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SPECIFICATIONS FOR THE MANUFACTURE AND INSTALLATION OF FOUR-SECTION AND OF TWO-SECTION, KNIFE-EDGE RAILWAY TRACK SCALES

(Supersedes NBS Circulars Nos. C83 and C333)

These specifications are those adopted by the American Railway Engineering Association; they have the endorsement and approval of the Association of American Railroads. The specifications for four-section scales were adopted in 1936 (except that Articles 1101 (d) and 1101 (e) were amended in 1941). The specifications for two-section scales were adopted in 1939 (except that Articles 1101 (d) and 1101 (e) were amended in 1941).

The specifications for four-section railway track scales as presented herein represent the latest revision of the specifications formerly published by the National Bureau of Standards as Circular C83.

The specifications for two-section railway track scales as presented herein represent the latest revision of the specifications formerly published by the National Bureau of Standards as Circular C333.

These specifications are now issued by the Bureau in continuation of its policy of disseminating information of value to present and prospective owners of commercial weighing scales, to the end that the design and performance characteristics of such equipment in service may continue to be improved. The National Bureau of Standards endorses these specifications and recommends their use in the procurement of railway track scales of the types covered by the specifications.

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SPECIFICATIONS FOR THE MANUFACTURE AND INSTALLATION OF FOUR-SECTION, KNIFE-EDGE RAILWAY TRACK SCALES

INTRODUCTION

These specifications are intended to apply to railway track scales for weighing cars in interchange service. They replace similar specifications adopted in 1920, and are intended to include also track scales covered by other codes of specifications, viz, "Railway Track Scales used for Weighing Grain", 56, I.C.C., 347 (Docket 9009, Claims for Loss and Damage to Grain, decided January 18, 1920), and "Railway Track Scales for Light Industrial Service", page 792, Vol. 31, 1930 Proc. They do not apply to scales originally installed before 1920, except that reinstallation of such scales should be governed as nearly as practicable by the provisions of these specifications relating to the installation of new scales. They are intended to secure reasonable uniformity in scales for similar service, without preventing improvement in types of scales or in scale parts. For special cases which are not covered in these specifications, the material, workmanship, and other qualities should be at least equal to those required herein, and the principles herein set forth should be followed so far as they apply.

The prospective purchaser of a track scale should specify a sectional capacity which, in conjunction with the required length, defines a scale of sufficient capacity to meet the maximal service requirements, together with such other information as will secure complete and uniform proposals.

I CAPACITY

101. Sectional Capacity Defined

The sectional capacity of a scale is the greatest live load which may be divided equally on the load pivots of a section without producing stresses in any member in excess of those specified in Section III.

102. Sectional Capacities Standardized

The rated sectional capacity of a four-section railway track scale shall be 50, 60, 75, 100 or greater than 100 tons. The rated sectional capacity shall in no case exceed the actual sectional capacity as defined in Paragraph 101.

103. Scale Capacity Defined

The capacity of a four-section railway track scale is the maximal live load it will support without stresses in excess of those specified in Section III being developed. The loading assumptions shall be:

(a) For scales of a sectional capacity of 100 tons or less, coupled cars having 12 feet center to center of adjacent end trucks, trucks under each car 22 feet center to center, and truck axles 5 feet 6 inches center to center.

(b) For scales of a sectional capacity of greater than 100 tons, a series of axle loads as stipulated by Cooper's E-60 or E-70 locomotive loading diagrams.

104. Maximal Live Loads for Standard Sectional Capacities and Scale Lengths

Table 1402 shows scale capacities for different scale lengths and the standardized sectional capacities, expressed in terms of:

(a) Coupled representative cars.
(b) Coupled Class GT gondolas.
(c) Cooper's locomotive loadings.

TABLE 1402

CAPACITIES OF FOUR-SECTION RAILWAY TRACK SCALES
(Loads given in thousands of pounds)

Length of Scale (feet)	Length of Span (feet)	Maximal Car Loads* Representative Car	Class GT Gondola	Cooper's** Locomotive Class
50 tons sectional capacity; main load pivot reaction, 50,000 pounds; dead load neglected.				
42	14	175.0		E-38
46	15.33	164.3	209.0**	E-36
50	16.67	156.2	192.2	E-34
60 tons sectional capacity; main load pivot reaction, 60,000 pounds; dead load neglected.				
42	14	210.0		E-46
46	15.33	197.1	250.9**	E-43
50	16.67	187.5	230.8	E-41
56	18.67	176.8	210.0	E-39
60	20	171.4	200.0	E-37
66	22	165.0	188.5	E-34
72	24	155.6	180.0	E-32
75 tons sectional capacity; main load pivot reaction, 75,000 pounds; dead load neglected.				
42	14	262.5		E-58
46	15.33	246.4	313.7**	E-54
50	16.67	234.4	288.5	E-51
56	18.67	221.0	262.6	E-48
60	20	214.2	250.1	E-45
66	22	206.2	235.7	E-43
72	24	194.6	225.0	E-41
100 tons sectional capacity; main load pivot reaction, 100,000 pounds; dead load neglected.				
42	14	350.0		E-77
46	15.33	328.6	418.2**	E-72
50	16.67	312.5	384.6	E-69
56	18.67	294.7	350.0	E-64
60	20	285.7	333.4	E-61
66	22	275.0	314.3	E-57
72	24	259.4	300.0	E-54

* Representative cars; 22'-0" c. to c. of trucks, 12'-0" c. to c. of end trucks of coupled cars, 5'-6" wheelbase of trucks.

Class GT gondolas; 36'-10.75" c. to c. of trucks, 16'-0" c. to c. of end trucks of coupled cars, 6-wheel trucks with 4'-4" c. to c. of truck axles.

** These loads exceed the nominal capacities permitted by Paragraph 105.

105. Nominal Capacity Defined and Limited

The nominal capacity of a scale is the greatest weight indication obtainable by use of all the reading elements in combination, fractional beams totaling 2 percent or less of the remaining elements being neglected. The nominal capacity of a track scale shall not exceed twice the rated sectional capacity.

II PLANS

201. Assembly plans shall be furnished showing the location of field connections and all information necessary for the purchaser to design and construct the pit and parts not furnished by the manufacturer. On request, the manufacturer shall furnish to the purchaser plans showing materials, stresses, and detailed dimensions for all scale parts.

III WORKING STRESSES AND FORMULAS

301. General Working Stresses

The maximal permissible unit stresses referred to in Section I are given below. In the stresses given, provision is made for the effect of impact caused by moving loads. For scales of 100 tons sectional capacity or less, if the dead load does not exceed 550 pounds per foot of track it may be neglected. For scales of greater than 100 tons sectional capacity, allowance must be made for a minimal dead load of 1000 pounds per foot of track. For scales of the respective types where the dead load exceeds the limits given, provision shall be made for the dead load according to the circumstances.

In designing cast iron members to sustain stress of any character, the maximal allowable unit stress shall be determined by the greatest thickness, exclusive of fillets, of the portion of the section carrying the stress being considered. In the main portion of a beam the thickness of the web or flange shall be used, whichever is the greater. The thickness of the flange shall be considered either as the average depth of the outstanding portion, or the breadth of flange outside to outside, whichever is less.

The bearing stress on steel pins shall not exceed 15,000 pounds per square inch on any diametral cross-section.

In proportioning rivets, nominal diameters shall be used.

The effective bearing area of a pin, bolt or rivet is the diameter of the member multiplied by the thickness of the metal upon which the member bears. In metal 3/8 inch thick and over, half the depth of countersink shall be omitted in calculating bearing area. In metal less than 3/8 inch thick, countersunk rivets shall not be assumed to carry bearing stress.

302. High Strength Alloys

For materials intended or represented to be "high strength" alloys, unit working stresses other than those given in Table 1403 may be used, provided these do not exceed 1/3 the unit stresses at the yield point established according to the test routine followed or prescribed by the American Society for Testing Materials for parts of the same analysis, heat treatment, and size, and provided further that the unit working stresses for any combination of gray iron and carbon steel exclusively shall not exceed those given in Table 1403 for steel castings. The purchaser, if he requests, shall be furnished with sufficient data or test specimens to enable him to determine the physical properties of the particular "high strength" material proposed to be used.

TABLE 1403

ALLOWABLE UNIT STRESSES IN POUNDS PER SQUARE INCH FOR IRON AND STEEL

Material	Transverse Bending Tension	Transverse Bending Compression	Direct Stress Tension	Direct Stress Compression	Shear and Torsion
Cast Iron (gray)					
Thickness of section					
0.25 inches...	5000	8500	3500	10000	5000
0.3	4780	8130	3350	9560	4780
0.35	4600	7820	3220	9200	4600
0.4	4450	7560	3110	8900	4450
0.45	4320	7340	3020	8640	4320
0.5	4200	7140	2940	8400	4200
0.6	4020	6830	2810	8040	4020
0.7	3870	6580	2710	7740	3870
0.8	3740	6360	2620	7480	3740
0.9	3630	6170	2540	7260	3630
1.0	3540	6020	2480	7080	3540
1.1	3450	5860	2410	6900	3450
1.2	3380	5750	2370	6760	3380
1.3	3310	5620	2320	6620	3310
1.4	3250	5520	2270	6500	3250
1.5	3190	5420	2230	6380	3190
1.6	3140	5340	2200	6280	3140
1.8	3050	5180	2130	6100	3050
2.0	2970	5050	2080	5940	2970
2.5	2810	4780	1970	5620	2810
3.0	2690	4570	1880	5380	2690
3.5	2580	4390	1810	5160	2580
4.0	2500	4250	1750	5000	2500
Steel,					
Castings .....,	10000	12000	10000	12000	8000
S.A.E. 1010 to 1020	10000	10000	10000	10000	7000
Pivots and Bearings					
S.A.E. 1095, hardened ...	24000	24000	24000	24000	
S.A.E. 6195 or 52100, hardened ...	30000	30000	30000	30000	

303. Knife-Edge Bearing Stresses

(a) For scales of 60 tons sectional capacity or less, the load per inch of knife-edge shall not exceed 6000 pounds for high carbon steel (S.A.E. 1095), or 7000 pounds for special alloy pivot steels (S.A.E. 6195 or 52100).

(b) For scales of greater than 60 tons sectional capacity, the load per inch of knife-edge shall not exceed 5000 pounds for high carbon steel (S.A.E. 1095), or 6000 pounds for special alloy pivot steels (S.A.E. 6195 or 52100).

304. Concrete Bearing Stresses

Bearing stresses on concrete shall not exceed 300 pounds per square inch under scale lever stands, and 400 pounds per square inch at all other points.

305. Projecting Pivots, Formula for Stresses

Where practicable, pivots shall be supported their full length by integral parts of the containing lever. When impracticable so to support the pivots, external bending moments shall be determined as follows:

Let M be the required bending moment in inch-pounds
L, the length in inches of the moment arm
T, the distance in inches between the friction faces of the loop
W, the total load in pounds on both ends of the pivot
D, the length in inches of bearing in the loop
B, the width in inches of the boss, or sustaining member enveloping the pivot.

Then,

$$L = \frac{D}{2} + (T-B) + \frac{1}{4} \text{ in.}$$

$$M = \frac{WL}{2}$$

306. Levers, Formulas for Loading

The main levers in a section shall be assumed to carry the sectional capacity equally divided between them. Each end extension lever shall be assumed to carry a load corresponding to 100 percent of the sectional capacity. The portion of each middle extension lever carrying only the load from the end extension lever shall be assumed to carry a load corresponding to 100 percent of the sectional capacity; the portion which

carries the combined load from the end and inner sections, 160 percent of the sectional capacity. The transverse extension lever, the shelf lever, and weighbeam shall be assumed to carry a load corresponding to 300 percent of the sectional capacity.

307. Bearing Pressures Under Foundations

The bearing areas of the foundation footings shall be such that the pressure under the footings will not exceed,

For fine sand and clay.... 4,000 pounds per square foot
For coarse sand and gravel or hard clay..... 6,000 pounds per square foot
For boulders or solid rock.....20,000 pounds per square foot

If the soil has not a safe bearing capacity equal to that of fine sand or clay, its bearing capacity shall be increased by drainage, by adding a layer of gravel or broken stone, or by driving piles.

IV LENGTH OF SCALE

401. Scale Length Defined

The length of a scale is the length of its weigh rails.

402. Scale Length--Limits

The weigh rails shall not extend beyond the center line of end sections. For general railway service the minimal scale length shall be 50 feet. For scales of 50 tons sectional capacity, the length shall not exceed 50 feet.

V SCALE LEVERS

501. Qualities of Castings

Castings used for levers shall not be warped. They shall be clean, smooth, uniform, and free from blisters, blowholes, and shrinkage holes and cracks.

502. Machined Ways for Nose Irons

Levers that are to be equipped with nose irons shall have those portions of the lever ends receiving them machined for the full distance over which the nose irons are to move.

503. Leveling Lugs

In scales of the straight lever type, each lever shall be provided with leveling lugs for longitudinal alinement. In scales of the torsion lever type, leveling lugs shall be provided on the pipe or torsion member for transverse alinement and on the extension arm for longitudinal alinement. Each pair of lugs shall be spaced 11 inches apart. The leveling surfaces of each pair of lugs shall be finished to a common plane, which shall be parallel to the plane through the knife-edges of the end pivots.

504. Marking of Levers

Figures denoting the ratio of each lever shall be cast or otherwise permanently marked on the lever.

505. Permanency of Adjustment

The design, workmanship, and factory adjustment of all levers shall be such that the proper ratio of the lever arms will be maintained.

VI. PIVOTS AND BEARINGS

601. Material

The material used for pivots and bearings shall be either:

(a) Special alloy pivot steel (S.A.E. 6195 or 52100), hardened to Rockwell C scale not less than 58, or
(b) High carbon steel (S.A.E. 1095) hardened to Rockwell C scale not less than 60.

602. Design

Pivots shall be so formed that the included angle of the sides forming the knife-edge will not exceed 90 degrees, and the offset of the knife-edge from the center line of the pivot will not exceed 10 percent of the width of the pivot for machined-in pivots, or 15 percent of the width of the pivot for cast-in pivots.

603. Mounting

(a) Fastening.--Pivots shall be firmly fastened in position without swaging or calking.
(b) Machined-in Pivots, When Required.--For scales of greater sectional capacity than 50 tons, main lever pivots shall be machine finished and fitted into machined ways.

(c) Continuous Contact Required.--Pivots shall be so mounted that continuous contact of the knife-edges with their respective bearings for the full length of the parts designed to be in contact will be obtained. In loop bearings the knife-edges shall project slightly beyond the bearings in the loops.

604. Position

In any lever the pivots shall be so mounted that:

(a) Each knife-edge will be maintained in a horizontal plane under any load within the capacity of the scale.
(b) A plane bisecting the angle of a knife-edge will be perpendicular to the plane through the knife-edges of the end pivots.
(c) The actual distance between the end knife-edges of any lever will not differ from the nominal distance by more than 1/64 inch per foot.
(d) The knife-edges in any lever will be parallel.

605. Support for Projecting Pivots

The reinforcing on the levers to support projecting pivots shall be tapered off to prevent accumulation of dirt next to the pivots and to provide proper clearances.

606. Fulcrum Distances

The minimal distance between the fulcrum pivot knife-edge and the load pivot knife-edge in main levers of scales of 75 tons sectional capacity or less shall be 6.5 inches. In scales of greater than 75 tons sectional capacity, the minimal distance shall be 8 inches.

607. Location of Main Lever Load Knife-Edges

The load knife-edges of main levers shall be so located that the center line of the weigh rails can be placed in the plane established by vertical lines through the centers of the knife-edges.

608. Design of Bearings

Bearing steels and the parts supporting or containing them shall be so applied to the mechanism that permissible movement of the platform will not displace the line of contact between any bearing and the opposing pivot.

609. Interchangeability of Bearing Steels

All bearing steels of the same nominal dimensions or parts identification shall be interchangeable or mounted in interchangeable bearing blocks. The interchangeable part shall be securely mounted in the part containing it.

610. Finish of Bearing Steels

The bearing surfaces shall be brought to a smooth, true, and accurate finish to insure continuity of contact with opposing pivots.

VII NOSE IRONS

701. Design

Nose irons shall be so constructed that:

(a) They will be positioned by means of adjusting screws of standard size and thread.
(b) They will be retained in position by means of screws or bolts of standard size and thread.
(c) The surfaces of nose irons intended to be in slidable contact with the levers will be machined true, so as to secure an accurate fit in or on the levers.
(d) When adjustments are made, the knife-edge will be held parallel to its normal position.

702. Screws and Bolts

Adjusting and retaining screws and bolts shall be made of a corrosion-resistant material.

703. Retaining Device

A device for retaining each nose iron in position shall be provided, and shall be so designed and constructed that:

(a) It will be independent of the means provided for adjustment.
(b) It will not cause indentations in the lever.
(c) Loads applied to the scale will not cause tension in the retaining bolts.
(d) The nose iron will remain in position when the retaining device is released.

704. Marking of Position

The position of each nose iron as determined by factory adjustment shall be accurately, clearly, and permanently indicated by well defined marks on the lever and nose iron which meet on a common line.

VIII LEVER FULCRUM STANDS

801. Qualities of Castings

Castings for lever stands shall be clean, smooth, uniform, and free from blisters, blowholes, and shrinkage holes and cracks.

802. Proportions

Lever stands shall be so designed, constructed and installed that, under any practical condition of loading, the resultant force through the bearing will fall within the middle third of the length and width of the base.

803. Bases for Lever Stands

The base of any lever stand shall be smooth, or shall be finished in any suitable manner true within a tolerance of 1/32 inch to a plane perpendicular to a vertical line through the center of the knife-edge bearing carried by the upright portion of the stand.

804. Finish of Tops of Stands

The top of any lever stand receiving a bearing steel, cap, or block shall be finished smooth and shall be parallel to the base within 1/32 inch.

805. Anchor Bolt Holes

Two or more anchor bolt holes, not less than 2 inches in diameter, shall be provided in proper places in the base of every fulcrum stand, unless other equally effective means for anchorage are provided.

806. Tie Bars

When tie bars for lever stands are used, contacting surfaces shall be machined.

IX LOOPS AND CONNECTIONS

901. Material

The requirements for material and hardness of bearing surfaces in loop connections shall be the same as those herein prescribed for pivots and bearings.

902. Design

In loops which form bearings for projecting pivots, the radius of the portion of the bearing making immediate contact with the knife-edge and the radius of the eye of the loop shall be not less than the longest side of the cross-section of the square pivot to be used in the loop, and like clearance shall be provided if pivots of other than square cross-section be used.

903. Length

Loops in like connections, except when adjustable, shall be of the same length.

904. Steelyard Rod

The steelyard rod shall be equipped with a turnbuckle.

905. Locknuts

Bolts or turnbuckles used as parts of the connections shall be provided with locknuts.

X CHECKS

1001. Number, Type, and Kind

Weighbridge checks shall be provided equivalent in functioning to not less than two longitudinal checks on each end and four transverse checks on each side, of the rod type. Checks of the rod and bumper types shall be adjustable.

1002. Position

Checks shall be set in the same horizontal plane and as high as possible. Longitudinal and transverse checks designed to take tension shall be respectively parallel and perpendicular to a vertical plane through the center line of track.

1003. Strength

When steel check rods are used on scales equipped with dead rails, the combined cross-sectional area in square inches of check rods at either end or side shall be not less than the sectional capacity in pounds divided by 60,000. On scales not equipped with dead rails, the combined check rods at either end or side shall be designed to resist a force of 66,000 pounds. Plate checks or other types designed to take tension shall be calculated for equivalent strength.

XI WEIGHBEAMS AND ACCESSORIES

1101. Design

(a) Limits for Beam Capacity.--See Paragraph 105.

(b) Full-Capacity Beam.--Except for special cases a weighbeam of the full-capacity type shall be provided.

(c) Shoulder Stop.--On each weighbeam a shoulder stop shall be provided to prevent the travel of the main poise back of the zero notch.

(d) Notches.--On main bars the notches shall not be spaced closer than 6 to the inch. Notches shall be so formed and positioned that accurate positioning of a poise will automatically result at any graduation at which the poise may be placed.

(e) Pawl or Latch.--For a poise on a notched weighbeam, the design and construction of the pawl or latch and its appurtenances shall be such that accurate positioning of the poise will automatically result at any graduation at which the poise may be placed.

(f) Projections or Recesses.--Poises shall be designed with the object of reducing to a minimum the number of recesses that will retain foreign material.

(g) Poise Bearings.--Each poise shall be constructed to move along its bar without side play. In full-capacity beams, the main poises shall be equipped with ball bearings.

1102. Marking

(a) Intervals.--For scales of less than 400,000 pounds nominal capacity, the notches and graduations on the main bar shall be made at 1000-pound intervals.

(b) Length of Graduation Marks.--For the main bar, the length of graduations other than those representing 0, 5, 10, 15, etc., thousand pounds shall be preferably 1.5 times the distance between their centers, but in no case greater than twice the distance between their centers. The length of graduations representing 5, 15, 25, etc., thousand pounds shall be not less than 1.5 times that of the intermediate graduations. The length of graduations representing 0, 10, 20, etc., thousand pounds shall be 0.75 inch.

(c) Size of Figures.--For the main bar, the zero graduation and every tenth graduation shall have its value in thousands of pounds (i.e., 0, 10, 20, etc.) marked by figures 3/8 inch in height, except the last graduation on the bar, which shall be marked in full (for example, 200,000 pounds). The 5s, 15s, etc., may or may not have the value in thousands of pounds marked, or may have a star or other device placed opposite the graduation. All numbers shall be placed directly above or below their respective graduations, and shall be within 1/16 inch to 1/8 inch of the graduation.

1103. Registering Weighbeams

(a) Where Required.--Every scale subject to the requirements for weighing grain (Docket 9009) shall be equipped with a full-capacity, type-registering weighbeam.

(b) Fractional Bar Stops.--On registering weighbeams, the fractional poise shall be equipped with means to insure a positive stop at any 20-pound interval, and a stop shall be provided to prevent the movement of the fractional poise beyond its proper travel in either direction.

(c) Operating Lever.--On registering weighbeams, a substantial type of hand grip shall be provided to facilitate the registration of the weight. The natural operation of the registering mechanism shall not cause lateral displacement of the weighbeam.

(d) Receptacle for Weight Ticket.--On registering weighbeams, means shall be provided to prevent the placing of the weight ticket in its receptacle in any position in which an incorrect weight can be registered.

(e) Type Figures.--On registering weighbeams, type figures shall be made of material sufficiently hard that under the designed conditions of use the figures will not become battered or defaced. The figures shall be plain and raised sufficiently to insure a clear impression upon the weight ticket. They shall be so attached that they cannot become loosened or detached without a positive indication that the weighbeam is out of order.

1104. Fractional Bars

For registering weighbeams the graduations for the fractional bar shall be placed at 20-pound intervals up to and including 980 pounds, or, if the fractional bar corresponds to a full 1,000 pounds, the last figure shall be marked to read 999 pounds. Nonregistering weighbeams shall be graduated in 50-pound intervals except for special cases.

1105. Balance Ball

The position of the balance ball shall be vertically adjustable. Unless otherwise required by law or regulation, longitudinal movement shall be controlled by means of a self-contained, hand-operated screw or other device which will not require the ball to be rotated.

1106. Counterbalance Weights

If counterbalance weights are to be used, the lower end of the counterbalance hanger stem shall be threaded, a cup for the loose balancing material shall be screwed to the lower end of the stem and each additional weight shall be provided with an elongated hole in the center through which the hanger stem may pass. When no counterbalance weights are necessary on top of the counterbalance cup, the cavity shall be closed by a cover, secured in a positive manner. No counterbalance weights shall be used in any place in the scale, except at the weighbeam. No slotted counterbalance weights shall be used.

1107. Ratio

A pivot with a loop shall be provided at the weighbeam tip. The ratio to this pivot shall be 7000, or 10,000. The ratio shall be plainly and permanently stamped on the weighbeam.

1108. Identification of Parts

Each weighbeam shall be given a serial number which shall be stamped on the weighbeam. The pivots, poises, and fractional bar shall have stamped upon them identification marks to show to which weighbeam each belongs, and the pivots shall be so marked as to indicate their proper positions in the weighbeam.

1109. Factory Adjustment of Notches

Each weighbeam notch shall be adjusted to within 0.002 inch of the nominal distance from the zero notch.

1110. Beam Fulcrum Stand

(a) The weighbeam shall be supported on a stand fitted with compensating bearings. Beam fulcrum stands shall be so designed, constructed and installed that the resultant line of forces applied through the bearing carried by the stand will fall within the middle third of the length and width of the base.

(b) Height.--The height of the stand measured from the bottom surface of the base to the pivot bearing surface shall not exceed 13 inches.

(c) Finish.--The bearing surface of the base of the stand shall be finished to a plane perpendicular to the axis of the upright portion of the stand, and the knife-edge line of the bearing shall be parallel to the base.

1111. Trig Loop

(a) Weighbeam Travel.--The play of the weighbeam in the trig loop shall be not more than 2 percent of the distance from the trig to the fulcrum pivot, nor less than 0.9 inch.

(b) Pointer.--The weighbeam shall be fitted with an indicator to be used in conjunction with a graduated target or other device on the trig loop to indicate a central position in the trig loop when the weighbeam is horizontal.

(c) Material.--The contact parts of the trig loop shall be made of a non-magnetic material.

1112. Weighbeam Support

The weighbeam fulcrum stand and trig loop stand shall be supported on a metal shelf mounted on metal pillars, or equivalent in strength and durability. The shelf shall be sufficiently rigid that, within the capacity of the scale, deflection cannot occur to such an extent as will affect the weighing performance.

XII ANTI-FRICTION POINTS AND PLATES

1201. Material and Design

Hardened steel anti-friction contacts shall be used to limit longitudinal displacement between knife-edges and bearings. They shall be smooth and so designed and applied as to provide contact at points on the knife-edge line.

1202. Clearances

The total clearance between anti-friction plates and points shall not exceed 1/16 inch on the weighbeam, 1/8 inch on the shelf lever, and 1/4 inch on all other levers. The minimal clearance shall be not less than 1/2 these respective amounts.

XIII CLEARANCES

1301. The clearance around and between the fixed and live parts of the lever system shall be at least 3/4 inch except at points where other clearances are specified.

XIV INTERCHANGEABILITY

1401. Units or parts of units intended to be interchangeable with like units or parts in scales of the same design and manufacture, shall be identified on the scale drawings or in the subject matter of the proposal in such manner as will clearly indicate the interchangeable parts, the manner of replacement, and the adjustments required, if any, after replacement.

XV SCALE WEIGHBRIDGES

1501. Type of Girders

Weighbridge girders shall be so designed that the joints over the centers of bearings will admit vertical flexure without deranging the sections.

1502. Weighbridge Bearings

The surfaces of weighbridge bearings intended to make contact with the bridge girders shall be finished so that, when in position, all the bearing surfaces will be within 1/32 inch of the same horizontal plane and parallel to it. To secure proper alinement of parts, the diameter of the bolt holes in the weighbridge bearings and in the girders shall exceed the diameter of the bolts fastening the bearings to the girders by 1/2 inch.

1503. Steel Specifications

Structural steel work shall conform to the AREA Specifications for Steel Railway Bridges, 1935.

1504. Girders--Size and Strength

Table 1404 gives the required section moduli for weighbridge girders for scales of different standard lengths and sectional capacities.

TABLE 1404

WEIGHBRIDGES FOR RAILWAY TRACK SCALES

Length of Scale (feet)	Length of Span (feet)	Section Modulus of one girder for scales of sectional capacity in tons as shown					
		50	60	75	100	greater than 100 Cooper's E-60	greater than 100 Cooper's E-70
42	14	118.7	142.4	178.0	237.3	212.7	245.7
46	15.33	135.7	162.8	203.5	271.3	251.6	290.6
50	16.67	152.3	183.0	228.5	304.7	290.8	335.8
56	18.67	176.9	212.3	265.4	353.8	350.1	404.1
60	20	192.9	231.4	289.2	385.7	401.3	463.2
66	22	216.6	259.9	324.8	433.1	478.5	552.2
72	24	242.1	290.5	363.1	484.2	556.6	642.1

Dead load neglected for scales of 100 tons sectional capacity or less; 500 pounds per foot of track per girder for scales of greater than 100 tons sectional capacity (see Paragraph 301).

1505. Bracing

Each weighbridge span shall be designed for a lateral force of 200 pounds per lineal foot, plus 4 percent of the sectional capacity of the scale, uniformly distributed along the top of the weigh rail.

1506. Diagonal Bracing

Diagonal bracing shall consist of not less than 3-inch by 3-inch by 3/8-inch angles, or equivalent. Not less than three diagonals per span shall be used.

1507. Transverse Bracing

To carry the lateral load to the knife-edges of the main levers, each span shall be provided at its ends with transverse bracing, for which the section modulus shall be not less than that determined by the formula,

$$S = \frac{1}{4}\frac{(0.04C+200L)d}{10,000}, \text{ wherein}$$

S, is the section modulus
C, is the sectional capacity in pounds
L, is the length of span in feet
d, is the distance in inches from the knife-edge of main lever to top of weigh rail, or to top flange of girder if ties are used or when pedestals are braced to resist tipping transversely to the girder.

Intermediate transverse bracing shall also be used at intervals not exceeding 6 feet, having a section modulus not less than that used at the ends of the span.

1508. Stiffeners

Not less than one pair of stiffener angles, other than splicing angles, shall be provided over each bearing of the girders in each span of the weighbridge. The ends of these stiffeners shall be milled to fit the fillets of the girder flanges.

1509. Weigh Rail Pedestals

The weigh rails shall be carried on metal pedestals spaced not over 30 inches center to center mounted on metal ties or directly on the weighbridge. The tops of pedestals shall be machined. The bottoms of the pedestals shall be machined unless type metal or equivalent is to be poured between the bottoms and the surfaces supporting them. Pedestals shall be so designed that they will transfer the lateral load specified in Paragraph 1505 to the weighbridge. Tie rods shall be provided to prevent spreading of the weigh rails due to the wedging action of wheel flanges.

1510. Fabrication and Assembly

In order to avoid distortion each pair of weighbridge girders shall be fabricated complete with diagonal and transverse bracing in the shop under proper inspection where practicable. Where this method is impracticable, and where field assembly is necessary, each pair of girders shall be placed in proper alinement and the bracing then introduced and secured by bolts or rivets.

1511. Weigh Rails--Length and Weight

The weight and section of the weigh rails shall be the same as those of the dead rails (see Paragraph 1803). Full-length rails shall be used.

1512. Clearance along Weigh Rails

The clearance between weigh rails or their pedestals and the rigid deck shall be not less than 1.5 inches unless other adequate provision for clearance is made, and the openings shall be protected from weather and dirt.

XVI PROTECTION FROM CORROSION

1601. The finish and treatment of all surfaces shall be such as to insure good appearance and satisfactory resistance to corrosion. The surface treatment shall be durable and appropriate for the intended uses.

XVII APPROACH RAILS

1701. Anti-Creep Provisions

Positive means shall be provided to prevent creeping of approach rails, and to maintain a clearance which shall be not less than 1/4 inch nor more than 3/4 inch between the approach rails and the weigh rails unless some special means is used to reduce impact when wheel loads pass from approach rails to weigh rails.

1702. Easer Rails

Easer rails, or load transfer devices, if used, shall be so constructed as to leave no lateral or vertical restraint upon the weigh rails when the device is unloaded.

XVIII DEAD RAILS AND DEAD RAIL BEAMS

1801. Dead Rails: When Required

All scales except those located where they cannot be subjected to locomotive or other loads in excess of the sectional capacity, and excepting also scales of greater than 100 tons sectional capacity, shall be equipped with dead rails.

1802. Elevation

Dead rails shall be constructed to the same elevation as the weigh rails.

1803. Weight of Rails

Rails shall be as specified by the purchaser, except that the following minimal requirements shall govern. When supported on floor beams 30 inches center to center the weight of rails for corresponding axle loads shall be not less than shown in the table below. For greater spacing of the floor beams the weight of rails shall be correspondingly increased.

Class of Locomotive Load	Weight of Rail per Yard
E-50	85 pounds
E-55	85 pounds
E-60	90 pounds
E-65	100 pounds
E-70	112 pounds

1804. Transverse Beams Supporting Dead Rails

(a) Structural Steel Work.--Structural steel work shall conform to the AREA Specifications for Steel Railway Bridges, 1935.

(b) Strength.--The following table gives the section moduli for floor beams corresponding to the loads and other conditions stated.

Assumptions Dead rail offset 16 inches
Floor beams 30 inches center to center
75 percent of axle load carried by one beam
Dead rails 59 inches center to center
Fiber stress, 10,000 pounds per square inch

Class of Locomotive Loading	Required Section Moduli: Floor Beam Supports 11 feet 0 inches c. to c.	Floor Beam Supports 11 feet 6 inches c. to c.
E-50	74.6	79.9
E-55	82.0	87.9
E-60	89.5	95.9
E-65	96.9	103.9
E-70	104.4	111.9

XIX DECK

1901. Type

Unless a scale is used to weigh other loads than freight cars of standard gage, the deck shall be of the fixed type.

1902. Construction

The material for the deck shall be surfaced to conform to safety requirements, shall be sufficiently strong to support the incidental traffic, and shall be waterproof.

1903. Clearance

The clearance between the bottom of the fixed deck beams, or deck supports, and the girders forming the weighbridge shall be not less than 2 inches.

XX EXCLUSION OF DIRT AND PRECIPITATION

2001. Means shall be provided to prevent accumulation of dirt and other foreign material in or about the pivots, bearings, or other parts, whereby interference with the action of the scale or undue deterioration of any part of the scale structure might result.

XXI LIGHTING

2101. Weighbeam, Scale House and Deck

Lighting of the weighbeam, scale house and deck shall be provided adequate for the needs of safe operation and to enable the weigher to read the weighbeam and observe car numbers and position of car wheels with certainty.

2102. Pit

The pit shall be provided with sufficient illumination to permit the ready and complete inspection of the scale parts.

XXII LOCATION AND ELEVATION

2201. Foundation

Scales shall be so located that an adequate foundation and at least 50 feet of tangent track at each approach to the weigh rails can be provided.

2202. Elevation

The scale shall be raised with respect to the other tracks of the yard to such an elevation that drainage of the surface water will be away from it. Means shall be provided to prevent surface water between the rails of the scale track from running into the pit.

2203. Right-Handed Weighbeam

Scales shall be so located that levers other than the shelf lever between the transverse extension lever and the weighbeam are unnecessary. Right-handed weighbeams are always to be preferred.

XXIII FOUNDATION AND PIT

Note.--This section presumes that scale pits fully enclosing the scale mechanism are necessary. When conditions permit, however, consideration should be given to the possibility of installing scales on foundations without side walls since this conduces to better maintenance, especially in the lower latitudes.

2301. Material

All scale foundations shall be constructed of concrete. The quality of materials and methods of mixing and placing the concrete shall conform to the specifications of the AREA for Class A concrete.

2302. Dimensions of Pit

The depth of the scale pit shall be not less than 7 feet from the base of the rail to the finished floor. The width between faces of side walls shall be not less than 10 feet, provided there shall be a horizontal clearance of not less than 16 inches between the faces of the side walls and the scale parts below the weighbridge girders and above the bases of the stands. The length inside the end walls shall be not less than 2 feet greater than the length of the scale assembly.

2303. Walls of Pit

The side and end walls shall be not less than 15 inches (preferably 18 inches) thick at the top, provided, that for scales used exclusively for weighing grain and which are not equipped with dead rails the pit walls may be 12 inches thick at the top. The foundation walls of the scale house shall be not less than 12 inches thick at the top and shall be solidly formed to the side walls of the scale pit.

2304. Waterproofing

Where necessary to prevent seepage of water through foundations, scale pits shall be membrane waterproofed, or waterproofed by methods equally effective.

2305. Drainage

The pit floor shall be pitched to a common point for drainage, and shall be smooth and free from pockets in which water may stand. If the pit floor is below subsurface water level, the pit shall be drained from its lowest point into a sump adequately equipped with automatic means for removal of water as it collects.

2306. Approach Walls

Approach walls, or piers of concrete shall be built to extend at least 15 feet (preferably 25 feet) from the pit face of the end wall at the approach and back under the track to preserve line and surface of approach tracks. They may be built in one solid mass of concrete or may consist of two parallel walls or piers; however, the latter construction shall have a single footing supporting both walls. Where necessary to secure safe bearing capacity the approach walls shall extend to the same depth as the pit walls.

2307. Wall Batter

Wall surfaces next to earth subject to freezing shall be constructed with a batter of not less than 1 to 12.

2308. Footings or Piers for Lever Stands

Concrete footings or piers supporting the lever stands shall be not less than 18 inches thick. Their tops shall be above the floor a sufficient distance to prevent the accumulation of water under the bases of stands, and shall be finished to exact level and elevation to receive the lever stands directly without the use of shims or grouting. If the scale is of a type having main levers or parts of the bearing assemblies that hang below the bases of the main lever stands, the piers shall be provided with recesses of a size to give clearance of not less than 1.5 inches, and so formed as to prevent accumulation of dirt. (See also Paragraph 307.)

2309. Pit Floor

The floor of the pit may be a mat of concrete approximately as thick as that required to support the main lever fulcrum stands, or if local conditions permit, the thickness may be reduced to not less than 6 inches. (See Paragraph 2305 for drainage requirements.)

2310. Anchor Bolts

Anchor bolts embedded in concrete a minimum of 15 inches shall be provided in foundations for lever stands to match the bolt holes provided for securing the stands.

2311. Floating Levers

Floating levers shall be anchored to the foundation to resist not less than twice the up-pull produced by the capacity live load.

2312. Deck Beam Supports

For deck beam supports, inverted T-rails, or old rails, or equally effective metal bearings shall be set in each side wall of the pit with the center of bearings not less than 6 inches from the inside of the pit wall. Such bearings shall not be fastened to transverse beams.

2313. Weighbeam Foundations

The pillars supporting the weighbeam shelf shall rest upon a reinforced concrete floor, or steel beams, or reinforced concrete beams, but the pillars and supporting beams, if used, shall be independent of the scale house floor if it is of timber. When necessary to install the weighbeam in a building other than a regular scale house, the pillar support shall rest on foundations independent of the building.

2314. Ventilation

Scale pits shall be ventilated to meet the needs of each particular case, the object being to prevent condensation on the metal parts.

2315. Entrance to Scale Pit

Entrance to the scale pit shall be either through the floor of the weighbeam house or the foundation wall, preferably the latter. The opening shall be closed by a door suitably fastened to prevent the entry of unauthorized persons.

2316. Grain-Weighing Scales--Cleaning

When available, compressed air shall be piped into the pit of each scale subject to the requirements for weighing grain (Docket 9009). Sufficient hose and a suitable nozzle to reach all parts of the scale under the deck for the purpose of blowing out dust shall be provided.

XXIV SETTING OF THE SCALE

2401. Fastening of Stands

After alining the lever stands the anchor bolt holes in the castings shall be filled with cement, or other suitable material, washers applied to the anchor bolts, and the nuts run solidly home.

2402. Alinement

All levers shall be level and connections plumb.

XXV WEIGHBEAM HOUSE

2501. Design

Except where the weighbeam is mounted in an adjacent building a suitable and substantial weighbeam house shall be provided to house a weighbeam and provide a weighing office. The minimal inside width of the scale house shall be 4 feet, and the minimal length shall be sufficient to allow the installation of a shelf and weighbeam of proper capacity together with accessories. It shall be provided with a bay window, or front and end windows, located with the sill about on a level with the top of the weighbeam shelf, and of sufficient size to give the weigher a clear and unobstructed view of the scale deck and approaching cars. The windows shall be glazed with clear glass, or clear wire glass, free from imperfections.

2502. Clearances

(a) Weighbeam Shelf.--A clearance of not less than 1 inch shall be provided between the inside of the scale house and weighbeam supports and shelf.

(b) Track.--The lateral clearance between the scale house and the center of any track shall be not less than 7 feet 6 inches if not otherwise required by law, or the purchaser.

2503. Ventilation

A suitable roof ventilator shall be provided for the scale house.

XXVI SENSIBILITY RECIPROCAL

2601. Definition

The sensibility reciprocal is the change in load required to turn the weighbeam from a position of equilibrium in the center of the trig loop to a position of equilibrium at either limit of its travel.

2602. Limit

The sensibility reciprocal shall not exceed 50 pounds.

XXVII TOLERANCE

2701. The tolerance in excess or deficiency on the first field test, after installation corrections, is 0.05 percent of the applied load, or 50 pounds per 100,000 pounds of applied load, for any position of a test weight car on the weigh rails. The procedure outlined in the "Definition of a Standard Test of a Railway Track Scale", page 37, shall be followed.

XXVIII SCALE SHED

2801. Scales subject to the requirements for weighing grain (Docket 9009) shall be covered by a shed equipped with end doors.

XXIX CAR PULLERS

2901. Installation

When a car puller is used the sheaves shall be located beyond each end of the scale so that the pull on the rope or cable will not produce an appreciable side pull on the scale. The angle of pull shall not exceed 6 degrees.

SPECIFICATIONS FOR THE MANUFACTURE AND INSTALLATION OF TWO-SECTION, KNIFE-EDGE RAILWAY TRACK SCALES

INTRODUCTION

These specifications are intended to apply to two-section, knife-edge railway track scales without dead rails or relieving gear, but not overhead suspended scales nor scales already in service, except that reinstallation of old scales should conform to the provisions relating to installation and to pivot and bearing steels.

Requests for proposals should specify sectional capacity and length of scale required, together with such other information as will result in complete and uniform proposals.

I CAPACITY

101. Sectional Capacity Defined

The sectional capacity of a scale is the greatest live load which may be divided equally on the load pivots of a section without producing in any member stresses in excess of those specified in Section III.

102. Sectional Capacities Standardized

The rated sectional capacity of a two-section, knife-edge railway track scale shall be either 150 or 200 tons. The rated sectional capacity shall not exceed the actual sectional capacity as defined in Article 101.

103. Scale Capacity Defined

The capacity of a two-section railway track scale is the weight of the heaviest locomotive that may pass over it without developing in any member stresses in excess of those specified in Section III.

104. Nominal Capacity Defined and Limited

The nominal capacity of a scale is the largest weight indication that can be obtained by the use of all the reading elements in combination, fractional bars totaling 2 percent or less of the remaining elements being neglected. The nominal capacity of a two-section track scale shall not exceed the rated sectional capacity.

II PLANS

201. Plans to be Furnished

Assembly plans shall be furnished showing the location of field connections and all information necessary for the purchaser to design and construct the pit and parts not furnished by the manufacturer. On request, the manufacturer shall furnish to the purchaser plans showing materials, stresses, and detailed dimensions for all scale parts.

III WORKING STRESSES AND FORMULAS

301. Unit Stresses

For all materials covered by specific mention in this Section, the unit stress given in this Article contains sufficient provision for impact.

In designing cast iron members to sustain stress of any character, the maximal allowable unit stress shall be determined by the greatest thickness, exclusive of fillets, of the portion of the section carrying the stress being considered. In the main portion of a beam, the thickness of the web or flange shall be used, whichever is the greater. The thickness of the flange shall be considered either as the average depth of the outstanding portion, or the breadth of flange outside to outside, whichever is less.

TABLE 1414

ALLOWABLE UNIT STRESSES IN POUNDS PER SQUARE INCH FOR IRON AND STEEL

Material	Transverse Bending Tension	Transverse Bending Compression	Direct Stress Tension	Direct Stress Compression	Shear and Torsion
Cast Iron (gray)					
Thickness of section, Inches					
0.25	5000	8500	3500	10000	5000
0.3	4780	8130	3350	9560	4780
0.35	4600	7820	3220	9200	4600
0.4	4450	7560	3110	8900	4450
0.45	4320	7340	3020	8640	4320
0.5	4200	7140	2940	8400	4200
0.6	4020	6830	2810	8040	4020
0.7	3870	6580	2710	7740	3870
0.8	3740	6360	2620	7480	3740
0.9	3630	6170	2540	7260	3630
1.0	3540	6020	2480	7080	3540
1.1	3450	5860	2410	6900	3450
1.2	3380	5750	2370	6760	3380
1.3	3310	5620	2320	6620	3310
1.4	3250	5520	2270	6500	3250
1.5	3190	5420	2230	6380	3190
1.6	3140	5340	2200	6280	3140
1.8	3050	5180	2130	6100	3050
2.0	2970	5050	2080	5940	2970
2.5	2810	4780	1970	5620	2810
3.0	2690	4570	1880	5380	2690
3.5	2580	4390	1810	5160	2580
4.0	2500	4250	1750	5000	2500
Steel					
Castings	10000	12000	10000	12000	8000
Pivots and Bearings--					
S.A.E. 6195 or 52100, hardened	30000	30000	30000	30000	
Structural--					
S.A.E. 1010 to 1020	10000	10000	10000	10000	6000
Stress in extreme fibers of pins					15000
Shear in power-driven rivets and pins					7500
Shear in turned bolts and hand-driven rivets					6000
Bearing on pins					14000
Bearing on power-driven rivets, milled stiffeners, and other parts in contact					15000
Bearing on rocker pins					7000
Bearing on turned bolts and hand-driven rivets					11000

Rivets driven by pneumatically or electrically operated hammers are considered power-driven.

For countersunk rivets, the above values shall be reduced 25 percent. Countersunk rivets shall not be assumed to carry bearing stress in metal less than 3/8 inch thick.

In proportioning rivets, nominal diameters shall be used.

The effective bearing area of a pin, bolt or rivet is the nominal diameter multiplied by the thickness of the metal upon which the member bears.

The gross area of the compression flange of a structural member shall be not less than the gross area of its tension flange.

302. High Strength Alloys

For materials intended or represented to be "high strength" alloys, unit working stresses other than those given in Table 1414 may be used, provided these do not exceed 1/3 the unit stress at the yield point established according to the test routine followed or prescribed by the American Society for Testing Materials for parts of the same analysis, heat treatment, and size, and provided further that the unit working stresses for any combination of gray iron and carbon steel exclusively shall not exceed those given in Table 1414 for steel castings. The purchaser, if he requests, shall be furnished with sufficient data or test specimens to enable him to determine the physical properties of the particular "high strength" material proposed to be used.

303. Knife-Edge Bearing Stress

The load per inch of knife-edge shall not exceed 6,000 pounds.

304. Concrete Bearing Stresses

Bearing stress on concrete shall not exceed 300 pounds per square inch under scale lever stands, and 400 pounds per square inch at all other points.

305. Projecting Pivots--Formula for Stresses

Where practicable, pivots shall be supported their full length by integral parts of the containing lever. Where impracticable so to support the pivots, external bending moments shall be determined as follows:

Let M = the required bending moment in inch-pounds
L = the length in inches of the moment arm
T = the distance in inches between the friction faces of the loop
W = the total load in pounds on both ends of the pivot
D = the length in inches of bearing in the loop
B = the width in inches of the boss, or sustaining member enveloping the pivot

Then

$$L = D/2+(T-B)+\frac{1}{4}\text{ inch}$$

and $M = WL/2$

306. Levers--Formulas for Loading

The main levers in a section shall be assumed to carry the sectional capacity equally divided between them. Each end extension lever shall be assumed to carry a load corresponding to 100 percent of the sectional capacity. The transverse extension lever, shelf lever, and weighbeam shall be assumed to carry a load corresponding to 200 percent of the sectional capacity.

307. Bearing Pressures Under Foundations

The bearing areas of foundation footings shall be such that the pressure under the footings will not exceed,

For fine sand and clay	4,000 lb. per sq. ft.
For coarse sand and gravel, or hard clay	6,000 lb. per sq. ft.
For boulders or solid rock	20,000 lb. per sq. ft.

If the soil has not a safe bearing capacity equal to that of fine sand or clay, its bearing capacity shall be increased by drainage, by adding a layer of gravel or broken stone, or by driving piles.

IV LENGTH OF SCALE

401. Scale Length Defined

The length of a scale is the length of its weigh rails.

402. Scale Lengths--Limits

For general railway service the minimal scale length shall be 50 feet. For scales of 150 tons sectional capacity, the length shall not exceed 60 feet.

403. Limits of Overhang

The scale may be longer than the distance between its sections. In no case, however, shall the distance from the center of a section to the nearer end of the weigh rails exceed 3 feet.

V SCALE LEVERS

501. Qualities of Castings

Castings used for levers shall not be warped. They shall be clean, smooth, uniform, and free from blisters, blowholes, and shrinkage holes and cracks.

502. Machined Ways for Nose Irons

Levers that are to be equipped with nose irons shall have those portions of the lever ends receiving them machined for the full distance over which the nose irons are to move.

503. Leveling Lugs

In scales of the straight lever type, each lever shall be provided with leveling lugs for longitudinal alinement. In scales of the torsion lever type, leveling lugs shall be provided on the pipe or torsion member for transverse alinement, and on the extension arm for longitudinal alinement. Each pair of lugs shall be spaced 11 inches apart. The leveling surfaces of each pair of lugs shall be finished to a common plane, which shall be parallel to the plane through the knife-edges of the end pivots.

504. Marking of Levers

Figures denoting the ratio of each lever shall be cast or otherwise permanently marked on the lever.

505. Permanency of Adjustment

The design, workmanship and factory adjustment of each lever shall be such that the ratio of the lever arms established by the relative positions of the pivot knife-edges will be within 0.02 percent of the nominal ratio.

VI PIVOTS AND BEARINGS

601. Material

The material used for pivots and bearings shall be special alloy steel, S.A.E. 6,195 or S.A.E. 52,100, hardened to Rockwell C scale not less than 58.

602. Design and Manufacture

Pivots shall be so formed that the included angle of the sides forming the knife-edge will not exceed 90 degrees, and that the offset of the knife-edge from the center line of the pivot will not exceed 10 percent of the width of the pivot.

603. Mounting

(a) Fastening.--Pivots shall be firmly fastened in position without swaging or calking.

(b) Machined-in Pivots--When Required.--Pivots in main and extension levers shall be fitted into machined ways.

(c) Continuous Contact Required.--Pivots shall be so mounted that continuous contact of the knife-edges with their respective bearings for the full length of the parts designed to be in contact will be obtained. In loop bearings the knife-edges shall project slightly beyond the bearings in the loops.

604. Position

In any lever the pivots shall be so mounted that:

(a) Each knife-edge will be maintained in a horizontal plane under any load within the capacity of the scale.

(b) A plane bisecting the angle of a knife-edge will be perpendicular to the plane through the knife-edges of the end pivots.

(c) The actual distance between the end knife-edges of any lever will not differ from the nominal distance by more than 1/64 inch per foot.

(d) The knife-edges in any lever will be parallel.

605. Support for Projecting Pivots

The reinforcing on the levers to support projecting pivots shall be tapered off to prevent accumulation of dirt next to the pivots and to provide proper clearance.

606. Fulcrum Distance

The distance between knife-edges of fulcrum and load pivots of main levers shall be not less than 8 inches.

607. Location of Main Lever Load Knife-Edges

The load knife-edges of main levers shall be so located that the center line of the weigh rails can be placed in the plane established by vertical lines through the centers of the knife-edges.

608. Design of Bearings

Bearing steels and the parts supporting or containing them shall be so applied to the mechanism that permissible movement of the platform will not displace the line of contact between any bearing and the opposing pivot.

609. Interchangeability of Bearing Steels

All bearing steels of the same nominal dimensions or parts identification shall be interchangeable or mounted in interchangeable bearing blocks. The interchangeable part shall be securely mounted in the part containing it.

610. Finish of Bearing Steels

The bearing surfaces shall be brought to a smooth, true and accurate finish to provide continuity of contact with opposing pivots.

VII NOSE IRONS

701. Design

Nose irons shall be so constructed that:

(a) They will be positioned by means of adjusting screws of standard size and thread.
(b) They will be retained in position by means of screws or bolts of standard size and thread.
(c) The surfaces of nose irons intended to be in slidable contact with the levers will be machined true, so as to obtain an accurate fit in or on the levers.
(d) When adjustments are made, the knife-edge will be held parallel to its normal position.

702. Screws and Bolts

Adjusting and retaining screws and bolts shall be made of a corrosion-resistant material.

703. Retaining Device

A device for retaining each nose iron in position shall be provided, and shall be so designed and constructed that:

(a) It will be independent of the means provided for adjustment.
(b) It will not cause indentation in the lever.
(c) Loads applied to the scale will not cause tension in the retaining bolts.
(d) The nose iron will remain in position when the retaining device is released.

704. Marking of Position

The position of each nose iron as determined by the factory adjustment shall be accurately, clearly and permanently indicated by well defined marks on the lever and nose iron which meet on a common line.

VIII LEVER FULCRUM STANDS

801. Qualities of Castings

Castings for lever stands shall be smooth, clean, uniform, and free from blisters, blowholes, and shrinkage holes and cracks.

802. Proportions

Lever stands shall be so designed, constructed and installed that, under any practical condition of loading, the resultant force through the bearing will fall within the middle third of the length and width of the base.

803. Bases for Lever Stands

The base of any lever stand shall be smooth, or shall be finished in any suitable manner within a tolerance of 1/32 inch to a plane perpendicular to a vertical line through the center of the knife-edge bearing carried by the upright portion of the stand.

804. Finish of Tops of Stands

The top of any lever stand receiving a bearing steel, cap or block shall be finished smooth and shall be parallel to the base within 1/32 inch.

805. Anchor Bolt Holes

Four or more anchor bolt holes, not less than 2 inches in diameter, shall be provided in proper places in the base of every fulcrum stand, unless other equally effective means for anchorage are provided.

806. Tie Bars

When tie bars for lever stands are used, contacting surfaces shall be machined.

IX LOOPS AND CONNECTIONS

901. Material

The requirements for material and hardness of bearing surfaces in loop connections shall be the same as those prescribed herein for pivots and bearings.

902. Design

In loops which form bearings for projecting pivots, the radius of the portion of the bearing making immediate contact with the knife-edge and the radius of the eye of the loop shall not be less than the longest side of the cross-section of the square pivot to be used in the loop, and like clearance shall be provided if pivots of other than square cross-section be used.

903. Length

Loops in like connections, except when adjustable, shall be of the same length.

904. Steelyard Rod

The steelyard rod shall be equipped with a turnbuckle.

905. Locknuts

Bolts or turnbuckles used as parts of connections shall be provided with locknuts.

X CHECKS

1001. Number, Type and Kind

Weighbridge checks shall be provided equivalent in functioning to not less than two longitudinal checks on each end and two transverse checks on each side, of the rod type. Checks of the rod and bumper types shall be adjustable.

1002. Position

Checks shall be set in the same horizontal plane and as high as possible. Longitudinal and transverse checks designed to take tension shall be respectively parallel and perpendicular to a vertical plane through the center line of track.

1003. Strength

Checks of the rod type shall be designed to act only in tension. The checks at either end or side shall be designed to resist the forces prescribed in Table 1415. Other types designed to take tension shall be calculated for equivalent strength.

TABLE 1415

FORCES TO BE ASSUMED IN THE DESIGN OF CHECK RODS FOR TWO-SECTION, KNIFE-EDGE RAILWAY TRACK SCALES

Sectional Capacity (tons)	Scale Length* (feet)	Each Lateral Check (pounds)	Combined Longitudinal Checks (pounds)
150	50	27,500	64,000
150	60	29,000	73,000
200	60	29,000	85,000
200	75	31,000	101,000

* For scale lengths intermediate to those shown, the values of the forces may be interpolated.

XI WEIGHBEAMS AND ACCESSORIES

1101. Design

(a) Limits for Weighbeam Capacity.--See Article 104.

(b) Full-Capacity Weighbeam.--Except for special cases, a weighbeam of the full-capacity type shall be provided.

(c) Poise Stop.--On each bar of the weighbeam a poise stop shall be provided to prevent the poise from traveling and remaining back of the zero notch or graduation.

(d) Notches.--On main bars the notches shall not be spaced closer than 6 to the inch. Notches shall be so formed and positioned that accurate positioning of a poise will automatically result at any graduation at which the poise may be placed.

(e) Pawl or Latch.--For a poise on a notched weighbeam, the design and construction of the pawl or latch and its appurtenances shall be such that accurate positioning of the poise will automatically result at any graduation at which the poise may be placed.

(f) Projections and Recesses.--Poises shall be designed with the object of reducing to a minimum the number of projections that may become chipped or broken off, and recesses that may retain foreign material.

(g) Poise Bearings.--Each poise shall be constructed to move along its bar without side play. The main poise shall be equipped with ball bearings.

1102. Marking

(a) Intervals.--For scales with a main poise travel of not more than 400,000 pounds, the notches and graduations on the main bar shall be made at 1,000-pound intervals.

(b) Length of Graduation Marks.--For the main bar, the length of graduations other than those representing 0, 5, 10, 15, etc., thousand pounds shall preferably be 1.5 times the distance between their centers, but in no case greater than twice the distance between their centers. The length of graduations representing 5, 15, 25, etc., thousand pounds shall be not less than 1.5 times that of the intermediate graduations. The length of graduations representing 0, 10, 20, etc., thousand pounds shall be 0.75 inch.

(c) Size of Figures.--For the main bar, the zero graduation and every tenth graduation shall have its value in thousands of pounds (i.e., 0, 10, 20, etc.) marked by figures 3/8 inch in height, except the last graduation on the bar, which shall be marked in full (e.g., 300,000 pounds). The 5s, 15s, etc., may or may not have the value in thousands of pounds marked, or may have a star or other device placed opposite the graduation. All numbers shall be placed directly above or below their respective graduations, and shall be within 1/16 inch to 1/8 inch of the graduation.

1103. Registering Weighbeams

(a) Fractional Bar Stops.--On registering weighbeams, the fractional poise shall be equipped with means to insure a positive stop at any 20-pound interval, and a stop shall be provided to prevent the fractional poise from traveling and remaining beyond its proper limit in either direction.

(b) Operating Lever.--On registering weighbeams, a substantial type of hand grip shall be provided to facilitate the registration of the weight. The natural operation of the registering mechanism shall not cause lateral displacement of the weighbeam.

(c) Receptacle for Weight Ticket.--On registering weighbeams, means shall be provided to prevent the placing of the weight ticket in its receptacle in any position in which an incorrect weight can be registered.

(d) Type Figures.--On type-registering weighbeams, type figures shall be made of material sufficiently hard that under the designed conditions of use the figures will not become battered or defaced. The figures shall be plain and raised sufficiently to insure a clear impression upon the weight ticket. They shall be so attached that they cannot become loosened or detached without a positive indication that the weighbeam is out of order.

1104. Fractional Bars

For registering weighbeams, the graduations for the fractional bar shall be placed at 20-pound intervals up to and including 980 pounds, or, if the fractional bar corresponds to a full 1,000 pounds, the last figure shall be marked to read 999 pounds. Non-registering weighbeams, except for special cases, shall be graduated in 50-pound intervals.

1105. Balance Ball

The position of the balance ball shall be vertically adjustable. Unless otherwise required by law or regulation, longitudinal movement shall be controlled by means of a self-contained, hand-operated screw or other device which will not require the ball to be rotated.

1106. Counterbalance Weights

If counterbalance weights are to be used, the lower end of the counterbalance hanger shall be threaded, a cup for the loose balancing material shall be screwed to the lower end of the stem, and each additional weight shall be provided with an elongated hole in the center through which the hanger stem may pass. When no counterbalance weights are necessary on top of the counterbalance cup, the cavity shall be closed by a cover, secured in a positive manner. No counterbalance weights shall be used in any place in the scale except at the weighbeam. No slotted counterbalance weights shall be used.

1107. Ratio

A pivot with a loop shall be provided at the weighbeam tip. The ratio to this pivot shall be 7,000 or 10,000, or a multiple thereof. The ratio shall be plainly and permanently stamped on the weighbeam.

1108. Identification of Parts

Each weighbeam shall be given a serial number which shall be stamped on the weighbeam. The pivots, poises and fractional bar shall have stamped upon them identification marks to show to which weighbeam each belongs, and the pivots shall be so marked as to indicate their proper positions in the weighbeam.

1109. Factory Adjustment of Notches

Each weighbeam notch shall be adjusted to within 0.002 inch of the nominal distance from the zero notch.

1110. Beam Fulcrum Stand

(a) Type.--The weighbeam shall be supported on a stand fitted with compensating bearings. Beam fulcrum stands shall be so designed, constructed and installed that the resultant line of forces applied through the bearing carried by the stand will fall within the middle third of the length and width of the base.

(b) Finish.--The base of the stand shall be finished to a plane perpendicular to the axis of the upright portion of the stand, and the knife-edge line of the bearing shall be parallel to the base.

1111. Trig Loop

(a) Weighbeam Travel.--The play of the weighbeam in the trig loop shall be not more than 2 percent of the distance from the trig to the fulcrum pivot nor less than 0.9 inch.

(b) Pointer.--The weighbeam shall be fitted with an indicator to be used in conjunction with a graduated target or other device on the trig loop to indicate a central position in the trig loop when the weighbeam is horizontal.

(c) Material.--The contact parts of the trig loop shall be made of a non-magnetic material.

1112. Weighbeam Support

The weighbeam fulcrum stand and trig loop stand shall be supported on a metal shelf mounted on metal pillars, or equivalent in strength and durability. The shelf must be sufficiently rigid that, within the capacity of the scale, deflections cannot occur to such an extent as will affect the weighing performance.

XII ANTI-FRICTION POINTS AND PLATES

1201. Material and Design

Hardened steel anti-friction contacts shall be used to limit longitudinal displacement between knife-edges and bearings. They shall be smooth and so designed and applied as to provide contact at points on the knife-edge line.

1202. Clearances

The total clearance between anti-friction plates and points shall not exceed 1/16 inch on the weighbeam, 1/8 inch on the shelf lever, and 1/4 inch on all other levers. The minimal clearance shall be not less than one-half these respective amounts.

XIII CLEARANCES

1301. General Requirement

The clearance around and between the fixed and live parts of the lever system shall be at least 3/4 inch except at points where other clearances are specified.

XIV INTERCHANGEABILITY

1401. Identification Required

Units or parts of units intended to be interchangeable with like units or parts in scales of the same design and manufacture, shall be identified on the scale drawings or in the subject-matter of the proposal in such a manner as will clearly indicate the interchangeable parts, the manner of replacement, and the adjustments required, if any, after replacement.

XV WEIGHBRIDGES

1501. Type of Girders

Girders shall be of the fish-belly type.

1502. Steel Specifications

Material and workmanship shall conform to the Specifications for Steel Railway Bridges--1938, published by the American Railway Engineering Association, punched and reamed work.

1503. Main Girders--Loading Assumptions and Required Section Modulus.

For the sectional capacities and scale lengths listed, the section moduli of single weighbridge girders shall be not less than those shown in Table 1416. For scale lengths intermediate to those shown, the values of the section moduli may be interpolated.

TABLE 1416

REQUIRED NET SECTION MODULUS, ONE WEIGHBRIDGE GIRDER

Sectional Capacity (tons)	Length of Scale (feet)	Length of Span (feet)	Assumed Dead Load per Girder (pounds)	Approximate Live Load-- Cooper's Locomotive Loading	Required Section Modulus One Girder
150	50	44	27,500	E-60	1,750
150	60	54	33,000	E-55	2,000
200	60	54	45,000	E-70	2,700
200	75	69	56,250	E-60	3,200

1504. Bracing

Each weighbridge shall be designed to resist a force of 300 pounds per foot of scale, uniformly applied laterally in either direction along the track, and a concentrated force of 20,000 pounds applied laterally in either direction at any point on the track.

(a) Diagonal Bracing.--Single diagonal bracing shall consist of not less than 3 1/2-inch by 3 1/2-inch by 3/8-inch angles.

(b) Transverse Bracing.--The ends of the weighbridge shall be provided with transverse bracing, of which the section modulus shall be not less than that determined by the formula

$$S = \frac{d(20,000+150L)}{18,000}$$

where S = the section modulus
L = the length of scale in feet
d = the distance in inches from the main lever load knife-edge to the top of the weigh rail

Intermediate transverse bracing, with section modulus not less than that determined by the above formula, shall be provided, spaced not farther apart than the distance between alternate stiffeners.

(c) Lateral Bracing.--Lateral bracing shall be provided between compression flanges, spaced not farther apart than the distance between intermediate transverse bracing, designed to resist compression shear equal to 5 percent of the axial stress in the compression flange of one girder.

(d) Stiffeners.--Not less than two pairs of stiffener angles shall be provided over each bearing of the girders and, in addition, suitable angle stiffeners shall be spaced not farther apart than the unsupported depth of the web plates. The ends of these stiffeners shall be milled to fit the girder flanges where bearing stress is transmitted from the stiffener to the flange.

NOTE: Attention is called to the reported economy and efficiency of welded stiffeners. When properly applied, welded stiffeners should be considered as meeting the requirements of this specification.

1505. Rivet Arrangement

Weighbridge girder flanges shall be connected to the web with enough rivets to transmit to the flange section the horizontal shear at any point, together with any load that is applied directly on the flange. Wheel loads shall be assumed to be distributed over 3 feet of flange. Rivets in end stiffeners shall be sufficient to develop the full computed stress in the stiffeners.

(a) Pitch.--The pitch in the direction of stress shall not exceed 7 times the diameter of the rivets (or not over 3 1/2 inches in the connection between the web and flange section), and the distance between centers of rivets shall be not less than 3 times the diameter of the rivets.

(b) Edge Distance.--The distance from the center of a rivet to a sheared edge shall be not less than 1 3/4 times the diameter. The distance from the center of a rivet to a rolled or planed edge shall be not less than 1 1/2 times the diameter, except that this distance may be not less than 1 1/4 times the diameter in the flange of a beam or channel. The distance from the center of a rivet to the edge of a plate shall not exceed 8 times the thickness of the plate.

1506. Fabrication and Assembly

Weighbridges shall be assembled and riveted up complete with all bracing, except lower flange transverse and diagonal bracing, in the shop under proper inspection.

1507. Weigh Rail Pedestals

The weigh rails shall be carried on metal pedestals, spaced not over 30 inches center to center, which shall be mounted on metal ties or directly on the weighbridge. The tops of pedestals shall be machined. The bottoms of pedestals shall be machined unless type metal or equivalent is to be poured between the bottoms and the surfaces supporting them.

1508. Weigh Rails

The weight of the weigh rails shall be not less than 100 pounds per yard. New rails shall be used. If splices are necessary, they shall be accurately applied.

1509. Clearance Along Weigh Rails

The clearance between weigh rails, or their pedestals, and the rigid deck shall be not less than 1.5 inches. The openings shall be protected from weather and dirt.

XVI TRANSVERSE BEAMS SUPPORTING APPROACH RAILS

1601. Section Modulus

The transverse beams at each end of the scale shall each have a section modulus of not less than 250 for 200-ton per section scales, or 197 for 150-ton per section scales.

1602. Fastening

The transverse beams shall be held at the ends by metal supports designed for line contact transversely with the beams. The supports shall be securely fastened to the foundation.

XVII PROTECTION FROM CORROSION

1701. Surface Finish and Treatment

The finish and treatment of all surfaces shall be such as to insure good appearance and satisfactory resistance to corrosion. The surface treatment shall be durable and appropriate to the intended uses.

XVIII APPROACH RAILS

1801. Anti-Creep Provisions

Positive means shall be provided to prevent creeping of approach rails, and to maintain a clearance, which shall be not less than 1/4 inch nor more than 3/4 inch, between the approach rails and the weigh rails unless some special means is used to reduce impact when wheel loads pass from approach rails to weigh rails or vice versa.

1802. Easer Rails

Easer rails, or load transfer devices, if used, shall be so constructed as to leave no lateral or vertical restraint upon the weigh rails when the device is unloaded.

XIX DECK

1901. Type

Unless a scale is used to weigh other loads than freight cars of standard gage, the deck shall be of the fixed type.

1902. Construction

The deck shall be surfaced to conform to safety requirements, shall be sufficiently strong to support the incidental traffic, and shall be waterproof.

1903. Clearance

The clearance between the bottom of the fixed deck beams, or deck supports, and the weighbridge girders shall be not less than 2 inches.

XX EXCLUSION OF DIRT AND PRECIPITATION

2001. General Requirement

Means shall be provided to prevent accumulation of dirt or other foreign material in or about the pivots, bearings, or other parts, whereby interference with the action of the scale or undue deterioration of any part of the scale might result.

XXI LIGHTING

2101. Weighbeam, Scale House and Deck

Lighting for the weighbeam, scale house and deck shall be provided, adequate for the needs of safe operation and to enable the weigher to read the weighbeam and observe car numbers and light weights and the position of car wheels with certainty.

2102. Pit

The pit shall be provided with sufficient illumination to permit the ready and complete inspection of the scale parts.

XXII LOCATION AND ELEVATION

2201. Foundation

Scales shall be so located that an adequate foundation and at least 50 feet of tangent track at each approach to the weigh rails can be provided.

2202. Elevation

The scale shall be raised with respect to the yard to such an elevation that surface water will drain away from it. Means shall be provided to prevent surface water between the rails of the scale track from running into the pit.

2203. Right-Handed Weighbeam

Scales shall be so located that levers other than the shelf lever between the transverse extension lever and the weighbeam are not necessary. Right-handed weighbeams are always to be preferred.

XXIII FOUNDATION AND PIT

NOTE: This section presumes that a scale pit fully enclosing the scale mechanism is necessary. When conditions permit, however, consideration should be given to the possibility of installing scales on foundations without side walls, since this conduces to better maintenance, especially in the lower latitudes.

2301. Material

All scale foundations shall be constructed of concrete. The quality of materials and methods of mixing and placing the concrete shall conform to the specifications of the American Railway Engineering Association for Class A concrete.

2302. Dimensions of Pit

The depth of the scale pit shall be not less than 7 feet from the base of the weigh rails to the finished floor. The width between faces of side walls shall be not less than 10 feet, provided there shall be a horizontal clearance of not less than 16 inches between the faces of the side walls and the scale parts below the weighbridge and above the bases of the stands. The length inside the end walls shall be not less than 2 feet greater than the length of the scale assembly.

2303. Walls of Pit

The side and end walls shall be not less than 15 inches (preferably 18 inches) thick at the top. The foundation walls of the scale house shall be not less than 12 inches thick at the top and shall be solidly formed to the side walls of the scale pit.

2304. Waterproofing

Where necessary to prevent seepage of water through foundations, scale pits shall be membrane-waterproofed, or waterproofed by methods equally effective.

2305. Drainage

The pit floor shall be pitched to a common point for drainage and shall be smooth and free from pockets in which water may stand. If the pit floor is below subsurface water level, the pit shall be drained from its lowest point into a sump adequately equipped with automatic means for removal of water as it collects.

2306. Approach Walls

Approach walls or piers of concrete shall be built to extend 15 feet (preferably 25 feet) from the pit face of the end walls and back under the track to preserve line and surface of tracks. They may be built of a solid mass of concrete or may consist of parallel walls or piers; however, the latter construction shall have a single footing supporting both walls. Where necessary to obtain safe bearing capacity the approach walls shall extend to the same depth as the pit walls.

2307. Wall Batter

Wall surfaces next to earth subject to freezing shall be constructed with a batter of not less than 1 to 12. For extreme low temperatures, the batter should be not less than 1 to 6, and should extend not less than 3 feet below the ground surface.

2308. Footings or Piers for Lever Stands

Concrete footings or piers supporting the lever stands shall be not less than 30 inches thick. Their tops shall be above the floor a sufficient distance to prevent the accumulation of water under the bases of stands, and shall be finished to exact level and elevation to receive the lever stands directly without the use of shims or grouting. If the scale is of a type having main levers or parts of the bearing assemblies that hang below the bases of the main lever stands, the piers shall be provided with recesses of a size to give clearance of not less than 1.5 inches, and so formed as to prevent accumulation of dirt. (See also Article 307.)

2309. Pit Floor

The floor of the pit may be a mat of concrete approximately as thick as that required to support the main lever fulcrum stands, or, if local conditions permit, the thickness may be reduced to not less than 6 inches. (See Article 2305 for drainage requirements.)

2310. Anchor Bolts

Anchor bolts embedded in concrete a minimum of 15 inches shall be provided in foundations for lever stands to match the bolt holes provided for securing the stands.

2311. Up-Pull Levers

Up-pull levers (floating levers) shall be anchored to resist not less than twice the up-pull produced by the capacity live load.

2312. Weighbeam Foundations

The pillars supporting the weighbeam shelf shall rest upon a reinforced concrete floor, or steel beams, or reinforced concrete beams, but the pillars and supporting beams, if used, shall be independent of the scale house floor if it is of timber. When necessary to install the weighbeam in a building other than a regular scale house, the pillar support shall rest on foundations independent of the building.

2313. Ventilation

Scale pits shall be ventilated to meet the needs of each particular case, the object being to prevent condensation on the metal parts.

2314. Entrance to Scale Pit

Entrance to the scale pit shall be either through the floor of the weighbeam house or the foundation wall, preferably the latter. The opening shall be closed by a door suitably fastened to prevent unauthorized entry.

2315. Safety Piers

Suitable piers, columns, or other supports should be provided to prevent excessive drop of the girders should failure of the scale parts occur.

XXIV SETTING OF THE SCALE

2401. Fastening of Stands

After alining the lever stands, the anchor bolt holes in the castings shall be filled with cement or other suitable material, washers applied to the anchor bolts, and the nuts run solidly home.

2402. Alinement

All levers shall be level and connections plumb.

XXV WEIGHBEAM HOUSE

2501. Design

Except where the weighbeam is mounted in an adjacent building, a suitable and substantial house shall be provided for the weighbeam and weighing office. The minimal inside width of the house shall be 4 feet, and the minimal length shall be sufficient to allow the installation of a shelf and weighbeam of proper capacity, together with accessories. It shall be provided with a bay window, or front and end windows, located with the sill about on a level with the top of the beam shelf, and of sufficient size to give the weigher a clear and unobstructed view of the scale deck and approaching cars. The windows shall be glazed with clear glass, or clear wire glass, free from imperfections.

2502. Clearances

(a) Beam Shelf.--A clearance of not less than 1 inch shall be provided between the inside of the scale house and the weighbeam supports and shelf.

(b) Track.--The lateral clearance between the scale house and the center of any track shall be not less than 7 feet 6 inches, if not otherwise required by law or by the purchaser.

2503. Ventilation

A suitable roof ventilator shall be provided for the scale house.

XXVI SENSIBILITY RECIPROCAL

2601. Definition

The sensibility reciprocal is the change in load required to turn the weighbeam from a position of equilibrium in the center of the trig loop to a position of equilibrium at either limit of its travel.

2602. Limit

The sensibility reciprocal shall not exceed 50 pounds.

XXVII TOLERANCE

2701. Acceptance Tolerance

The tolerance in excess or deficiency on the first field test, after installation corrections, is 0.05 percent of the applied load, or 50 pounds per 100,000 pounds of applied load, for any position of the test weight car on the weigh rails. The procedure outlined in the "Definition of a Standard Test of a Railway Track Scale" shall be followed.