Form 259

DEPARTMENT OF COMMERCE

Bureau of Standards

REPORT

HMR:RDM
II-8

Letter
Circular
LC 295

1-12-31

RAILROAD TRACK SCALE TESTING SERVICE

OF THE

NATIONAL BUREAU OF STANDARDS

FISCAL YEAR JULY 1, 1929 TO JUNE 30, 1930.

HMR:EGH
II-8

Letter Circular LC 295

RAILROAD TRACK SCALE TESTING SERVICE OF THE NATIONAL BUREAU OF STANDARDS FISCAL YEAR, 1930

- - - -

C O N T E N T S

- - - -

SECTION I - STATISTICAL SUMMARY OF WORK DONE

Page No.

SECTION II - COMMENTS AND CONCLUSIONS

SUPPLEMENT

RAILROAD TRACK SCALE TESTING SERVICE

OF THE

NATIONAL BUREAU OF STANDARDS

FISCAL YEAR 1930

SECTION I

STATISTICAL SUMMARY OF WORK DONE

INTRODUCTION

To comply with requests for information regarding the general fitness of carload freight weighing facilities in the United States, the National Bureau of Standards has adopted the routine of publishing annually the results of railroad track scale tests made during the preceding fiscal year. The first of these reports was published at the close of the fiscal year, 1924. This report reviews the work done during the fiscal year ended June 30, 1930.

The investigation of railroad track scales was begun by the Bureau in 1913 and has since continued as a regular function. The work is supported by Congressional appropriation. Operating schedules for the three field units are arranged to include: (1) Annual test and calibration of twenty master track scales to which carriers or other organizations periodically refer test weight cars for weight standardization; (2) test of track scales whose owners have filed formal requests for the service; and (3) tests of several hundred track scales located in representative sections of the country and used for different kinds of service.

According to records compiled during the past year the total number of railroad track scales used for weighing revenue freight on railroads is approximately 3,800. In addition about 5,500 track scales are in service at industrial plants. With the present organization and equipment the Bureau is seldom able to test more than 800 of these in any one year. The annual testing schedules are therefore planned, as far as may be possible, to serve different localities in succeeding years and to insure widespread distribution of the tests.

An important feature of all track scale tests made by the Bureau is an inspection of each scale to discover whatever faulty mechanical conditions or incorrect installation features may be present and adversely influence weighing performance. Formal reports made to the scale owner detail the test performance, and contain recommendations for advisable repair, maintenance or replacement measures.

Form No. 566, attached to this report as a supplement, contains a description of two of the Bureau test units and of the customary test procedure. A definition of the allowable tolerance for error and method of computing the error are also included.

FIELD OPERATIONS SUMMARY

Table 1 gives in summarized detail an analysis of operating time of field units during the past fiscal year.

TABLE 1

SUMMARY OF FIELD OPERATION OF RAILROAD TRACK SCALE TESTING UNITS, NATIONAL BUREAU OF STANDARDS, FISCAL YEAR, 1930.

Item	Field Equipment No.1	No.2	No.3	Total
Days in the field	222	183	286	691
Days in actual operation	157	106	190	453 (65.6%)
Days lost in repairs	10	35	11	56 (8.1%)
Days lost in transit	20	9	37	66 (9.6%)
Days lost, weather, Sundays, etc.	35	33	48	116 (16.8%)
Tests made	312	186	368	866*
Track scales adjusted	7	7	43	57
Test cars calibrated	9	11	4	24
Miles travelled	6065	6200	7380	19645
Miles per test	19.4	33.3	20.1	22.7
Miles per day in field	27.3	33.9	25.8	28.4
Tests per day in field	1.4	1.0	1.3	1.3
Tests per day of operation	2.0	1.8	1.9	1.9

*Note: This figure includes 10 master scale tests by the No. 1 outfit and 6 master scale tests by the No. 2 outfit. The net number of railroad track scale tests is 850.

Tests were made on 74 different railroad systems and in 31 states and the District of Columbia.

ANALYSIS OF TEST RESULTS

The total number of railroad track scales tested during the fiscal year 1930 was 850. Of these, 520 were operated by railroads and 321 were in use at industrial plants. Nine tests were made for the Federal government and different States and municipalities. Adjustments were made on fifty-seven scales to improve the weighing performance.

Table 2 is a statement and analysis of results of all tests made during the year. Classification of the scales tested is according to location and ownership. The districts to which scales have been allocated correspond to those established by the Interstate Commerce Commission.

The tolerance by which the weighing performance of a track scale is graded as correct or incorrect is shown on the attached Form No. 566 and requires, in substance, that the average of any two errors occurring with a test load at positions which the trucks of a freight car may occupy while being weighed shall not exceed two-tenths of one percent, (0.20%), of the applied load. The values of the test loads used by the Bureau are 40,000 and 80,000 pounds.

TABLE 2. SUMMARY OF TRACK SCALE TEST RESULTS - FISCAL YEAR 1930.

District and Scale Ownership	Number of scales tested	Within Tolerance		Not Within Tolerance		Mean Numerical Per cent of applied load	Analysis of Errors of Incorrect Scales					
							Errors in excess			Errors in deficiency		
		Number	Per cent	Number	Per cent		Number of scales	Per cent of incorrect scales	Mean error	Number of scales	Per cent of incorrect scales	Mean error
EASTERN												
Railroad	195	150	76.9	45	23.1	0.17	32	71.1	0.35	13	28.9	0.45
Industrial	77	50	64.9	27	35.1	0.24	11	40.7	0.47	16	59.3	0.51
Government	3	3	100.	--	----	0.11	--	----	----	--	----	----
State or Municipality	1	---	-----	1	100.	0.54	--	----	----	1	100.	0.54
Total	276	203	73.6	73	26.4	0.19	43	58.9	0.38	30	41.1	0.48
SOUTHERN												
Railroad	163	110	67.5	53	32.5	0.25	26	49.1	0.39	27	50.9	0.63
Industrial	111	64	57.7	47	42.3	0.24	22	46.8	0.34	25	53.2	0.43
Government	---	---	----	--	----	----	--	----	----	--	----	----
State or Municipality	1	---	----	1	100.	0.32	1	100.	0.32	--	----	----
Total	275	174	63.3	101	36.7	0.24	49	48.5	0.37	52	51.5	0.54
WESTERN												
Railroad	162	136	84.0	26	16.0	0.15	11	42.3	0.31	15	57.7	0.48
Industrial	133	103	77.4	30	22.6	0.18	16	53.3	0.44	14	46.7	0.46
Government	1	---	----	1	100.	1.95	--	----	----	1	100.	1.95
State or Municipality	3	1	33.3	2	66.7	0.90	--	----	----	2	100.	1.28
Total	299	240	80.3	59	19.7	0.18	27	45.8	0.39	32	54.2	0.57
ALL DISTRICTS												
Railroad	520	396	76.2	124	23.8	0.19	69	55.6	0.36	55	44.4	0.55
Industrial	321	217	67.6	104	32.4	0.22	49	47.1	0.40	55	52.9	0.46
Government	4	3	75.0	1	25.0	0.57	--	----	----	1	100.	1.95
State or Municipality	5	1	80.0	4	20.0	0.71	1	25.0	0.32	3	75.0	1.03
GRAND TOTAL	850	617	72.6	233	27.4	0.20	119	51.1	0.38	114	48.9	0.55
For 1929	726	521	71.8	205	28.2	0.20	93	45.4	0.38	112	54.6	0.47

The items of major significance in Table 2 are those in the third and sixth columns of figures. They indicate, respectively, the proportion of correct scales and magnitude of the average indicated errors of weighing. Thus, the proportion of scales found to be correct in the eastern, southern and western districts were, respectively, 73.6%, 63.3%, and 80.3%. In the same order, the average error values were 0.19%, 0.24% and 0.18% of the applied test loads. The comparative standing of the three districts with respect to correctness of track scales is believed to be fairly represented by these figures.

At the foot of Table 2 appear the totals of the different columns. For purposes of comparison, the totals for the preceding year are also given. The item at the foot of the third column showing the percentage of correct scales, namely, 72.6%, is noteworthy in that it is the highest percentage found for any year up to this time, although the increase over the past few years is too small to be definitely significant. The average error of all scales, namely, 0.20%, shown at the foot of the sixth column, happens to conform exactly to the tolerance figure by which track scales are graded as being correct or incorrect. The value is the same as that obtained last year, and, as such, is smaller than any found in preceding yearly periods.

Of the railroad owned scales, 76.2% were within the tolerance compared to 67.6% of the industry owned scales. The average error for railroad owned scales was 0.19%, and that for industry owned was 0.22%. The relative quality of performance of railroad and industry owned scales is treated in detail in a later section of this report.

A part of Table 2 is devoted to a study of the error characteristics of the scales found outside the tolerance. Of the total number of incorrect scales, substantially one-half showed over-weight indications and one-half underweight indications. A conclusion drawn from data similar to these in previous reports is that inaccuracies in track scale weights do not collectively constitute either an advantage or disadvantage to shippers, consignees, or carriers as a class. In a general way, that conclusion may reasonably be held to be supported by the data in this report; however, a close scrutiny of these data and those of recent years shows a tendency towards a majority of errors in deficiency by industry owned track scales. That circumstance, however, is a consequence of prevailing maintenance methods and mechanical condition of weighing equipment, and is not in any sense indicative of viciousness in weighing methods.

The average value of the under-weight errors will be seen to be greater than that of the over-weight errors. This is a consequence of the fact that casual obstruction or interference occurring at certain weight transmitting members of a track scale may support a portion of the applied load and thus cause a serious deficiency in weight indication.

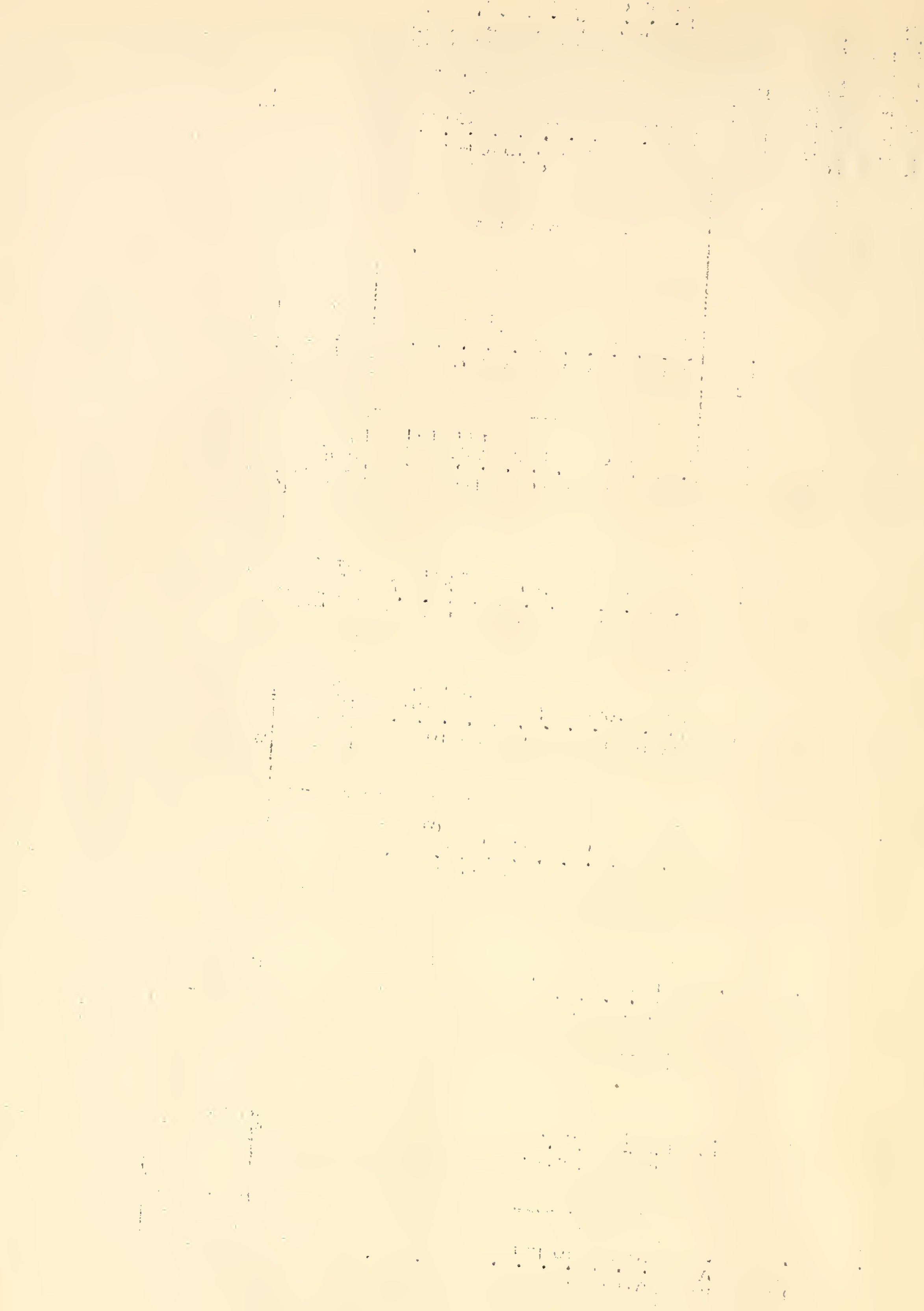
RELATIVE FREQUENCY OF ERRORS OF DIFFERENT MAGNITUDE

Table 3 was prepared to illustrate the frequency distribution of the weighing errors. The few scales owned by city, State or Federal departments have been disregarded and the remainder have been separated according to districts and by ownership class.

At the foot of the table, the average weighing error for each group of scales is given and averages for each of the two preceding years are shown. Attention is directed to the totals of the two final columns.

TABLE 3. DISTRIBUTION OF TRACK SCALE ERRORS - FISCAL YEAR 1930.

ERRORS	EASTERN DISTRICT		SOUTHERN DISTRICT		WESTERN DISTRICT		ALL DISTRICTS	
	Rail-road 195 tests	Indus-trial 77 tests	Rail-road 163 tests	Indus-trial 111 tests	Rail-road 152 tests	Indus-trial 133 tests	Rail-road 520 tests	Indus-trial 321 tests
Percentage of Applied Load	% of scales tested	% of scales tested	% of scales tested	% of scales tested	% of scales tested	% of scales tested	% of scales tested	% of scales tested
0.00 to 0.05 incl.	12.8	10.4	4.9	3.6	17.9	11.3	11.9	8.4
0.06 to 0.10 "	27.2	28.6	27.0	22.5	34.0	36.1	29.2	29.6
0.11 to 0.15 "	26.2	15.6	22.1	16.2	24.1	15.0	24.2	15.6
0.16 to 0.20 "	10.8	10.4	13.5	15.3	8.0	15.0	10.8	14.0
0.21 to 0.25 "	7.2	3.9	6.8	11.7	4.3	6.0	6.2	7.5
0.26 to 0.30 "	4.6	7.8	4.3	6.3	1.8	3.8	3.6	5.6
0.31 to 0.35 "	3.1	7.8	3.7	4.5	2.5	1.5	3.1	4.0
0.36 to 0.40 "	1.0	3.9	4.9	5.4	0.6	3.0	2.1	4.0
0.41 to 0.45 "	1.5	0.0	3.1	3.6	1.8	2.3	2.1	2.2
0.46 to 0.50 "	0.5	1.3	1.8	2.7	0.6	1.5	1.0	1.9
0.51 to 1.00 "	5.1	6.5	4.3	7.2	4.3	2.3	4.6	5.0
Over 1.00	0.0	3.9	3.7	0.9	0.0	2.3	1.1	2.2
Mean Error % of applied load	0.17	0.24	0.25	0.24	0.15	0.18	0.19	0.22
Mean Error Fiscal year 1929	0.22	0.21	0.16	0.26	0.18	0.22	0.19	0.21
Mean Error Fiscal year 1928	0.17	0.14	0.31	0.29	0.16	0.20	0.23	0.24



MASTER SCALE TESTS

Of the 19 master track scales in use in the United States, 16 were calibrated during the year. Several required readjustment or modification. The master scale owned by the Reading Company at Reading, Pennsylvania, was retired and replaced with a new installation early in the year.

TRACK SCALES FOR WEIGHING GRAIN

Separate analysis has been made of test results for 47 track scales in grain-weighing service. On the basis of the 0.10 per cent tolerance which is applied to scales in this class of service, 22 scales or 46.8 per cent of the total were correct. For the entire group, the average weighing error was 0.15 per cent. Our published reports have repeatedly emphasized the fact that comparatively few track scales in grain-weighing service conform to the type specified for this work or are of the kind which will consistently yield correct weighing results. The situation remains unchanged in the main, particularly at grain terminal markets where destination weights are used to fix sales transactions.

In contrast with the status in the grain handling industries, there may be cited a test at a Great Lakes port, of a group of 27 scales used for "origin" weighing of carload coal shipments. With only a few exceptions, these were scales of approved specification type. Eighty-five per cent of these were correct within the regular tolerance of 0.20 per cent. Sixty-three per cent were correct within the regular grain tolerance and the average error for all was 0.11 per cent.

TEST CAR CALIBRATIONS IN THE FIELD

A part of the work performed in connection with the field testing was the restandardization of the weight of twenty-four track scale test cars for railroads or industries without master scale facilities. These cars were of various types. Their variations from standard weight values ranged from zero to -108 pounds and +70 pounds, the average being 37 pounds.

CALIBRATION OF TEST CARS ON BUREAU MASTER SCALE

Table 4 contains statistical data relating to the calibration of railroad track scale test weight cars at the Bureau of Standards Master Scale Depot, Clearing, Illinois.

Individual cars are indicated by the letters, A, B, C, etc. Results of successive calibrations are shown in chronological order. Letters inclosed with a parenthesis, thus, (B), indicate that the corresponding cars are "self-contained" test weight cars.

> Note: According to construction test weight cars are designated as being of one or the other of two types: (1), "Self-contained" cars in which the body is essentially a one or two piece casting; and (2), "Compartment" cars in which the body consists of a steel plate shell in one or more compartments loaded with billets or other form of permanently fixed weight.

The symbol, ° , attached to some of the error values in the last two columns indicates that when the corresponding values were obtained there was positive evidence that repairs or alterations had been made previously to calibration, or that the errors found were for some other reason not representative of variations resulting from normal use. Absence of the symbol does not necessarily mean that the errors found represent variations resulting from normal use, but that evidence to the contrary at the time of calibration was not positive.

TABLE 4. TRACK SCALE TEST WEIGHT CAR CALIBRATIONS
NATIONAL BUREAU OF STANDARDS MASTER SCALE DEPOT, CLEARING, ILLINOIS
FISCAL YEAR 1930.

Car	Report No.	Nominal Weight (lb.)	Air Brakes (Yes)	Air Brakes (No)	Errors in Pounds (Plus)	Errors in Pounds (Minus)
A	105	50,000	X			5
(B)	60	40,000		X	8	
	66					6°
	99					7
(C)	61	80,000		X		9
	67					3°
	100					4
D	81	40,000	X			12
E	80	80,000	X		24	
F	56	75,000	X			56
	58					7°
	90					24
	98					117°
	106				132	
(G)	86	80,000		X	6	
(H)	73	80,000	X		3	
	94					19°
I	68	61,400	X			30
	93					105
(J)	87	61,600	X		24	
K	57	60,500	X			56
	91				2	
(L)	95	80,000	X		10°	(New car)
(M)	79	80,000	X			14° (New car)
(N)	78	80,000	X			45° (New car)
(O)	75	80,000	X			8° (New car)
	101					21

TABLE 4 (Continued)

Car	Report No.	Nominal Weight (lb.)	Air Brakes (Yes)	Air Brakes (No)	Errors in Pounds (Plus)	Errors in Pounds (Minus)
P	74	52,500	X		21	
Q	59	60,000	X			111
(R)	63	30,000		X	8	
	76				8	
	97					9
	104					14°
(S)	65	30,000		X		5
	82					4
	102					16°
(T)	55	40,000		X		1
	71					1
	85				6°	
	88				19	
	108					6
(U)	54	80,000		X		12
	70					10
	84					11
	89				2	
	107					20
(V)	64	80,000		X	40	
	83					0
	103					13°
(W)	62	80,000		X		4
	77				15	
	96					12
(X)	72	83,000		X		200°
(Y)	69	80,000		X	4	
	92					252°
TOTALS						
25 cars	55 calibrations	14 cars with air brakes	11 cars without air brakes		17 too heavy	38 too light

Review of Calibration Results. Fifteen different organizations are represented in the ownership of the 25 cars to which calibration service was furnished. Of that number, 13 are railroads.

Thirty-four railroads operate out of Chicago of which 22 are major trunk lines. Of the latter, 5 operate their own master scales. Of the 13 roads to which calibration service was furnished, 12 do not own master scales.

Of the 25 cars calibrated, 17 were of the self-contained type and of these 13 were equipped with roller bearings. All compartment type cars were equipped with air brakes, and all had straight journals.

Forty-one calibrations or 2.4 calibrations per car were made on self-contained cars, and 14 calibrations or 1.8 calibrations per car were made on compartment type cars.

In 28 calibrations on self-contained cars, no evidence was discovered that the errors did not result from normal use. In these the cars were heavy in 11 cases, light in 7, and in one case the car was correct. Similarly, for compartment type cars, in 12 cases, 4 were found to be heavy and 8 light. The average error of such self-contained cars was 9.8 pounds and for compartment type cars the average error was 48.2 pounds.

(Note: The averages just given are calculated from the "absolute" errors, that is, no distinction is made between plus and minus errors).

RESEARCH AND INVESTIGATION

Research was begun during the year on adequate corrosion protective coatings for industrial test weights of large denomination. This is expected to continue for at least another year. It contemplates that series of test weights of 50 pound to 10,000 pound denomination will be treated with a variety of protective coatings and subjected to conditions of practical use. A complete journal record of each weight is to be kept following which the statistical data will be analyzed and the results published.

COOPERATION WITH INDUSTRIAL TECHNICAL GROUPS

Cooperative committee contact was established with three technical groups, namely, (I), the National Scale Mens Association, (II), the National Scale and Balance Manufacturers Association, and (III), the American Railway Engineering Association. Four projects were handled as listed below.

Specifications for the Repair and Overhauling of Heavy Capacity Scales. This project was brought to completion. It is planned that the code will appear as one of the Letter Circular Series of the Bureau of Standards. Cooperative with group (I). Universal Test and Inspection Record Forms for Heavy Capacity Scales. This project was brought to completion. Cooperative with Group (I).

Specifications for Railway Track Scales for Light Industrial Service. This project was brought to completion. The code will appear as a circular of the Bureau of Standards. Cooperative with Groups (I), (II), and (III).

Specifications for Track Scale Test Weight Cars. This project is in the final stage of completion. Consummation of certain details with the Mechanical Division of the American Railway Association is being waited upon. The code will appear as a Bureau of Standards Circular. Cooperative with Groups (I) and (III).

Formal Committee contact which has been maintained for some years with the American Railway Engineering Association on matters pertaining to railway weighing machinery and methods of use was continued.

COOPERATION WITH OTHER GOVERNMENT DEPARTMENTS

Consulting advice has been furnished other Federal departments as required on weighing equipment and methods of use. The affairs of the Federal Business Association at Chicago were participated in by attendance at monthly meetings and otherwise as required on particular details.

TRACK SCALE CENSUS

This year the railways of the country were circularized to secure a revised census of railroad track scales owned by the carriers and by industries served by them. The returns, now virtually complete, will be used in revising the office records and in working up a new map system as a visible record of scale locations and their test history at the section headquarters office.

A rather unexpected fact revealed by the census returns is that the number of track scales now in use is roughly 25 per cent less than in 1925 when the last census was taken. The reduction in number, although somewhat greater than had been anticipated, may be ascribed to an increasing trend toward elimination of minor weighing points on railroads and to the growing practice of transacting business on the basis of weight agreement rather than destination or in-transit weights. A very close approximation of the number of scales now operating is 3800 railroad owned scales and 5200 industry owned scales.

PUBLICATIONS

Letter Circular No. 276, a summary and discussion of the track scale investigations for the year 1929, was published and given wide circulation early in this fiscal year.

An abstract of the master scale test results for the year 1929 was prepared and supplied to a very limited group of railroad management officials who have direct interest in that subject.

MISCELLANEOUS TESTS

Miscellaneous work performed in the section this year includes the following:

Restandardization of five 10,000-pound weights for a railroad department.

Recalibration of all test weights and accessory apparatus used by the Bureau for field testing.

SECTION II

COMMENTS AND CONCLUSIONS

SHORT HAUL. TRANSPORTATION SERVICE

Curiously enough competition of the motor bus, motor truck, and privately owned automobile with the steam carrier has had a detrimental effect on field operation of the testing outfits. Due to the number of local trains, both freight and passenger that have been taken out of service, short haul movements are at times inconvenient or even impossible to arrange in a manner that will insure a continuous operating schedule. The difficulty lies in coordinating movements of equipment and crews consistently with seasonable working hours.

TEST WEIGHT CARS: Air Brakes.

As a helpful measure toward maintaining the constancy of weight of test cars, it is considered advisable that air brakes, a feature common to all rolling stock, be omitted. On the other hand, however, operating practice is such that those responsible for the purchase of test weight cars are constrained to regard air brakes as a practical necessity. How effective this constraint is may be deduced from the fact that each of four new cars received at the master scale depot during the last year was equipped with air brakes. The broadening of the tendency thus displayed is regarded as a deterrent to maintenance of accuracy of test weight cars.

In many sections of the country trains may be, and except for comparatively rare applications of air, practically are operated with the engine brakes. In such cases test weight cars might be equipped with air brakes without serious objection from the standpoint of accuracy. However, in a territory where grades and curves are plentiful air brakes are very objectionable, and consequently it is preferable in such cases that the cars be not so equipped. The facts are that test weight cars have been and are now, operated without air brakes under all conditions and this is not in conflict with law or formal regulation by public authority.

Equalizers and Spring Stops. A test weight car is essentially a rigid body mounted on semi-elliptical springs on two axles usually on seven-foot centers. In respect to the spring mounting the type of car is unique in American railroading practice. Spring failures are common and experience shows that in the event of spring failure the derailing menace is considerable. Several devices have been developed in efforts to eliminate this transportation hazard.

One method is by the use of equalizers. Satisfactory and unsatisfactory results have been reported. The idea may be sound in principle but some opinions are well fixed that the practical applications of it are faulty and likely to introduce complications more serious than the trouble whose elimination is intended.

In the event of spring failure the danger of derailment ensues because one corner of the car drops down so far that under certain conditions of operation on imperfect roadbed, the diagonally opposite wheel is lifted clear of the rail. This danger is held to be avoidable by means of spring stops which consist essentially of casting fixtures attached to the car body above each spring band. The installation is such that under all ordinary conditions of operation sufficient clearance to prevent contact between the stop and the band is provided. Excessive spring deflection is prevented by the stop striking on the band. In the event of total spring failure the stop rides rigidly down on the band and provides reasonably safe operation until repair service can be obtained.

As far as test weight car construction is concerned the two safety devices just mentioned are developments in recent times. From the standpoint of simplicity and certainty of results the latte seems better suited to the intended purpose. It should be pointed out, however, that the frequency of spring failures past and present indicates the assumptions made in the design are inadequate and insufficiently contemplate the rigors of service peculiar to the transportation of test weight cars. Adequate spring design should go far toward making safety contrivances unnecessary.

TRACK SCALES: Quality of Performance.

Figures 1 and 2 succinctly show the development of quality of performance in railroad track scales. Since both curves are practically flat from the year 1927 forward it is demonstrated that general average conditions are not now improving as formerly. Since it has been felt that the maximum grade of performance reasonably obtainable has not been reached, the hope has been maintained that before a falling off in accuracy should set in, measures would be taken for further improvement. That hope has not been realized with sufficient completeness and now it is indicated that a peak anticipated in previous reports has actually been reached and that a decline in the quality of weight measurement in American commerce is apparently inevitable.

Figure 1

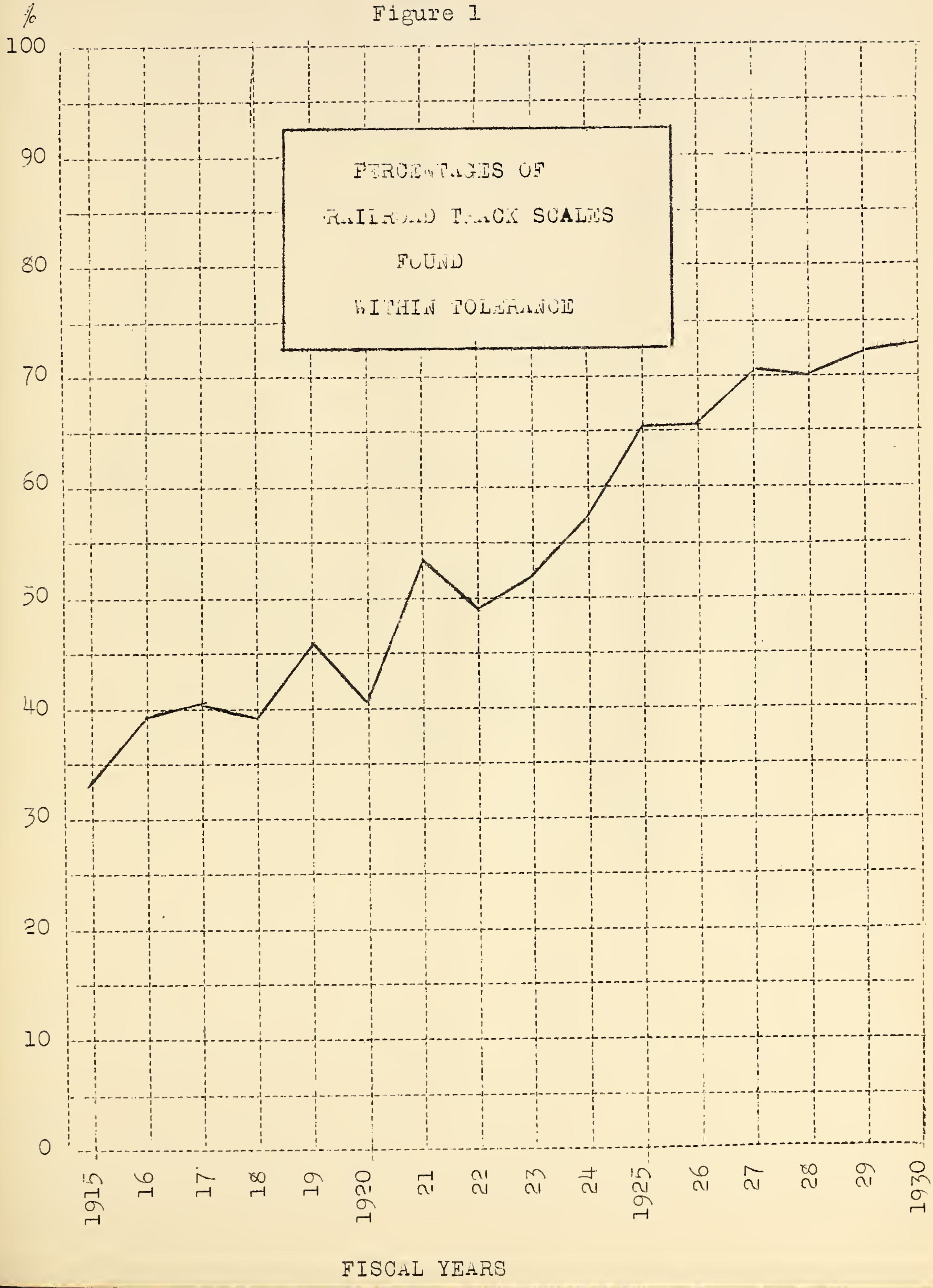
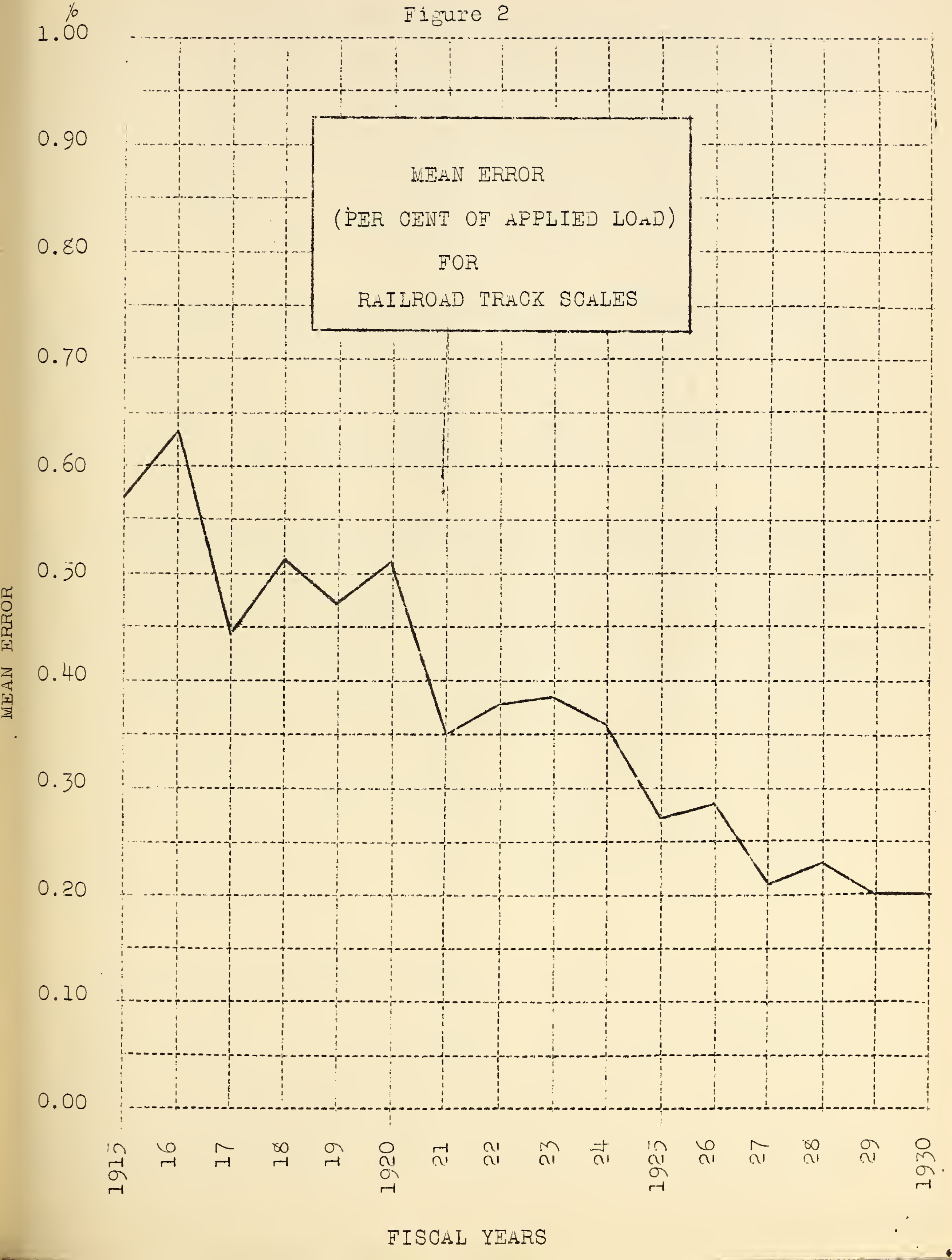

%
100
90
80
70
60
50
40
30
20
10
0
PERCENTAGES OF
RAILROAD TRACK SCALES
FOUND
WITHIN TOLERANCE
1915
16
17
18
19
1920
21
22
23
24
1925
26
27
28
29
1930
FISCAL YEARS

Figure 2


%
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
MEAN ERROR
(PER CENT OF APPLIED LOAD)
FOR
RAILROAD TRACK SCALES
MEAN ERROR
1915
16
17
18
19
1920
21
22
23
24
1925
26
27
28
29
1930
FISCAL YEARS

Methods of Weight Determination. Based on a principle axiomatic in the railroad industry that weighing cars after consignment complicates operation and slows up deliveries, the carriers in recent years have shown a tendency to avoid weighing. Two outstanding manifestations of the tendency may be mentioned. First, the distribution of a great variety of goods in uniformly sized packages has permitted the practice of establishing billing weights by means of the count of the number of packages, or the volume, or other control. Second, the carriers will on certain terms accept the shipper's weight determined at the point of origin on his own scale.

The consequences of the tendency just mentioned are that railroad operated weighing points have been reduced in number about 25% in the past five years, and that the burden of weight determination is being shifted to the shippers or industries at originating points. In instances where the nature of the commodity requires weight determination by the process of actual weighing on a track scale the burden is a real one indeed, and is in fact the nub of the issue whether the quality of wholesale weight measurement in American commerce will improve or deteriorate.

Conditions Adverse to Improvement. In considering the question as to whether or not the quality of weight determinations will be improved by shifting to the shippers the burden of weighing, the following facts may well be reviewed. Formal construction requirements for weighing machinery heretofore considered adequate for the transportation interests entail a disproportionate unproductive capital investment by many individual shippers who in the aggregate furnish a very great proportion of freight to the transportation industry. The result of this situation is that the average industry owned track scale dates its life since original installation or last complete overhauling (renewal of pivots, bearings, etc.) from July, 1921. Further the annual substitution of factory new equipment is represented to be less than two per cent of the total amount in use. Thus it appears that under the present renewal and replacement policy the average industry owned track scale must endure with more or less periodic rejuvenations nine years or more apart for a period of upward of fifty years, a circumstance out of accord with common experience.

Evidence of Incipient Decline. That a decline in the quality of weighing performance may be anticipated seems to be indicated by a study of Table 5 which correlates data from this and previous reports on the comparative quality of performance of railroad owned and industry owned track scales. Columns 4 and 7 contain the critical data which indicate that industry owned scales are not keeping pace in improvement with railroad owned scales. The inference may readily be drawn that this may be due to a difference in the native quality of weighing machinery and maintenance methods. Those intimately acquainted with conditions will, as a matter of course, accept the inference as a

fact which requires no statistics to prove, because it is such a fact, but what is less evident is the discrepancy in the rate of improvement of the two classes of scales. The underlying truths are that the rate of improvement in railroad owned scales is hardly what it should be considering all the circumstances, and that the industry owned scales, which as stated previously are receiving the burden of weighing freight, are falling away from a standard of performance presumably set by the carriers as being necessary for their own interests. On account of the sluggish retirement of obsolete equipment the chief credit for improvement, such as it is, must be given to diligent and intelligent maintenance methods. A structure depending upon maintenance alone, however, must ultimately break down, and the chief point of the preceding argument is that with respect to modern commercial weighing practice a manifestation of that most fundamental principle is imminent.

TABLE 5. RELATIVE QUALITY OF PERFORMANCE OF RAILROAD OWNED AND INDUSTRY OWNED TRACK SCALES.

1	2	3	4	5	6	7
Year	Percentage of Scales Tested that passed the Tolerance		Differ-ence (2)-(3)	Average Error in Per Cent of Scales Tested		Differ-ence (6)-(5)
	Railroad owned	Industry owned		Railroad owned	Industry owned	
1924	57.9	54.3	3.6	0.36	0.36	0.00
1925	67.2	63.3	3.9	0.28	0.25	-0.03
1926	66.9	64.1	2.8	0.26	0.22	-0.04
1927	72.0	68.1	3.9	0.20	0.22	+0.02
1928	73.9	63.5	10.4	0.23	0.24	+0.01
1929	74.0	68.4	5.6	0.19	0.21	+0.02
1930	76.2	67.6	8.6	0.19	0.22	+0.03

Remedial Measures. As a means of expediting the retirement of obsolete weighing equipment, the associated involved interests during the past year promulgated a set of specifications for the manufacture and installation of railway track scales for light industrial service. The code which is intended to appear later as a formal publication of the National Bureau of Standards purposes to describe a scale of minimum cost consistent with sensible demands for ruggedness and accuracy, and by limitations upon the rail length and beam capacity, to restrict the distribution of the scale to the intended service, namely, industrial plants that weigh comparatively few cars up to 180,000 pounds gross load. The recent demoralization of buying power has made the remedial effect of these specifications negligible up to the present time.

Form 566

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

Washington, D. C.

SUPPLEMENT TO REPORT OF TRACK SCALE TEST
(Track Scale Testing Equipments, Nos. 1 and 2)

Nature of Test Load.—The test load applied to the scale consists of standardized test weights mounted on a four-wheel truck of known weight. The wheel base of the truck is 5 feet in length, which corresponds closely to the truck of a freight car. The truck is driven by an electric motor at a slow and uniform speed, so that its movement is practically without impact, and therefore there is little tendency for the scale parts to shift during the operation of the load across the scale.

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.

U. S. GOVERNMENT PRINTING OFFICE: 1929