometimes to other parties in direct interest and are very frequently made the basis for the adjustment and correction, or in some cases for the replacement, of the scale. It is the general policy of the Bureau not to furnish these individual reports to parties of outside interest, this policy having been formulated as the only one which can consistently be followed in view of the circumstances under which the work is done. One of the strongest reasons dictating this course is that there can be tested each year with our present equipment and personnel, only a very small percentage of the scales in use. The scales to be tested therefore must be selected from among the requests received, or at random, in such a way that the general existing conditions can be most accurately gauged.

In arranging schedules for each of the Bureau's three testing equipments, attempts are made to accommodate as many requests for the service that have been previously filed as far as it is at all possible. The Bureau charges no fee for this service and therefore no expense is connected with the test with the possible exception of switching charges which may sometimes be assessed by railroad companies for handling the outfits. Schedules are ordinarily laid out six months to a year in advance. It is required that each master scale in the United States, about twenty in number, be visited each year, and this circumscribes the territory which can be visited to some extent. This and other demands upon the service make it inefficient for the Bureau to attempt to reach outlying points, or to schedule trips where the outfits cannot be kept reasonably busy at actual testing work. These facts should be borne in mind when making requests for the service, and they will help to explain many cases in which service cannot be given in accordance with such requests.

Introduction

INVESTIGATION OF RAILROAD TRACK SCALES

Extended progress was made during the year ending June 30, 1924, in the investigation of the condition of railroad track scales used for weighing revenue freight. The experience of past years was repeated in that it was not found possible to operate the track scale testing equipments the full year due to shortage of funds; however, the idle period consumed only about twenty percent of the available time which is a considerable reduction of the periods of enforced idleness in past years. The testing time lost through enforced laying up the testing equipments was utilized in repairing and overhauling testing equipments and by transferring men to equipments used for testing coal tipple scales.

Railroad master scale testing schedules were completed in regular order, involving the test of 19 master scales and 1018 commercial track scales. The work was well distributed throughout the country. Tests were made in 37 states and the District of Columbia. A list of states in which work was done follows.

Alabama	Minnesota	Oklahoma
California	Michigan	Oregon
Colorado	Mississippi	Pennsylvania
Connecticut	Missouri	South Carolina
District of Columbia	Montana	South Dakota
Florida	Nebraska	Texas
Georgia	Nevada	Tennessee
Illinois	North Carolina	Utah
Indiana	North Dakota	Virginia
Iowa	New Hampshire	Washington
Kansas	New Jersey	West Virginia
Kentucky	New York	Wisconsin
Massachusetts	Ohio	

The testing work is always planned to make the results as representative as possible. Tests were made on 86 railroads and at approximately 300 industrial plants.

A resume of the results of the tests of railroad track scales is shown in the table below. Master scale test results are shown elsewhere. The data have been arranged geographically, the country being divided into three districts corresponding with the territorial divisions adopted by the Interstate Commerce Commission in its "Report on the Statistics of Railways", which are designated as the Eastern, Southern, and Western Districts. (The Eastern district includes territory east of the Mississippi River, and north of Ohio and Potomac

Rivers and a line connecting Parkersburg, West Virginia and the southwestern corner of Maryland. The Southern district includes territory south of the Eastern District and east of the Mississippi River. The Western district includes all territory west of the Mississippi River.) The data are classified to indicate ownership by railroads, industries, and the Federal Government. A brief analysis of the errors on incorrect scales is also given.

RESULTS OF TESTS ON TRACK SCALES

District & Scales Owned by	No. of scales	Passed Tol.		Failed Tol.		Mean Numerical Error %	Analysis of Errors on Incorrect Scales					
							Scales Weighing Heavy			Scales Weighing Light		
		No.	%	No.	%		No. of Scales	% of Incorrect scales	Mean Plus Error in %	No. of Scales	% of Incorrect scales	Mean Minus Error in %
Eastern												
Railroad	211	123	58.3	88	41.7	0.32	49	55.7	0.45	39	44.3	0.79
Industrial	67	33	49.2	34	50.8	0.52	19	55.9	0.37	15	44.1	1.55
Government	4	4	100	0	00.0	0.12	0	----	----	0	----	----
Total	282	160	56.7	122	43.3	0.40	68	55.7	0.43	54	44.3	1.19
Southern												
Railroad	115	50	43.5	65	56.5	0.45	23	35.4	0.67	42	64.6	0.74
Industrial	31	14	45.2	17	54.8	0.41	6	35.3	0.44	11	64.7	0.75
Government	0											
Total	146	64	43.8	82	56.2	0.44	29	35.4	0.62	53	64.6	0.74
Western												
Railroad	341	214	62.7	127	37.3	0.35	66	52.0	0.67	61	48.0	0.83
Industrial	250	142	56.8	108	43.2	0.31	63	58.3	0.37	45	41.7	0.81
Government	0											
Total	591	356	60.2	235	39.8	0.33	129	54.9	0.53	106	45.1	0.82
All Districts												
Railroad	667	386	57.9	280	42.1	0.36	138	49.3	0.60	142	50.7	0.79
Industrial	348	189	54.3	159	45.7	0.36	88	55.3	0.38	71	44.7	0.96
Government	4	4	100	0	00.0	0.12	0	----	----	0	----	----
Grand Total	1019	580	56.9	439	43.1	0.36	326	51.4	0.51	213	48.6	0.85

to be in good weighing condition and receiving a commendable amount of attention to maintenance.

This phase of revenue freight weighing control is now receiving considerable attention. It is likely that the number of master scales in the country will shortly be increased, and what is perhaps more significant in relation to the Bureau's calibration service, the capacity of master scales in some instances will very likely have to be increased to keep pace with the increasing capacity of freight equipment. Should this be done, the Bureau will be called upon to expand its testing facilities. The Bureau holds this work to be its more responsible activity in the field and it is indeed the key to the gradual improvement in revenue freight weighing previously discussed.

TRACK SCALES FOR WEIGHING GRAIN

Interstate Commerce Commission Docket 9009 (56 I. C. C. 347) decided January 13, 1920, and American Railway Association Grain Circular No. 1, effective January 1921, published pursuant to the recommendations in the above mentioned decision, require among other things, that track scales used for weighing grain shall comply with a tolerance of 0.10% of the applied load. During the past year in connection with its regular track scale testing service, the Bureau tested 89 track scales used for weighing grain exclusively, and of this number 31 scales or 34.8% passed the prescribed tolerance. This figure is a great improvement over that shown in the fiscal year of 1923 when only two scales out of 32 passed the tolerance. The improvement is believed to be due to publicity given to the I. C. C. tolerance during the past year and to the growing sense of responsibility of scale owners toward the maintenance of proper weighing conditions. The Bureau's facilities now do not permit giving an amount of attention to the matter of weighing grain commensurate with its importance.

Form 565

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
Washington, D. C.

SUPPLEMENT TO REPORT OF TRACK SCALE TEST
(Track Scale Testing Equipment No. 3)

Nature of Test Load.—Testing equipment No. 3 comprises two short wheel-base test cars, one weighing 40 000 pounds and the other weighing 80 000 pounds. In these cars are incorporated the latest and best developments of test weight car design and construction now in use by railroads. The body of each car is made of solid castings provided with roller bearings, mounted on a 7-foot wheel base. These cars are standardized frequently on master scales which have been calibrated on one of the Bureau of Standards precision equipments No. 1 or No. 2.

Position of Test Loads.—The sections of the scale are designated as 1, 2, 3, etc., numbered from left to right when standing at the beam and facing the scale platform. Each pair of main levers constitutes a section.

The Bureau's method of testing a railroad track scale differs from the method used by many railroads in that the test truck is not centered over each section, but it is placed at the extreme ends of each span by setting each pair of wheels in turn directly over each section. The advantage of this method is that the load is carried entirely on one span and is thus supported by only two sections, while, on the other hand, when the load is centered over the section it is carried on two spans and is thus supported by three sections. The former method has been selected because it gives more nearly exact information in regard to the individual sections.

The positions of the test truck are designated in order from left to right as 1R, 2L, 2R, 3L, 3R, etc., the numbers referring to the section and the letters indicating that the body of the truck lies to the left or right of the section. These are known and hereafter referred to as the normal positions of the test truck.

If for any reason the test truck can not be placed in one of its normal positions, then its position is designated as a certain distance to the left (−) or right (+) of its nearest normal position. Thus, a position of the truck 25 inches to the right of the normal position known as 1R is designated as 1R+25″; if it is 25 inches to the left of the normal position known as 4L it is designated as 4L−25″.

Character of Error.—The amount by which the beam indication differs from the actual value of the load applied is called the "error" of the scale for the given position of the test truck. A plus (+) error signifies that the indication of the beam is in excess of the load on the platform; a minus (−) error signifies the opposite condition.

Maximum Indicated Error of Weighing.—Since the errors found with the test truck in general correspond to those that would be produced by one truck of a freight car, it is apparent that the largest algebraic sum of any two errors found that may be duplicated by the two trucks of a freight car corresponds to a possible error of weighing a freight car whose gross weight is twice the weight of the test load, or instead the mean of these two errors may be used if the weight of the freight car is considered equal to the weight of the test load.

Since the distances between the two trucks of freight cars of various types differ greatly, any two of the normal positions of the test truck on the scale except those which are at the same section, such as 2R and 2L, etc., may be duplicated by the trucks of some car, but on account of the improbability that the two trucks of a car can assume a position on the same span of the scale the Bureau does not use in the computation of the maximum error two errors found on opposite ends of the same span.

Therefore, in computing the maximum indicated error of weighing of the scale for the load applied, the largest mean of any two errors corresponding to normal positions of the test truck not closer together than similar points on adjacent spans is used.

Tolerance.—A tolerance of two-tenths of 1 per cent (0.20 per cent) on the "maximum indicated error of weighing" for any test load applied to the scale has been adopted by the Bureau. A tolerance of 0.20 per cent applied to a load of 100 000 pounds amounts to 200 pounds. The test loads used by the Bureau are in no case less than 40 000 pounds.

Sensibility Reciprocal.—The term "sensibility reciprocal" is defined as the change of weight indication required to be made upon the beam or the weight required to be added to or subtracted from the platform to turn the beam from a horizontal position of equilibrium at the middle of the loop to a position of equilibrium at the top or at the bottom of the loop.

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