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RAILWAY TRACK SCALE TESTING SERVICE
OF THE

NATIONAL BUREAU OF STANDARDS

FISCAL YEAR 1941 (JULY 1, 1940 to JUNE 30, 1941)

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FISCAL YEAR 1941

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I. INTRODUCTION

This report is issued primarily as a statistical summary and analysis of the results of the railway track scale tests conducted by the National Bureau of Standards throughout the United States in the fiscal year 1941, July 1, 1940 to June 30, 1941. Certain supplementary and related activities are reviewed and some subjects of relevant interest are discussed.

Former reports of similar character have explained the specific purposes of the Bureau's railway track scale testing service and have described the several activities of which it is comprised. The following explanatory résumé will therefore suffice.

The National Bureau of Standards functions as an agency of the United States Department of Commerce. Two of its fundamental responsibilities are to provide industry and commerce with authentic weighing and measuring standards and to pursue such measures as are helpful in assuring that all weighing and measuring operations essential to trade and transportation are performed on a uniform basis and with acceptable accuracy. The railway track scale testing service is the instrumentality through which the Bureau fulfills these important responsibilities to the rail transportation industry and to interstate commerce where the wholesale marketing and distribution of materials are conducted in terms of carload weight and involve the utilization of several thousand railway track scales. The service is organized and administered with the following four objectives in view:

1. Calibration of Master Track Scales. The key facilities through which the Bureau provides the railways and dependent commercial or industrial interests with an accurate and uniform standard for the weighing of freight car loads are nineteen master track scales. These are owned by railways or other organizations and are used periodically by them to check and standardize test-weight cars employed as standards in the testing and adjustment of commercial railway track scales. Employing two field units specially designed for the purpose, the Bureau annually calibrates each master track scale and takes any additional measures necessary to insure that each will serve as a dependable source of standardization. Fifteen master scales are owned by railways, two by States, one by a steel manufacturing organization, and one by the National Bureau of Standards. The locations of master scales are indicated on the map, Fig. 1.

2. Standardization of Track Scale Test-Weight Cars. Two supplementary methods by which the Bureau transmits standards of weight to interstate commerce and transportation agencies are:

(1) The periodic standardization of a considerable number of railway track scale test-weight cars on the Bureau master scale at Clearing, Illinois, and (2) the occasional weighing of test-weight cars in the field when, for some reason, standardization on a master scale is impracticable; this latter method is a somewhat superficial form of standard transmission in which a commercial track scale is used as a medium for comparison of a test-weight car with Bureau mass standards.

3. Tests of Commercial Track Scales. The third feature of the service is the annual testing and inspection of several hundred railway track scales used either by the common carriers for revenue freight weighing or by industrial and commercial agencies for establishing or adjusting the basis of sales transactions. While this activity is essentially investigational and designed to ascertain how generally railway track scales conform to adopted requirements for accuracy and reliability, it also contributes to progressive improvement of conditions by directing the attention of track scale owners to miscellaneous faulty conditions requiring correction; and by supplying them with advice on needed measures of maintenance, repair, or replacement.

The two units of equipment which conduct master scale calibrations are also used in this service, as well as a third unit which comprises two test-weight cars weighing, respectively, 40,000 and 80,000 pounds. Transportation of the field testing units over the railways is arranged in cooperation with the Association of American Railroads. Itineraries and operation schedules are designed to provide widespread annual distribution of the service and to insure a representative "sampling" of conditions prevailing in each section of the United States and in each general category of use or ownership.

4. Miscellaneous Related Functions. Various incidental activities with which the Bureau supplements its field functions include collateral research, investigation, or special testing in field and laboratory, cooperation with technical associations and other groups in formulating specifications, and the dissemination of technological information on railway track scale construction, maintenance, or operation.

II. ABSTRACT OF 1941 FIELD ACTIVITIES

Each of the several functions enumerated in Section I will be discussed in succeeding sections of the report. A condensed summary of the year's work is presented in the following abstract:

1. Master railway track scales calibrated, 17
2. Railway track scale test-weight cars:
 - a. Standardizations on Bureau master scale, 49
 - b. Weighings in the field, 30
3. Commercial railway track scales:
 - a. Total number tested, 1036
 - (1) Railroad-owned, 647 or 62.5 percent of total
 - (2) Industry-owned, 389 or 37.5 percent of total
 - b. States in which tests were made, 39
 - c. Railroads upon the lines of which tests were made, 109

III. MASTER TRACK SCALE CALIBRATION

CALIBRATION METHOD.

Ordinarily the calibration of a master track scale comprises three separate series of tests, each being conducted with mass standards of high precision:

1. An initial "Maintenance Test" which is applied to ascertain whether the required qualities of performance have been maintained since the last preceding calibration. For this test, standard-weight loads of 40,000, 60,000, and 80,000 pounds are applied to the scale, in two successive test runs, at each of five definite positions on the scale rails.

2. An "Adjustment Test" is applied after any adjustments or other modifications are made to the scale. Loads of 30,000, 50,000, and 70,000 pounds, in addition to the loads previously mentioned, are utilized for this test, procedure being identical with that mentioned in the preceding paragraph.

3. A test of the scale counterpoise weights and of the weighbeam notch or graduation spacing.

If no adjustments or other modifications are made, the "adjustment" and "maintenance" tests are combined.

MASTER TRACK SCALE TOLERANCES.

The accuracy requirements for master track scales are presented in the following table of tolerances.

Load lb.	Tolerance in Pounds	
	Maintenance Test	Adjustment Test
30,000		3.7
40,000	8.4	4.2
50,000		4.7
60,000	10.4	5.2
70,000		5.6
80,000	12.0	6.0

1941 CALIBRATION RESULTS

Seventeen of the nineteen master track scales were calibrated, one of these being calibrated on two occasions, near the beginning and the end of the period. All the master scales were found to be accurate within the "maintenance" tolerances and in all but two instances they were accurate within the "adjustment" tolerances. In these two cases, adjustments were made and the scales were found, on final test, to be accurate within the adjustment tolerances. A reconditioned weighbeam assembly was installed on one master scale and the weighbeam balance ball assembly of one other was adjusted to improve the sensitiveness of the scale. Four counterpoise weights on three master scales were found to be inaccurate by small amounts and the counterpoise weight complement of one scale was found to be in unsatisfactory condition. With the exception of these faults and of some miscellaneous minor mechanical defects in the scale lever systems or deficiencies in approach track and scale house maintenance, all master scales were found to be in an excellent state of maintenance.

CALIBRATION FREQUENCY.

As indicated above, all but two of the master railway track scales in the United States were calibrated during the year. Each of those not calibrated had been calibrated during the closing weeks of the preceding year and both were to be calibrated again shortly following the close of the year. Although it is the aim of the Bureau to test all master scales each year, this can not

always be accomplished without detriment to other important objectives of the field operations. Occasional and minor deviations from the normal twelve-month cycle of calibration are not considered to be serious because of the high standards of maintenance and the inherent accuracy of these installations.

IV. COMMERCIAL RAILWAY TRACK SCALE TESTS

TEST METHODS AND TOLERANCES.

Descriptions of Bureau track scale test technic and statements of the applicable tolerances have appeared in previous reports and will be omitted from this one.

The special 0.30 percent tolerance relating to errors in the individual component sections of some types of track scales was adopted by the Bureau at the beginning of the fiscal year 1940. (Only seven of the 1036 scales tested this year were affected by the special proviso.)

ITINERARIES OF TEST UNITS.

The itineraries of the three railway track scale testing equipments of the Bureau are based upon approximately twelve months of field operation, and are submitted to and approved in advance by the participating carriers. The routes followed during the period covered by this report are indicated by the dotted lines in Fig. 1.

CLASSIFICATION OF SCALES.

In ensuing tabulations and discussions of data, all scales are classified both as to ownership and as to geographical location. The ownership classes are "railroad-owned" and "industry-owned", frequently designated merely as "railroad" and "industry" scales. Railroad-owned scales are those owned by common carriers; in the very large majority of instances they are used by the carriers for determining weights of commodities in carload lots for the purpose of assessing freight charges; however, shippers and consignees often utilize these weights in the sale or purchase of the commodity transported. All scales not falling within the category of railroad-owned scales are classified as industry-owned; these are usually owned by industrial concerns, although a very few are owned by other agencies, such as Federal, State, or local governments. Industry scales are largely used for determining weights in connection with the purchase or sale of goods; a small percentage are employed in manufacturing operations; when a "weight agreement" is in effect between a shipper and a carrier, weights ascertained on an industry-owned scale are accepted by the carrier as the basis for the assessment of freight charges.



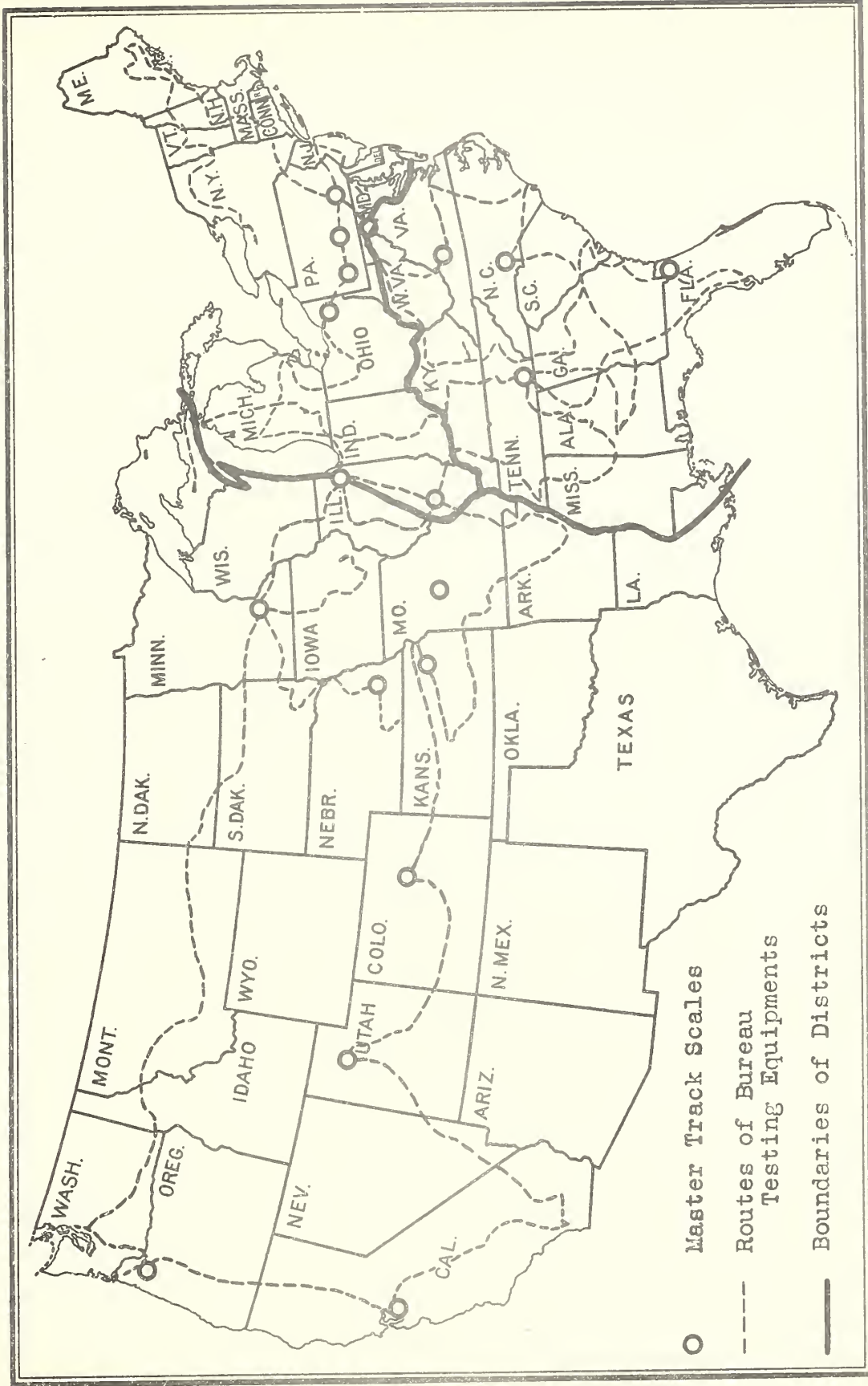
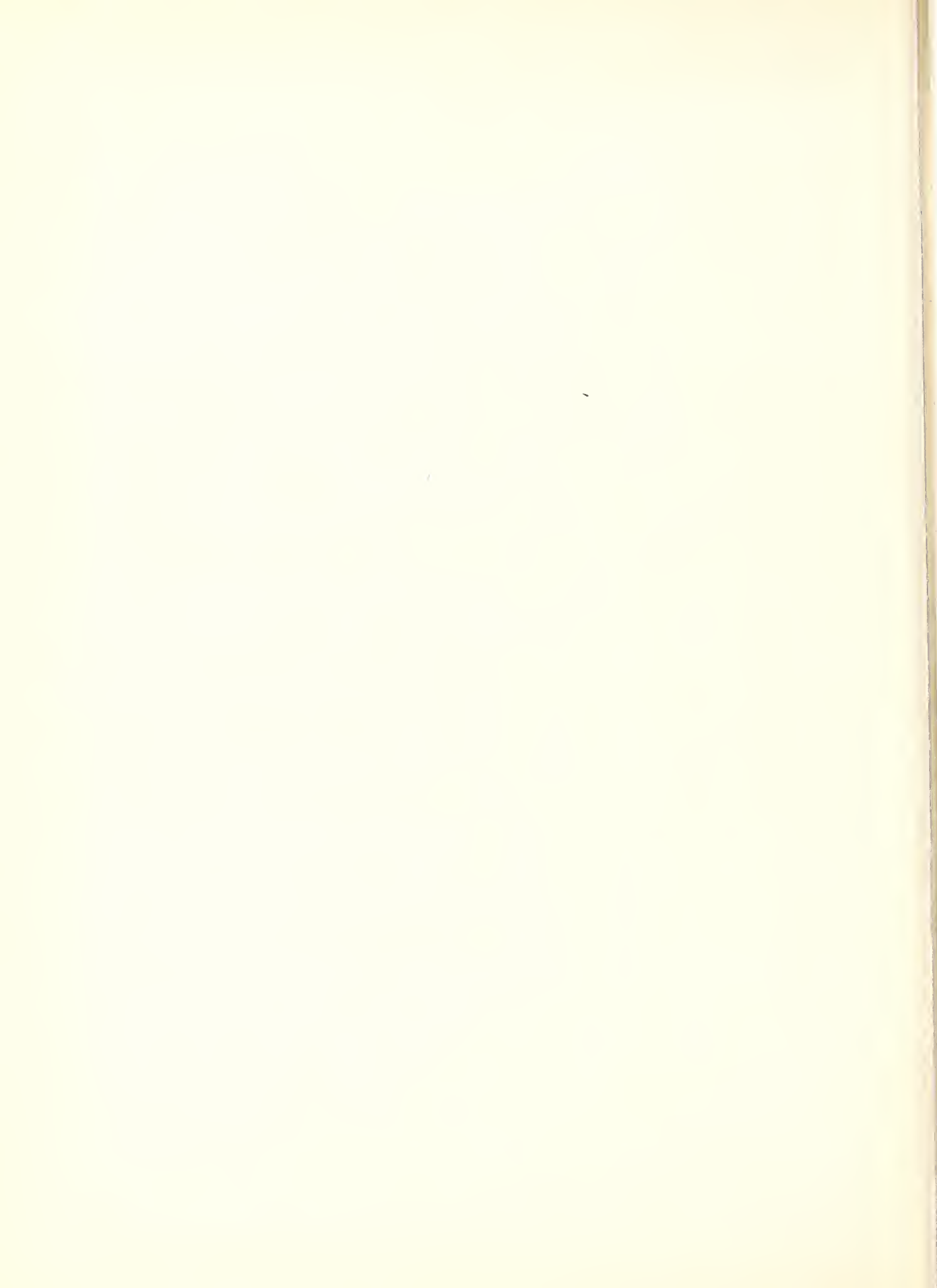


Figure 1



The basis of geographical classification for scales is that adopted by the Interstate Commerce Commission in its "Reports on the Statistics of Railways in the United States", and recognizes three "districts", the Eastern, the Southern, and the Western. The common boundaries of these districts are shown by the solid lines in Figure 1; it should be noted, however, that the Interstate Commerce Commission has in certain cases necessarily assigned to a particular district a carrier having some lines in another district, and that the same assignments have been followed in the classification of scales in this report.

As to classification upon the basis of weighing performance, all railway track scales tested are designated as "accurate" or "inaccurate" according to the results of the tests made upon them in the condition in which they were found, the criterion being the basic maintenance tolerance of ± 0.20 percent and the limiting sectional tolerance of ± 0.30 percent. Special requirements are prescribed for scales in grain-weighing service. These have been disregarded except in computing the data presented in the section devoted to "Scales in Grain-Weighing Service," for which the criterion of accuracy is a special basic maintenance tolerance of ± 0.10 percent.

SUMMARY OF TEST RESULTS.

Table 1 is a statistical summary of the results of the tests made on railway track scales during the year. The data show results on railroad-owned, industry-owned, and total scales for each district and for the nation as a whole. Attention is directed to the explanatory footnote regarding the effect on the statistical data of one scale which was in error by a grossly abnormal amount and which was excluded in computing mean values based on maximum percentage errors so that these would not be unduly affected.

TABLE 1. SUMMARY OF RAILWAY TRACK SCALE TEST DATA

(Figures not in parentheses are for the Fiscal Year 1941; figures in parentheses are for the Fiscal Year 1940, and are included for purposes of comparison.)

District and scale ownership	Number of scales tested	Accurate		Inaccurate		Mean numerical error -- percentage of applied load
		Number	Per- cent	Number	Per- cent	
EASTERN						
Railroad	242 (227)	193 (202)	79.8 (89.0)	49 (25)	20.2 (11.0)	0.14 (0.13)
Industry	165 (147)	134 (105)	81.2 (71.4)	31 (42)	18.8 (28.6)	0.20(a) (0.21)
Totals	407 (374)	327 (307)	80.3 (82.1)	80 (67)	19.7 (17.9)	0.17(b) (0.16)
SOUTHERN						
Railroad	214 (118)	152 (83)	71.0 (70.3)	62 (35)	29.0 (29.7)	0.22 (0.19)
Industry	115 (92)	65 (60)	56.5 (65.2)	50 (32)	43.5 (34.8)	0.24 (0.20)
Totals	329 (210)	217 (143)	66.0 (68.1)	112 (67)	34.0 (31.9)	0.22 (0.19)
WESTERN						
Railroad	191 (242)	170 (227)	89.0 (93.8)	21 (15)	11.0 (6.2)	0.12 (0.10)
Industry	109 (178)	90 (144)	82.6 (80.9)	19 (34)	17.4 (19.1)	0.29 (0.16)
Totals	300 (420)	260 (371)	86.7 (88.3)	40 (49)	13.3 (11.7)	0.18 (0.12)
ALL DISTRICTS						
Railroad	647 (587)	515 (512)	79.6 (87.2)	132 (75)	20.4 (12.8)	0.16 (0.13)
Industry	389 (417)	289 (309)	74.3 (74.1)	100 (108)	25.7 (25.9)	0.24(c) (0.19)
Grand Totals	1036 (1004)	804 (821)	77.6 (81.8)	232 (183)	22.4 (18.2)	0.19(d) (0.15)

In computing the values (a), (b), (c), and (d), one scale with the abnormally large error of 18.12 percent was excluded; otherwise these values would have been respectively, 0.31%, 0.21%, 0.28%, and 0.21%.

As indicated in Table 1 the total number of scales tested during the year was 1036, a somewhat greater number than that for the preceding year. Sixty-two and one-half percent of the total were railroad-owned scales and 37.5 percent were industry-owned, approximately the same ratio prevailing in each district. Thirty-nine percent of the tests were made in the Eastern District, 32 percent in the Southern District, and 29 percent in the Western District.

The items in the third column, denoting the percentages of scales found accurate, are the data of chief interest for they indicate the proportion of scales which conformed to adopted requirements for weighing accuracy in each ownership and location category. Next in order of significance are the values in the extreme right hand column which are the averages of mean maximum percentage weighing errors developed during tests and which thus indicate the average magnitude of weighing inaccuracies for the several categories.

With respect to percentages of accurate scales, it will be noted that 77.6 percent of the total number of scales tested were found accurate as compared with 81.8 percent in the preceding year, that the total percentage for each district was also slightly less than the corresponding percentage for last year, that a marked decrease developed in the percentage of accurate railroad-owned scales for all districts, and that the percentage of accurate industry-owned scales for all districts remained virtually the same as last year.

As to the mean error values in the final column, this year's grand total value of 0.19 percent represents an appreciable increase over last year. Increases of varying degree developed for each district, and, with one exception, there were increases in each ownership class. Although a comparison of the totals and averages for the years 1940 and 1941 shows a decrease in the proportion of accurate scales and a concurrent increase in the magnitude of the average weighing inaccuracy, consideration of variable factors involved in the collection of basic source data in successive years does not justify conclusion that a retrogressive trend is definitely indicated.

RAILROADS CLASSIFIED ON BASIS OF CHARACTER OF RESULTS OBTAINED.

Upon 47 railroads, 5 or more railroad-owned scales were tested, the number of scales on individual railroads ranging from 5 to 42; in Table 2 these railroads are classified upon the basis of the percentages of the tested scales which were found accurate for each.

TABLE 2. RAILROADS CLASSIFIED ON BASIS OF PERCENTAGE OF RAILROAD-OWNED SCALES FOUND ACCURATE

Groups -- Percentages of scales accurate	Railroads falling in the several groups		Scales tested on railroads in the several groups	
	Number	Percent	Number	Average number per railroad
100%	15	32	171	11
90% - 99%, incl.	7	15	95	14
80% - 89%, incl.	10	21	126	13
70% - 79%, incl.	2	4	26	13
Less than 70%	13	28	141	11
Totals	47	100	559	12

In Table 3 this same group of railroads is classified upon the basis of the mean errors of all railroad-owned scales tested for each railroad.

TABLE 3. RAILROADS CLASSIFIED ON BASIS OF MEAN ERROR OF RAILROAD-OWNED SCALES TESTED

Groups -- Ranges of mean errors of scales	Railroads falling in the several groups		Scales tested on railroads in the several groups	
	Number	Percent	Number	Average number per railroad
Not more than 0.05%	2	4	23	12
0.06% to 0.10%, incl.	12	26	159	13
0.11% to 0.15%, incl.	16	34	172	11
0.16% to 0.20%, incl.	7	15	81	12
More than 0.20% (0.21% to 0.27%)	10	21	124	12
Totals	47	100	559	12

The data presented in Table 3 may be restated as follows: Two railroads, or 4 percent, have a mean error on all scales tested of not more than 0.05 percent (one-quarter of the basic tolerance), 14 railroads, or 30 percent, have mean errors of not more than 0.10 percent (one-half the basic tolerance), 30 railroads, or 64 percent, have mean errors of not more than 0.15 percent (three-fourths of the basic tolerance), and 37 railroads, or 79 percent, have mean errors of not more than 0.20 percent (the basic tolerance figure); in the case of the remaining 10 roads, or 21 percent, the mean errors are more than 0.20 percent. Last year's figures in these four accuracy groups were, respectively, 11, 56, 87, and 13 percent of the 37 railroads involved last year.

Five hundred and fifty-nine scales in all were tested on these 47 railroads. Four hundred and thirty-five scales, or 77.8 percent, were found accurate. Of the remaining 88 scales tested upon all other lines, 80 scales, or 90.9 percent, were found accurate.

RELATIVE ADEQUACY OF RAILROAD-OWNED AND INDUSTRY-OWNED SCALES.

In Table 4 the quality of performance of railroad-owned scales and industry-owned scales, tested in the fiscal years 1930 to 1941, are compared. Plus signs in columns 4 and 7 indicate superiority of railroad-owned scales over industry-owned scales.

TABLE 4. RELATIVE QUALITY OF PERFORMANCE OF RAILROAD-OWNED AND INDUSTRY-OWNED RAILWAY TRACK SCALES, 1930-1941

Year	Percentage of tested scales found accurate			Mean numerical error -- percentage of applied load		
	Railroad	Industry	Difference (2)-(3)	Railroad	Industry	Difference (6)-(5)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1930	76.2	67.6	+8.6	0.19	0.22	+0.03
1931	79.9	72.3	+7.6	0.16	0.25	+0.09
1932	81.4	77.6	+3.8	0.15	0.20	+0.05
1933	80.3	81.1	-0.8	0.17	0.16	-0.01
1934	84.4	71.1	+13.3	0.13	0.22	+0.09
1935	80.6	74.0	+6.6	0.18	0.20	+0.02
1936	78.1	67.4	+10.7	0.19	0.26	+0.07
1937	83.7	65.7	+18.0	0.14	0.27	+0.13
1938	82.8	79.2	+3.6	0.17	0.17	0.00
1939	87.4	80.4	+7.0	0.13	0.16	+0.03
1940	87.2	74.1	+13.1	0.13	0.19	+0.06
1941	79.6	74.3	+5.3	0.16	0.28	+0.12

Table 4 should be studied carefully. It shows a persistent superiority in accuracy of railroad-owned as compared with industry-owned scales. In the Bureau's opinion this is the result of the superior standards of maintenance and repair provided by most railroads. Unfortunately, certain railroads have in recent years adopted or extended the practice of charging for the testing of some industry-owned scales, and this has tended to cut down the frequency of test. The situation is fundamentally unsound, because the principal function of industry-owned scales is to establish a basis of sale and purchase of commodities, while railroad-owned scales are used principally to determine the basis for freight charges at relatively low cost per unit of weight.

ERROR FREQUENCY DISTRIBUTION.

Table 5 shows the frequency distribution of the errors on railway track scales tested during the year. Data are given for railroad-owned scales and for industry-owned scales for each district and for the country as a whole.

TABLE 5. FREQUENCY DISTRIBUTION OF RAILWAY TRACK SCALE ERRORS

Errors --- percentage of applied load	EASTERN			SOUTHERN			WESTERN			ALL		
	DISTRICT		Indus-try	DISTRICT		Indus-try	DISTRICT		Indus-try	DISTRICTS		Indus-try
	Rail-road	Percent of scales tested		Rail-road	Percent of scales tested		Rail-road	Percent of scales tested		Rail-road	Percent of scales tested	
Accurate scales												
0.00 to 0.05 incl.	24.0	19.4	14.5	10.4	34.0	23.9	23.8	18.0				
0.06 to 0.10 "	23.5	35.8	24.8	20.9	28.3	36.7	25.3	31.6				
0.11 to 0.15 "	19.9	17.5	19.1	13.9	14.7	10.1	18.1	14.4				
0.16 to 0.20 "	12.4	8.5	12.6	11.3	12.0	11.9	12.4	10.3				
Inaccurate scales												
0.21 to 0.25 incl.	5.8	5.5	4.2	10.5	3.2	1.8	4.5	5.9				
0.26 to 0.30 "	6.2	3.0	1.9	6.1	2.1	2.8	3.6	3.8				
0.31 to 0.35 "	2.5	3.0	6.5	7.8	2.1	1.8	3.7	4.1				
0.36 to 0.40 "	0.8	0.6	4.7	2.6	0.5	0.0	2.0	1.0				
0.41 to 0.45 "	0.8	0.6	0.9	5.2	0.0	0.0	0.6	1.8				
0.46 to 0.50 "	1.7	0.6	1.4	2.6	1.0	0.9	1.4	1.3				
0.51 to 1.00 "	1.2	1.25	5.6	7.8	1.6	7.4	2.8	4.9				
Over 1.00	0.0	3.0	3.3	0.9	0.5	1.8	1.2	2.1				
More than 0.30 at one position	1.2	1.25	0.5	0.0	0.0	0.9	0.6	0.8				
Mean numerical errors												
Accurate scales	0.10	0.10	0.10	0.11	0.09	0.09	0.10	0.10				
Inaccurate scales	0.33	0.70(a)	0.49	0.40	0.41	1.21	0.42	0.65(b)				
All scales, 1941	0.14	0.20(c)	0.22	0.24	0.12	0.29	0.16	0.24(d)				
Mean numerical errors,												
All scales, 1940	0.13	0.21	0.19	0.20	0.10	0.16	0.13	0.19				

In computing the values (a), (b), (c), and (d), one scale with the abnormally large error of 18.12 percent was excluded; otherwise these values would have been, respectively, 1.26%, 0.82%, 0.31%, and 0.28%.

From the data presented in Table 5, certain general data may be derived, as presented in Table 6.

TABLE 6. CUMULATIVE DATA DERIVED FROM TABLE 5

Error Groups	EASTERN DISTRICT		SOUTHERN DISTRICT		WESTERN DISTRICT		ALL DISTRICTS	
	Rail- road	Indus- try	Rail- road	Indus- try	Rail- road	Indus- try	Rail- road	Indus- try
	Percent of 242	Percent of 165	Percent of 214	Percent of 115	Percent of 191	Percent of 109	Percent of 647	Percent of 389
Scalés accurate within:								
1/4 basic tolerance	24.0	19.4	14.5	10.4	34.0	23.9	23.8	18.0
1/2 basic tolerance	47.5	55.2	39.3	31.3	62.3	60.6	49.1	49.6
3/4 basic tolerance	67.4	72.7	58.4	45.2	77.0	70.7	67.2	64.0
Full basic tolerance	79.8	81.2	71.0	56.5	89.0	82.6	79.6	74.3
Scalés inaccurate by more than:								
Basic tolerance ^a	20.2	18.8	29.0	43.5	11.0	17.4	20.4	25.7
Twice basic tolerance	3.7	5.4	11.2	16.5	3.1	10.1	6.0	10.1
2 1/2 times basic tolerance	1.2	4.2	8.9	8.7	2.1	9.2	4.0	7.0

^a Including scales of more than two sections, inaccurate only by reason of sectional errors in excess of 0.30 percent.

SCALES IN GRAIN-WEIGHING SERVICE.

In the foregoing material the basis for determining accuracy has been the regular maintenance tolerance of ± 0.20 percent with the limiting sectional tolerance of ± 0.30 percent. However, as has been mentioned, a special tolerance of ± 0.10 percent* is applicable to scales in grain-weighing service. This tolerance was adopted by the Bureau pursuant to the recommendation of the Interstate Commerce Commission in Docket 9009 (56 ICC 347). The results of tests on industry scales in grain-weighing service, when this special tolerance is made the criterion, are entered on the last line of Table 7, following corresponding data for the eleven preceding years.

TABLE 7. TEST DATA ON RAILWAY TRACK SCALES IN GRAIN-WEIGHING SERVICE, 1930-1941

Fiscal Year	Number of Scales Tested	Within Special Grain-Scale Tolerance		Not Within Special Grain-Scale Tolerance		Mean Numerical Error--Percentage of Applied Load	
		Number	Percent	Number	Percent	Grain Scales	All industry scales
1930	47	22	46.8	25	53.2	0.15	0.23
1931	97	51	52.6	46	47.4	0.12	0.25
1932	72	46	63.9	26	36.1	0.13	0.20
1933	58	34	58.6	24	41.4	0.13	0.16
1934	96	55	57.3	41	42.7	0.15	0.22
1935	122	88	72.1	34	27.9	0.12	0.20
1936	91	46	50.5	45	49.5	0.16	0.26
1937	40	21	52.5	19	47.5	0.16	0.27
1938	105	68	64.8	37	35.2	0.12	0.17
1939	58	33	56.9	25	43.1	0.12	0.16
1940	52	32	61.5	20	38.5	0.15	0.19
1941	71	55	77.5	16	22.5	0.10	0.28

* For scales of more than two sections, this tolerance is applied to the largest mean value which can be derived from two errors developed during a single test run "for positions farther apart than the distance between adjacent sections," instead of "for positions not closer together than the distance between adjacent sections" as in the case of the tolerance applicable to scales not in grain-weighing service.

The data in Table 7 show that the percentage of accurate grain scales is greater this year than in any preceding year; also, the mean percentage error is less. However, the erratic record of these scales in the past should be considered before accepting this year's figures as assurance of a general trend.

The frequency distribution of the errors on grain-weighing scales is shown in Table 8. For purposes of comparison, similar data are included for industry-owned scales other than grain scales, and for all railroad-owned scales.

TABLE 8. FREQUENCY DISTRIBUTION OF ERRORS OF RAILWAY TRACK SCALES IN SEVERAL GROUPS

Errors -- percent of applied load	Grain-weighing service	Industry-owned other than grain	Railroad- owned
	Percent of 71 scales tested	Percent of 318 scales tested	Percent of 647 scales tested
0.00 to 0.05, incl.	28.2	15.7	23.8
0.06 to 0.10 "	49.3	27.7	25.3
Subtotals	(77.5)	(43.4)	(49.1)
0.11 to 0.15, incl.	5.6	16.4	18.1
0.16 to 0.20 "	7.0	11.0	12.4
Subtotals	(90.1)	(70.8)	(79.6)
0.21 to 0.25, incl.	2.8	6.6	4.5
0.26 to 0.30 "	5.7	3.5	3.6
0.31 to 0.35 "	0.0	5.0	3.7
0.36 to 0.40 "	0.0	1.2	2.0
0.41 to 0.45 "	1.4	1.9	0.6
0.46 to 0.50 "	0.0	1.6	1.4
0.51 to 1.00 "	0.0	6.0	2.8
Over 1.00	0.0	2.5	1.2
More than 0.30 at one position	0.0	0.9	0.6
Mean numerical errors:			
Scales in error from 0.00 to 0.20%	0.08	0.10	0.10
Scales in error by more than 0.20%	0.30	0.87	0.42
All scales	0.10	0.33	0.16

The data in the preceding table make possible a direct comparison for the fiscal year 1941 between the accuracy of scales used in grain-weighing service and the accuracy of scales of the other groups included; note particularly the second series of subtotals, showing percentages of scales found accurate within the ordinary tolerances applied to railway track scales.

ADJUSTMENTS ON SCALES

It is not deemed a primary function of the Railway Track Scale Testing Service of the Bureau to improve, as a part of its tests, the mechanical condition or the accuracy of the scales tested; this responsibility rests primarily upon other agencies. However, from time to time it is found practicable to correct minor mechanical faults, and, in the case of scales which are in such mechanical condition as to justify adjustment for weighing accuracy, it is sometimes considered expedient to make adjustments and retests, particularly when requested to do so by a representative of the scale owner present at a test.

During the year corrective adjustments and/or slight modifications were attempted on 89 railroad-owned and 34 industry-owned scales. In the case of the railroad-owned scales, 46 originally found inaccurate were determined to be accurate after adjustments or corrections, while in the case of 40 accurate scales the weighing errors were reduced; three inaccurate scales failed to respond to adjustment and, although the weighing errors were reduced, were left inaccurate. In the case of the industry-owned group of 34 scales, 20 scales originally found inaccurate were left weighing within tolerance, and the errors of 14 scales originally found accurate, were reduced. A summary of conditions "as found" and "as left" is presented in Table 9.

TABLE 9. COMPARISON OF CONDITIONS OF RAILWAY TRACK SCALES AS FOUND, AND AS LEFT AFTER ADJUSTMENTS

Scale ownership	Accurate		Inaccurate		Mean numerical error -- percentage of applied load
	Num-ber	Per-cent	Num-ber	Per-cent	
RAILROAD-OWNED (647 scales)					
As found	515	79.6	132	20.4	0.16
As left	561	86.7	86	13.3	0.14
INDUSTRY-OWNED (389 scales)					
As found	289	74.3	100	25.7	0.28
As left	309	79.4	80	20.6	0.22
TOTALS (1036 scales)					
As found	804	77.6	232	22.4	0.21
As left	870	84.0	166	16.0	0.17

DISTRIBUTION OF TESTS BY DISTRICTS.

The distribution, by Districts, of the railway track scale tests made in 1941, was as shown below. The totals for the numbers of scales in service, upon which the percentages are based, are estimates made as of July 1, 1939.

In All Districts

647 or 19 percent of some 3400 railroad-owned scales
389 or 12 percent of some 3350 industry-owned scales
1036 or 15 percent of some 6750 total scales.

In Eastern District

242 or 19 percent of some 1275 railroad-owned scales
165 or 12 percent of some 1375 industry-owned scales
407 or 15 percent of some 2650 total scales

In Southern District

214 or 29 percent of some 750 railroad-owned scales
115 or 17 percent of some 675 industry-owned scales
329 or 23 percent of some 1425 total scales

In Western District

191 or 14 percent of some 1375 railroad-owned scales
109 or 8 percent of some 1300 industry-owned scales
300 or 11 percent of some 2675 total scales.

SCALES NOT FORMERLY OR RECENTLY TESTED BY THE BUREAU.

For several years the itineraries and schedules of the Bureau test units have been planned with a view to testing as many as practicable of the scales not previously or recently tested by the Bureau. Pursuant to this policy tests were made on a total of 123 scales which had not been formerly tested by the Bureau and 48 scales which had not been tested for ten or more years. Table 10 shows the distribution of the testing service on the basis of the interval since the last preceding Bureau test.

TABLE 10. TESTED SCALES CLASSIFIED ON BASIS OF PERIODS ELAPSING SINCE LAST FORMER TESTS BY BUREAU EQUIPMENTS

Scale Owner- ship	Number of scales tested	No former test ^a		Last former test:					
				10 years or more ago		5 - 9 years ago		Less than 5 years ago	
				Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
RAILROAD	647	46	7	44	7	265	41	292	45
INDUSTRY	389	77	20	4	1	113	29	195	50
TOTAL	1036	123	12	48	5	378	36	487	47

^a Records on railroad-owned scales are complete from the beginning of the service; on industry-owned scales from July 1, 1928.

Although satisfactory progress is being made in gradually reducing the number of scales which the Bureau has not tested to date, the following circumstances combine to render a total elimination of such scales in the early future increasingly difficult: (1) The isolated location of numerous individual scales situated on spur lines remote from main lines, (2) the inaccessibility during certain seasons of the year of very many scales located at cane and beet sugar mills, cotton seed oil mills, etc., (3) the status of a considerable number of scales which are temporarily out of service, and (4) the impracticability of reaching some scales without an excessive loss of time. Estimates of the number and percentages of scales remaining untested in each district and ownership group are given in Table 11.

TABLE 11. SUMMARY OF SCALES NOT TESTED BY BUREAU EQUIPMENTS

Ownership and District	Total scales in service (est.)	Scales Not Tested as of June 30, 1941	
		Number ^a (est.)	Percentage of total scales in service
RAILROAD			
Eastern	1275	24	2
Southern	750	14	2
Western	1375	82	6
All Districts	3400	120	4
INDUSTRY			
Eastern	1375	119	9
Southern	675	64	9
Western	1300	260	20
All Districts	3350	443	13
ALL SCALES			
Eastern	2650	143	5
Southern	1425	78	5
Western	2675	342	13
All Districts	6750	563	8

^a Records on railroad-owned scales are complete from the beginning of the service, on industry-owned scales from July 1, 1928.

DISTRIBUTION, BY STATES, OF RAILWAY TRACK SCALES AND TESTS.

The estimated total numbers of railway track scales in the United States and in each separate classification of ownership and location have been stated earlier in this report. A breakdown of the data to show, by States and without ownership differentiation, the estimated number of scales in each State and the actual numbers last tested in given intervals, is shown in Tables 12 and 13.

Table 12 lists the estimated number and percentage of scales which are located in each State, and the actual number and percentage of those which have been tested by the Bureau to date. A study of the table will show that in three States and the District of Columbia all scales have been tested, that in 36 States and the District of Columbia 90 percent or more have been tested, and that in only one State have less than 80 percent been tested. A comparison of the values in the second column, representing the percentage of scales located in each State, with the final column, representing the percentage of tests made in each State, indicates that distribution of the testing service over the years has been very closely proportional to distribution of the scales.

Table 13 shows the numbers and percentages of scales which were tested in each State during specific intervals. It is worthy of note that in only six States have less than 50 percent of the scales been tested during the past 5 years; in seven States, 90 percent or more of the scales have been tested during this 5-year interval, corresponding percentages for the remaining 35 States and the District of Columbia ranging from 52 to 89 percent. Considering all scales in the United States, 69 percent have been tested during the past five-year period.

(In Tables 12 and 13, percentages of State totals are reported to the nearest whole percent, fractions having been rounded out. This results, in some instances, in a difference between the percentage shown for a particular State in the fourth column of Table 12 and the sum of the percentages shown for the same State in the third, fifth, and seventh columns of Table 13; however, all percentages in each of these tables are correctly computed upon the basis of the corresponding numbers of scales reported.)

TABLE 12. DISTRIBUTION, BY STATES, OF RAILWAY TRACK SCALES ON RECORD AND OF RAILWAY TRACK SCALES TESTED TO DATE

State	Scales on Record		Scales Tested		
	Num- ber (est.)	Percent of Total in U. S.	Num- ber	Percent of State Total	Percent of Total in U.S.
Alabama	163	2.4	152	93	2.5
Arizona	20	0.3	18	90	0.3
Arkansas	100	1.5	89	89	1.4
California	179	2.6	174	97	2.8
Colorado	134	2.0	109	81	1.8

TABLE 12. (Continued)

State	Scales on Record		Scales Tested		
	Num- ber (est.)	Percent of Total in U. S.	Num- ber	Percent of State Total	Percent of Total in U. S.
Connecticut	45	0.7	40	89	0.6
Delaware	14	0.2	13	93	0.2
District of Columbia	9	0.1	9	100	0.1
Florida	78	1.1	77	99	1.2
Georgia	203	3.0	195	96	3.1
Idaho	33	0.5	31	94	0.5
Illinois	588	8.7	533	91	8.6
Indiana	278	4.1	260	93	4.2
Iowa	159	2.4	127	80	2.1
Kansas	164	2.4	152	93	2.5
Kentucky	187	2.8	173	93	2.8
Louisiana	146	2.2	125	86	2.0
Maine	38	0.6	38	100	0.6
Maryland	68	1.0	64	94	1.0
Massachusetts	98	1.5	88	90	1.4
Michigan	243	3.6	233	96	3.8
Minnesota	172	2.5	155	90	2.5
Mississippi	106	1.6	101	95	1.6
Missouri	181	2.7	170	94	2.7
Montana	44	0.6	42	95	0.7
Nebraska	73	1.1	69	95	1.1
Nevada	11	0.2	9	82	0.1
New Hampshire	23	0.3	22	96	0.4

TABLE 12. (Continued)

State	Scales on Record		Scales Tested		
	Num- ber (est.)	Percent of Total in U. S.	Num- ber	Percent of State Total	Percent of Total in U.S.
New Jersey	155	2.3	147	95	2.4
New Mexico	25	0.4	11	44	0.2
New York	302	4.5	276	91	4.5
North Carolina	120	1.8	118	98	1.9
North Dakota	21	0.3	17	81	0.3
Ohio	478	7.1	438	92	7.1
Oklahoma	113	1.7	90	80	1.5
Oregon	33	0.5	31	94	0.5
Pennsylvania	710	10.5	659	93	10.6
Rhode Island	14	0.2	14	100	0.2
South Carolina	70	1.0	66	94	1.1
South Dakota	21	0.3	21	100	0.3
Tennessee	154	2.3	147	95	2.4
Texas	350	5.2	308	88	5.0
Utah	54	0.8	43	80	0.7
Vermont	24	0.3	23	96	0.4
Virginia	128	1.9	124	97	2.0
Washington	75	1.1	74	99	1.2
West Virginia	85	1.2	80	94	1.3
Wisconsin	225	3.3	199	88	3.2
Wyoming	43	0.6	40	93	0.6

TABLE 13. NUMBER AND PERCENTAGE OF SCALES LAST TESTED IN EACH STATE IN GIVEN INTERVALS

State	Scales on Record	Last Tested					
		1937-41 inclusive		1932-36 inclusive		Before 1932	
		Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Alabama	163	103	63	47	29	2	1
Arizona	20	18	90	0	0	0	0
Arkansas	100	75	75	12	12	2	2
California	179	151	84	20	11	3	2
Colorado	134	70	52	26	19	13	10
Connecticut	45	38	84	2	4	0	0
Delaware	14	9	64	2	14	2	14
Dist. of Columbia	9	8	89	1	11	0	0
Florida	78	64	82	13	17	0	0
Georgia	203	145	72	49	24	1	0
Idaho	33	26	79	5	15	0	0
Illinois	588	317	54	189	32	27	5
Indiana	278	162	58	93	33	5	2
Iowa	159	71	45	44	28	12	8
Kansas	164	96	59	47	29	9	5
Kentucky	187	149	80	23	12	1	1
Louisiana	146	85	58	29	20	11	8
Maine	38	34	89	4	11	0	0
Maryland	68	63	93	1	1	0	0
Massachusetts	98	72	73	16	16	0	0
Michigan	243	186	77	37	15	10	4
Minnesota	172	113	66	33	19	9	5

TABLE 13. (Continued)

State	Scales on Record	Last Tested					
		1937-41 inclusive		1932-36 inclusive		Before 1932	
		Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Mississippi	106	68	64	31	29	2	2
Missouri	181	102	56	60	33	8	4
Montana	44	38	86	4	9	0	0
Nebraska	73	41	56	21	29	7	10
Nevada	11	3	27	6	55	0	0
New Hampshire	23	20	87	2	9	0	0
New Jersey	155	137	88	9	6	1	1
New Mexico	25	11	44	0	0	0	0
New York	302	208	69	57	19	11	4
North Carolina	120	112	93	5	4	1	1
North Dakota	21	13	62	3	14	1	5
Ohio	478	347	73	84	18	7	1
Oklahoma	113	43	38	44	39	3	3
Oregon	33	30	91	1	3	0	0
Pennsylvania	710	588	83	60	8	11	2
Rhode Island	14	11	79	3	21	0	0
South Carolina	70	47	67	18	26	1	1
South Dakota	21	7	33	13	62	1	5
Tennessee	154	116	75	30	19	1	1
Texas	350	210	60	80	23	18	5
Utah	54	36	67	6	11	1	2
Vermont	24	21	88	2	8	0	0

TABLE 13. (Continued)

State	Scales on Record	Last Tested					
		1937-41 inclusive		1932-36 inclusive		Before 1932	
		Num- ber	Per- cent	Num- ber	Per- cent	Num- ber	Per- cent
Virginia	128	115	90	8	6	1	1
Washington	75	68	91	6	8	0	0
West Virginia	85	78	92	0	0	2	2
Wisconsin	225	143	64	28	12	28	12
Wyoming	43	16	37	23	53	1	2

V. RAILWAY TRACK SCALE TEST-WEIGHT CARS

STANDARDIZATION OF RAILWAY TRACK SCALE TEST-WEIGHT CARS ON BUREAU MASTER TRACK SCALE

During the year 29 railway track scale test-weight cars, operated by 15 railways, were submitted for standardization one or more times to the Bureau Master Scale Depot at Clearing, Ill., a total of 49 such standardizations having been made. The nominal weights of these cars ranged from 30,000 pounds to 92,500 pounds, although 18 cars, or 62 percent of the total number, were 80,000-pound cars. Sixteen of the cars submitted conformed in the most essential respects with recommended specifications for test-weight cars.

Essential data on all standardizations of test-weight cars on the Bureau master track scale are shown in Table 14. As in previous reports individual cars are designated by letters. When the letter is enclosed in parentheses, (), this indicates that the car conforms essentially to the recommended specifications. An error in the column headed "Plus" denotes that the actual weight of the car exceeded its nominal weight value by the amount shown; an error in the column headed "Minus" denotes the converse. An asterisk, (*), is used in connection with the error in instances where there was information to the effect that the car had been repaired or altered since the last preceding standardization by the Bureau, or where there was evidence that this was the case. However, it is often difficult to get this information, so it cannot be said with certainty that when the symbol is omitted, the car in question had not been so altered or repaired; the absence of the symbol indicates only that this was not ascertained or apparent.

TABLE 14. STANDARDIZATIONS OF RAILWAY TRACK SCALE
TEST-WEIGHT CARS ON BUREAU MASTER TRACK SCALE

Designation of test car	Bureau Report No.	Nominal weight in pounds	Period in months since last preceding standardization	Error in pounds	
				Plus	Minus
(A)	666	80 000	8		4*
	696		8	8*	
(B)	667	80 000	4		18*
	688		5	5	
	692		1		2*
	711		4		21*
C	668	80 000	2		10
	683		4	48*	
	689		1	50*	
	702		3	53*	
D	669	80 000	5		27*
	695		6		17
(E)	670	80 000	7		269*
	704		7		355*
F	671	61 400	2		19
	691		4	38	
	708		3		48*
G	672	30 000	3		18
H	673	80 000	3		8
I	674	80 000	5	26*	
	709		8	69*	
J	675	61 600	5		49
	699		6		16*
	714		3		17
(K)	676	80 000	10	1	
(L)	677	30 000	First std.		15
M	678	60 000	6	2	
	706		6	30	
N	679	80 000	6		53
	705		6	4	

TABLE 14. (Continued)

Designation of test car	Bureau Report No.	Nominal weight in pounds	Period in months since last preceding standardization	Error in pounds	
				Plus	Minus
(O)	680	80 000	9		15*
	701			5	6
(P)	681	80 000	12		5*
Q	682	50 000	13		12*
(R)	684	80 000	6		9
	710			6	5
S	685	92 500	8	66	
(T)	686	80 000	6	6	
(U)	687	80 000	13		101*
V	690	60 600	7 (a)		5
(W)	693	80 000	10		6
	712			4	5*
(X)	694	40 000	10		1
	713			4	5*
(Y)	697	80 000	18		9*
(Z)	698	80 000	11	68*	
(AA)	700	80 300	16		11*
(BB)	703	80 300	13	9*	
CC	707	80 000	14	24*	

29 Cars 49 Standardizations

(a) The car had been weighed in the field four months prior to this standardization and therefore this was not considered to be a "normal" submission.

Frequency of Submission. Fifteen of the 29 cars listed in Table 14, or 52 percent, were submitted for standardization only once during the year; 10 cars, or 34 percent, were submitted twice; 2 cars were submitted three times; and 2 cars were submitted four times. One of the cars standardized had not previously been submitted. Considering the remaining 48 "normal" submissions, it is found that the shortest period between standardizations on the Bureau master scale was one month (2 instances), and the longest eighteen months (1 instance). There were 27 periods between 2 and 6 months, inclusive (56 percent); 13 periods between 7 and 12 months, inclusive (27 percent); 3 periods of 13 months; 1 period of 14 months; 1 period of 16 months; and one period of 18 months. The average period was 6.8 months.

Errors on Non-Repaired Cars. In the case of 23 standardizations of cars, it was not ascertained and there was no evidence that the cars had been repaired since the preceding standardization. Eight of these cars were found to be above nominal weight by an average amount of 19 pounds, 15 were below nominal weight by an average amount of 16 pounds, and the average numerical error of all, without regard to sign, was 17 pounds. Nine of these cars conformed to essential specification requirements. Of this group, 3 were found heavy and 6 were found light, the average error being 6 pounds; of the 14 remaining non-specification cars 5 were found to be heavy, and 9 were found to be light, the average error being 24 pounds.

WEIGHING OF TEST-WEIGHT CARS IN THE FIELD

In connection with tests of commercial railway track scales, the Bureau customarily makes field weighings of such test-weight cars as are presented for this purpose. In each case the weighing is made on a scale which is suitable for the purpose and which has just been tested, the method of substitution weighing being used; as high a degree of accuracy cannot be realized in these weighings as when a master scale is utilized, but the weights are, nevertheless, determined with a reasonable degree of accuracy, and these weights may properly be utilized as the basis for adjustments.

Thirty weighings of as many cars were made in the field. Of these cars, nine were found heavy, and 15 light, while 3 were found accurate within the precision inherent in the method of weighing necessarily adopted in the field. The nominal weight of one car was not known prior to the weighing. The conditions under which the weighings were made on two cars were not such as to render practicable accurate determinations; however, the results indicated that the actual weights of the cars were somewhat less than their stenciled weights. The 9 heavy cars were in error by an average of 69 pounds, and the 15 light cars were

in error by an average of 51 pounds. The average numerical error of the 27 cars first mentioned was 51 pounds; the corresponding figure reported last year was 38 pounds. The most seriously inaccurate car weighed in 1941 was 240 pounds heavy; three other cars had errors of +120, -120, and -110 pounds, respectively.

In 14 instances of inaccurate cars, it was practicable for the Bureau inspectors to correct the weights immediately; in the remaining cases, the errors were reported to the owners, thus making it possible for them to make the needed corrections.

VI. MISCELLANEOUS ACTIVITIES

The following miscellaneous work was performed along with or as a supplement to the field testing, calibrating, and standardizing program for the year.

1. Reports. A formal report announcing the results of each track scale test, describing installation or maintenance deficiencies requiring correction, and recommending specific or general corrective measures was addressed to the owner of the scale and copies were supplied to parties or agencies having legitimate interest in the test results.

The usual general report on the track scale testing service for the preceding year was issued to railways and to other parties at interest.

Special reports summarizing the results of all tests conducted on their lines were issued to each railway on the lines of which ten or more scales had been tested in the preceding year.

The owner of each master scale was supplied with a detailed report on its calibration. A composite summary of all master track scale calibrations for the preceding year was supplied to certain joint associations of carriers.

2. Special Field Tests. A locomotive wheel-load and axle-load weighing scale of recent installation on one railway was tested exhaustively with standard weights applied to individual units of the installation and to separate pairs of units.

Two "lorry" scales employed for weighing ore in course of transfer from ship to freight cars at an eastern port were tested.

3. Cooperation with Technical Groups. A member of the staff represented the Bureau on a committee of the American Railway Engineering Association and participated in technical revision of specifications for railway track scales in grain weighing service.

A considerable amount of correspondence was exchanged with several parties in relation to test car procurement, track scale maintenance, track scale testing, etc.

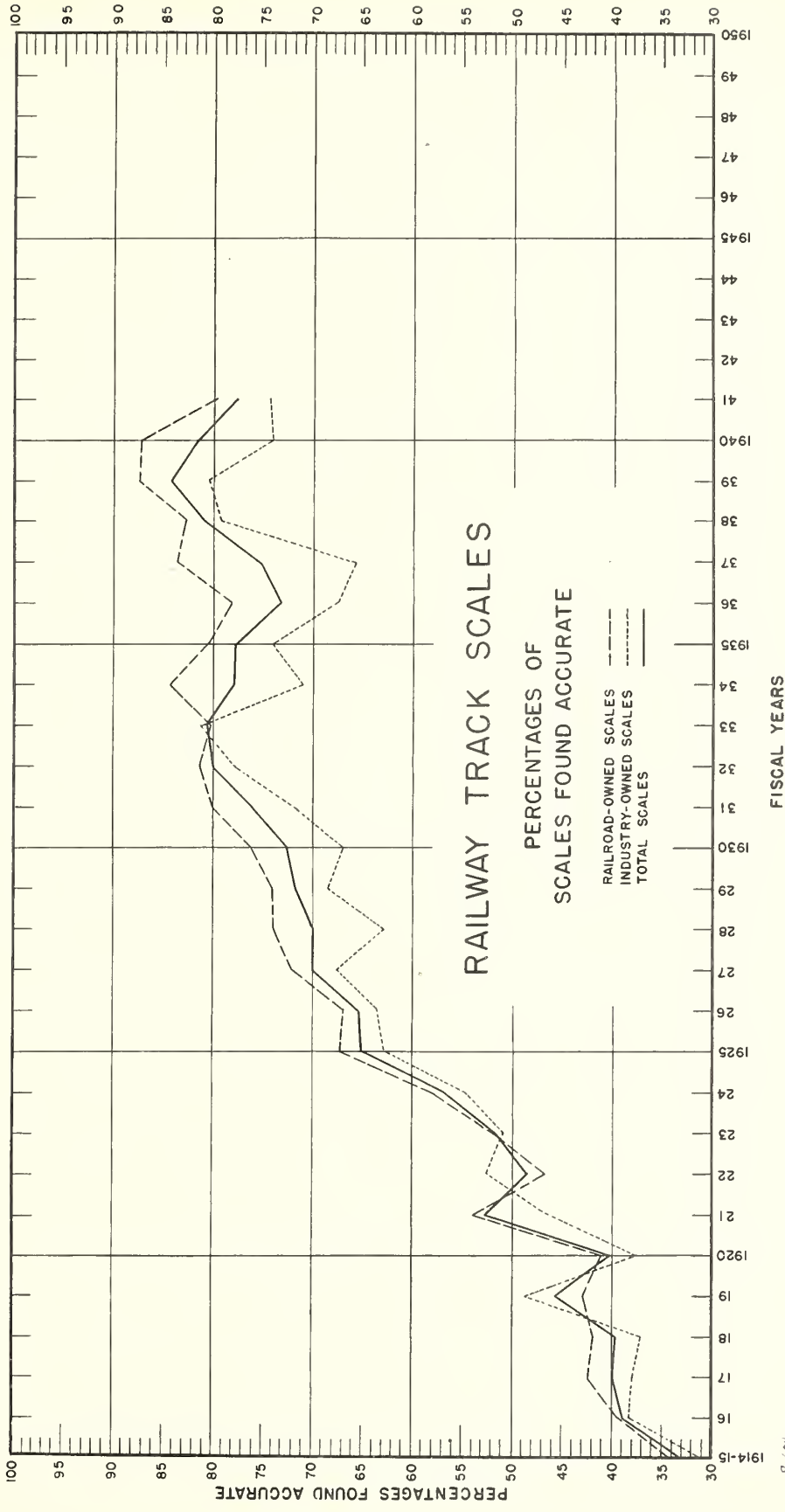
VII. CONCLUSION

The percentages of railroad-owned, industry-owned, and total scales of the railway track type tested by the Bureau and found within the tolerance since the beginning of the testing program in 1914, are shown in Figure 2, plotted upon an annual basis. Figure 3 presents in similar form, corresponding mean numerical percentage errors, based upon the maximum percentage errors developed on individual tests. Thus the two curves combine to present in graphic form a comprehensive picture of the progress which has been made in improving the nation's freight car weighing facilities. In the comment which follows, attention is directed to certain characteristics of these depicted progress records, and discussion is based upon a conjectural interpretation of those characteristics and of their probable implications as viewed in the light of information gained by the Bureau over a period of some twenty-five years.

Considering first the solid line in each figure, denoting the successive annual percentages of total accurate scales and corresponding mean percentage errors, it is apparent that up to the year 1933 the trend of improvement was reasonably consistent, that an intermediate peak level was reached in the year 1933, that there was a general recession in the period from 1933 to 1936, that a high peak level was reached in 1939, and that some recession has developed in the past two years. In the opinion of observers conversant with the conditions which have prevailed during the past decade, there is little doubt that the recessions reflect the effects of the financial depression period when, particularly in industry, there was virtually no replacement of obsolete or inadequate weighing equipment with new and modern facilities, and a general relaxation of those maintenance measures which are essential to continuous satisfactory functioning of large capacity weighing machines, and that the new record attained in 1939 was effected largely by a resumption of replacement and maintenance measures as business conditions improved. Speculation as to the probable reasons for an apparent current incipience of new recession would, at this time, be premature.

Considering next the two broken lines in each figure and observing particularly the order and incidence of their respective deviations from the solid mean line, it is noted that with very few exceptions, there has been a persistent superior performance by railroad-owned scales, the differences generally being considerable in the period subsequent to 1933. Unquestionably the principal circumstance which these conditions manifest





8-654
 FIGURE 2



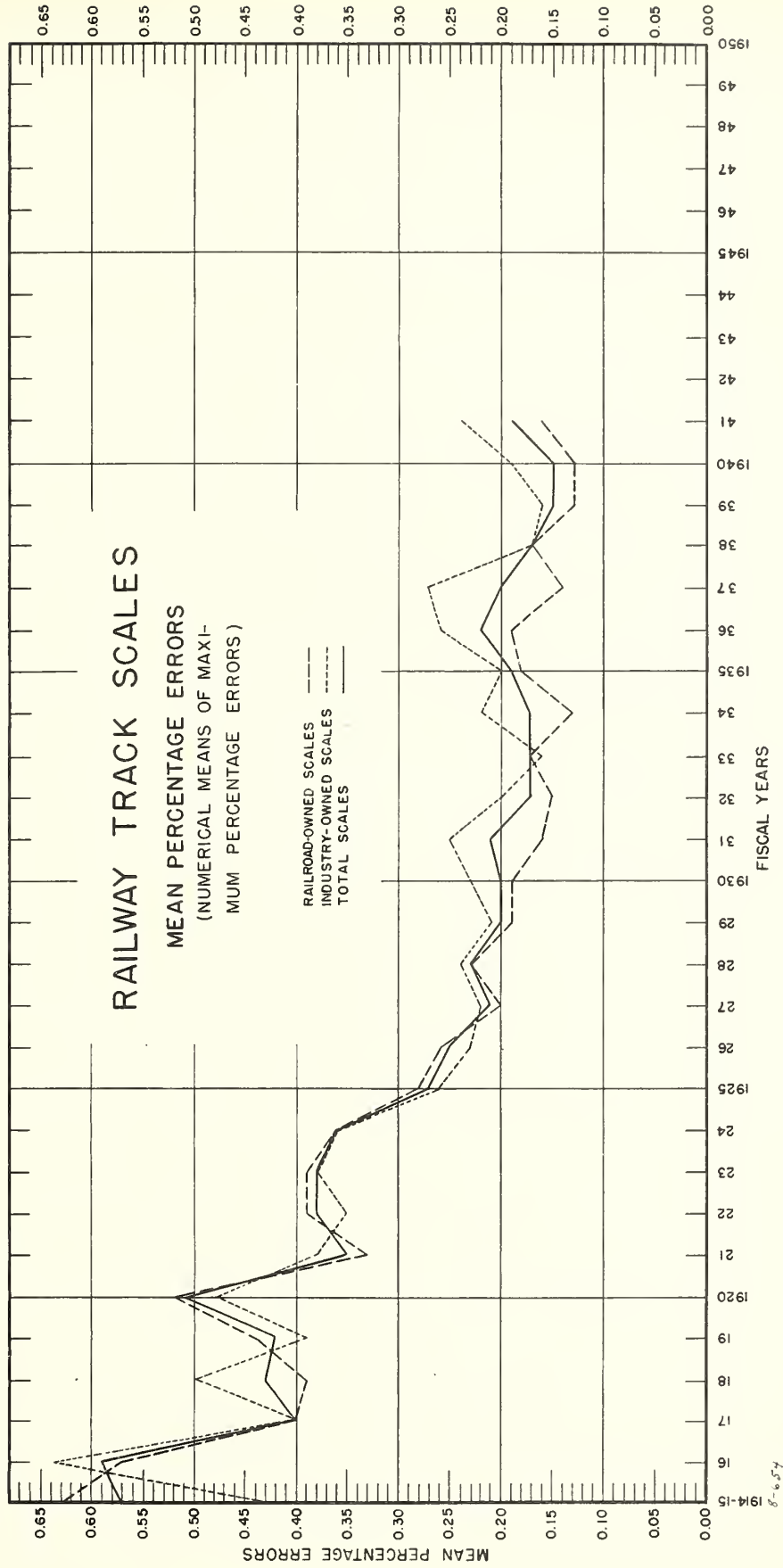


FIGURE 3

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is the general superiority of the maintenance and repair standards prevailing in the field of railroad-owned scales. However, there is ground for some surmise that a contributing factor which deters more general improvement in the industry-owned class of scales is the increasing prevalence of fee testing by railways, and the consequent relative infrequency of test, adjustment, and expert attention provided for industry-owned scales by their owners.

Thoughtful consideration of all the elements which have been effective in bringing conditions in the railway track scale field to their present status, and anticipation of means which must be employed to bring about further progress, or indeed to sustain the present status, inevitably leads to the conclusion that a common deficiency of maintenance in the case of industry-scales has retarded general progress, that elimination of this deterrent factor is the key to future improvement, and that, since the railways, generally speaking, already possess the organization, facilities, and personnel required for the purpose, the joint interests of carriers and industries would be greatly enhanced by adoption of cooperative measures whereby industry scales would be more regularly tested and serviced by, or under the supervision of, railway personnel. In view of the continuously increasing practice of "weight agreement" negotiation, which involves the acceptance of industry scale weights by the carriers, it is obvious that the benefits of such a program would be of mutual advantage to transportation and industry.

