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THE PENNSYLVANIA RAILROAD

SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF TRACK

C. E. 78.

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Rec. & signed for Nov. 26, 1957
C. O. Harry

PREFACE

These specifications are published for the guidance of District Engineers, Supervisors Track, Foremen Track, contractors and others building or repairing track. They may be made a part of a contract and as such carry the same force as any other specifications.

They are intended as a guide to economical standards of track construction and maintenance and must be interpreted in the light of experience, and the requirements of service, deviating from them only where experience has indicated that such deviation is permissible, without endangering the safe operation of trains.

INDEX OF SUBJECTS

ROADBED

Drainage:

1. Drainage is of first importance in track maintenance.

2. Water mixing with the materials of the roadbed, makes the entire structure unstable in varying degrees, depending upon the kind of material and quantity of water.

3. Stability of track requires that water seeping or flowing toward the track be intercepted and diverted before it reaches the roadbed, and that water falling upon the roadbed be quickly drained to the side ditches. The presence of non-flowing water, even at an elevation several feet below the sub-ballast, affects the stability of the track, both by weakening cohesion of the material in the sub-grade itself and by providing a base from which water will be drawn upward by capillary attraction to the sub-ballast.

4. (*a*) Water pockets in the roadbed, sometimes at considerable depth below the surface, must be drained; the supporting bank shoulder must not be taken away before the bottom of the pocket is located and an outlet provided. In particularly bad locations, the elevations of the top of impervious material under the center of the track should be determined by borings, and lateral trenches provided at the low points. It may be necessary to preserve the grade of the bottom of these trenches and of the drainage system by a heavy wooden grid on a layer of cinders.

(*b*) Pressure grouting is also an effective method of stabilizing. The action of pressure grouting forces the water from the pocket and replaces it with a quick setting mixture which resists water absorption. The void is filled and future accumulation of water in the pocket is prevented.

5. Maintain frequent cross drains, particularly where bridges, road crossings and sags interfere with longitudinal drainage.

MATERIAL

Handling and Care of:

50. It is costly to move materials from place to place and to handle and care for materials on hand. For this reason the amount of materials on hand and the number of handlings should be kept to a minimum. This requires careful planning of work, elimination as far as possible of emergency and non-programmed work and close co-operation with the Stores Department.

51. Materials not in use deteriorate, and after stock on hand is reduced to a minimum, metals should be protected against rust by spraying with metal preservative oil, Reference 37-209.

52. Rails, joint bars and tie plates held in storage, also emergency rails at mile posts, shall be protected from corrosion by spraying with metal preservative oil, Reference 37-209.

53. Threaded and insulated parts should be kept in buildings out of weather, and lumber piled so as to permit free passage of air.

CROSS TIES

Use:

101. (*a*) Sizes 3A, 4 and 5 shall be used in main tracks of main line and important branches. Size 3 may be used in main track of branch lines of light traffic and in secondary tracks. Sizes 1 and 2 are suitable for yard and industrial tracks.

Regional Engineer shall determine size to be used in any specific situation requiring an interpretation of these instructions.

(*b*) The number of ties which shall be considered as standard for each rail length of track shall be based on the following:

	Number of Ties Per Rail length of Track	
	33 ft. Rail	39 ft. Rail
(1) For main tracks with 100 lb. or heavier rail and with over 15,000,000 gross tons per mile per year and of lesser tonnage where speeds are 50 miles or more per hour	20	24
(2) For main tracks with 100-lb, or heavier rail and with 7,000,000 to 15,000,000 gross tons per mile per year, where train speeds are moderate	18	20
(3) For main tracks with 100-lb. or heavier rail and with less than 7,000,000 gross tons per mile per year, and for sidings, industry side tracks with considerable traffic, and yards (except storage tracks)	16	18
(4) For storage tracks, and industry side tracks with light traffic.	14	16
(5) For the last 60 feet of dead end tracks	12	

(6) In the case of all tracks on sharp curves, additional ties may he used when necessary to hold the gage,

(7) When rails of other than standard lengths are used, the number of ties shall be proportionately reduced or increased.

Placing:

102. Before using ties, it should be known that they bear the standard acceptance brands of the inspector.

103. Ties shall, be placed with the wider heart wood face down, and square to the line of rail.

104. In order to present a trim appearance, the ends of standard length ties shall be brought to a uniform line with the rail as follows:

(*a*) On single track roads, line the right hand ends of ties going north or west.

(*b*) On two main track roads, line the outside ends of ties.

(*c*) On four track roads, line the outside ends of ties of the outside tracks, and the inside ends of ties of the inside tracks.

(*d*) On three, five, and six track roads, line the outside ends of the outside tracks, and let the line sides of the ends of ties of the inside tracks remain the same for each of such tracks as they were when additional outside tracks were constructed.

(*e*) Exceptions may be made where, in the use of tie installation machinery it is advisable to change the line side to that opposite the one above indicated.

(*f*) For various rail sections the correct distance from end of tie to edge of base of rail for standard 8' 6" tie is as follows:—

85 P.R.R.	19"
100 P.S.	19"
130 P.S. & heavier	18¼"

(*g*) When necessary to use ties of less than standard length in track laid with standard ties, they shall be centered in the track.

(*h*) When building new tracks alongside of present tracks, and the ends of the ties are not then in line in conformity with the above rules, replacement ties should be laid in accordance with the rules, but it is not necessary to realine all of the old ties at the same time.

105. (*a*) The best ties shall be used at the joint.

(*b*) Ties shall be spaced a uniform distance center to center, disregarding the actual number of ties in each half rail length of track.

(*c*) For various prescribed numbers of ties per rail, the following spacing center to center of ties shall apply:

24 ties per 39-ft. rail—19½" center to center.
22 " " " "—21¼ " " "
20 " " " "—23½" " " "
18 " " " "—26" " " "
16 " " " "—29¼" " " "

106. Ties shall be kept properly spaced and square to the line of the rail. Ties shall be respaced when there is a variance from correct spacing of 3 inches at joints and 5 inches at intermediate ties.

Damage to Ties:

107. When handling or spacing ties, care shall be taken not to damage them with picks or hammers. Tie tongs, lining bars or other suitable tools shall be used.

108. When necessary to adze treated ties, the cut surfaces must be immediately slushed with pentachlorophenol (penta) in oil, Reference 47-1375.

109. Only sufficient adzing to obtain a sound and true bearing for the tie plate shall be done.

110. Standard tie plugs must be used to plug holes when spikes have been drawn.

SWITCH TIES

Use:

111. For number required; size and lengths, see Appendix I. For interlocked switches see Plan S-195-( ) .

BRIDGE TIES

Use:

112. On open floor bridges oak or pine ties shall be used as follows:

Tons of Traffic Per Annum			
9,000,000 Tons or More		Less Than 9,000,000 Tons	
Tangents	Curves	Tangents or Curves Less Than 3 Degrees	Curves 3 Degrees or More
Oak	Oak	Oak or Pine	Oak

Preboring:

113. 9/16" holes shall be bored, and treated with Penta in oil, Reference 47-1375, before driving any track spikes in bridge ties. Suitable holes must also be bored for the drive spikes which fasten tie spacing bar.

TIE PLATES

Assignment:

201. Tie plates shall be used under running rails on all cross ties, switch ties and bridge ties.

Placing:

202. Care must be taken that the outside shoulder of the plate will have full bearing against the base of rail.

203. (*a*) Tie pads of type approved by the Chief Engineer shall, be used between the tie plate and the tie on all new ties on open deck bridges, except under very light traffic. At the direction of the Regional Engineer they may also be used in tunnels.

(*b*) Tie pads shall not be doubled, or otherwise used in lieu of shims to correct for irregular surface.

RAILS

Distribution:

301. So far as practicable, rails shall be distributed in proper position for laying without further handling.

302. When being unloaded, the work must be done with the assistance of suitable devices for preventing injury to the rails.

303. Rail must be placed base down, parallel with the track and with sufficient bearing to avoid bending or swinging.

304. In yards and station grounds, if not to be laid immediately, rails should be uploaded in piles far enough back to be well out of the way of trainmen, and in a convenient place for redistributing just before laying.

305. When rails are distributed along the track so that there may be danger of trainmen falling over them, telegraph report stating their location shall be made to the Superintendent in order that trainmen may be warned.

Preparation for Laying:

306. Prior to rail renewals, the track should be placed in good surface and line.

307. If, in special cases it is considered desirable to precurve rails, a roller bender shall be used. Particular care must be taken to insure uniform curvature throughout their length.

308. Rails that may have been damaged or have sharp bends must not be laid in main tracks. Damaged or bent rails must be straightened and may be used in yards and side tracks.

309. Bolts, spring washers, spikes, tie plugs, tie plates, rail anchors, etc., must be distributed as nearly as possible where they will be used; but they should not be unloaded much in advance of laying the rail, and care should be taken to keep them from getting buried or lost. They must not be placed on top of the ties nor in the cribs.

Laying:

310. Under no condition shall more rail be laid in one day than can be rightly taken care of during the day in which it is laid, so that no damage to the rail or fastenings will result from a continued use under normal traffic. Loose ties must be tamped up to a good bearing under the new rail. The standards for spiking and bolting must he followed, and rail anchors must be applied before trains are permitted to pass over it; follow-up attention must be given to the track to prevent damage to the rail.

311. As insulating fibres are easily damaged, immediate action must be taken to have insulating joints properly spiked and supported. Fibre bushings will not withstand severe blows on bolt heads.

312. Rails should be laid one at a time, and to insure good adjustment, the rail ends must be brought squarely together against suitable rail-expansion shims and bolted before spiking. Under special conditions, certain departures from this plan are permissible as follows:

(*a*) At locations where trains cannot be diverted to other tracks during the work of, laying rail, stretches of rails not over 1,000 feet in length may be bolted together at one side of track, and then lined into place with such care as will insure the proper allowance for expansion

being maintained between the ends, and avoidance of unequal adjustment.

313. Rail expansion shims of soft wood not over 1 inch in width of the prescribed thickness, Plan 69573-( ), shall be placed between the ends of adjacent rails in order to insure the space allowance for expansion required by the rail temperatures in the following table, and may be left in place.

(*a*) Expansion Allowance Table

Range of temperature of the rail in degrees Fahrenheit	Space between adjacent rail ends for expansion allowance for rails	
	33 ft. long	39 ft. long or over
Below 10°.....	¼	5/16
10° to 29°.....	3/16	¼
30° to 48°.....	3/16	3/16
49° to 67°.....	1/8	1/8
68° to 86°.....	1/16	1/16
Over 86°.....	none	none

(*b*) With temperature over 86 degrees, rails should be laid without expansion allowance.

(*c*) The space between rail ends in insulating joints should only be sufficient to permit the insertion of standard end posts.

314. (*a*) The standard rail thermometer shall be used to ascertain the temperature of the rail. Thermometer shall be laid close to the web on the side of the base of the rail which is shaded from the sun's rays in advance of the laying and left there long enough to record the temperature accurately. Foreman in charge shall see that temperature is checked frequently and proper rail expansion shims are used.

(*b*) All thermometers must be checked by the Supervisor to see that they are accurate.

315. Rails shall be laid so that the joints of one line of rails shall be opposite the middle of rails in the other line, with permissible variations as follows:

(*a*) Except through turnouts the staggering of the joints on one side must not vary more than 30 inches in either direction from the center of the opposite rail, preferably not exceeding 18 inches.

316. Rails less than 18 feet long shall not be used in main tracks, except short rails not less than 14 feet long may be used for:

(*a*) Temporary closures.

(*b*) Connections within turnouts.

(*c*) Connecting rails of different weights and types, temporarily.

317. When laying rails, joints should not be placed in road crossings, within the limits of switch rails, opposite frog guard rails, within 6-ft. of the ends of open floor bridges or trestles or within 12-ft. of the edge of a road crossing. Rails 78-ft. or longer will be provided for such locations when practicable.

318. Rails of the same section shall be used in road crossings, switch connections station platforms, open floor bridges, trestles, and viaducts in order to avoid compromise joints.

319. Rails of unequal wear and of different sections must be brought to an even surface and gage at joints. If necessary, the difference in height of rails must be run off by the use of wooden or metal shims of ample length to permit their being securely fastened to the ties. If wooden shims are used round holes must be provided in them for the spikes. The use of shims or nutlocks between web of rail and joint bar is prohibited and the adjustment must be accomplished by:

(*a*) Compromise joints of approved design. (Compromise joints will be of forged or cast steel. Cast steel joints will not he used in main tracks without permission of the Chief Engineer.)

(*b*) Grinding or approved method of welding. (Use of the acetylene torch to adjusts the dimensions of compromise joints, manufacture compromise joints from standard bars or burn holes in joint bars is prohibited in main tracks, other important tracks, or tracks adjacent thereto. Joint bars are of heat treated carbon steel, and are easily damaged by application of flame.)

320. (*a*) When necessary to make a temporary connection for the passage of a train, the union must be made with a piece of old rail not less than 14 feet long connected with the new rail by a compromise joint with the full number of bolts and spikes. When the work for the day is completed for the passage of trains at authorized speed, the full length of old rail shall be continuous with the new rail.

(*b*) The use of switch rails to make temporary connections when laying rail is prohibited.

321. Holes for complete bolting must be provided at the ends of cut rails, in accordance with the standard arrangement and the following practice:

(*a*) When new holes are necessary, they must be drilled, and not be punched, slotted or burned with a torch. They must, under no circumstances be placed between two holes already drilled in the rail.

(*b*) The distance from the end of a rail to the center of the first bolt hole must not be less than twice the diameter of the hole.

(*c*) The distance between the centers of any two holes of the same size must not be less than four times the diameter of the hole, and in the case of holes of different sizes not less than 3¾ times the average diameter of the two holes.

(*d*) The connection between rail ends must be made with fully bolted joint bars.

322. (a) The tools which may be used for cutting new and partly worn rails are named below:

(1) Rail Saws.

(2) Track Chisels.

(3) Gas Cutting Torches in accordance with Letter of General Practice No. 84-( ). (For sidings, side tracks and yards only.) When necessary to make a square, smooth cut, a guide shall be used.

(*b*) When using a track chisel, a sledge of not over 8-lb. shall be used; the use of a spiking hammer is prohibited.

(*c*) Except for the welding of engine burns in accordance with Letter of General Practice No. 329-( ), and except for the application of welded bonds, gas or arc welding or brazing is prohibited on any portion of the rail, except on the top surface, not farther than 8 inches from end of rail. (See Letters of General Practice No. 216-( ) , 329- ( ) , and Specification C. E. 49- ( ).

323. Gas cutting torch must never be used on rail except as covered by paragraph 322-(a)-(3). Any rail in main track, other important track, or adjacent track accidentally damaged by torch must be promptly removed from track.

Track Circuit Rails Bonded:

324. (*a*) Where rails are bonded for track circuits, no rail bonds shall be broken or rails removed except in case of emergency, unless a signal maintainer is present to insure that the signals display their most restrictive indication and, in cab signal or train control territory, that the coded track circuits are inoperative, and that facilities to bond the new rails are available. In case of emergency, a broken rail, switch or frog may be renewed without waiting for the signal maintainer. In such cases, the joints shall be tightened to make as good contact as possible with the rails, and the signal maintainer notified that the rail bonds have been broken. However, if such work is within the starting circuit of automatic highway crossing protection, the track shall not be restored to service until all trains approaching the crossing have been instructed to be prepared to stop prior to passing over the crossing involved or until crossing protection is provided.

(*b*) In electric traction territory, before disconnecting leads of impedance bonds or removing rails, frogs, etc., care shall be exercised to insure that at least one return path for traction current is maintained. When making rail renewals, etc., before the rail is disconnected a return path for traction current shall be provided by using a temporary bond, Plan E-413610-( ), across the track each side of the rail section to be removed, making sure that no insulating rail joints interfere with this cross bonding circuit. In emergencies when the signal maintainer is no not present, he shall be notified that rail bonds have been broken.

Care of Material Released:

325. When removing rail from track, the bolts, nuts and rail anchors must not be damaged.

RAIL ANCHORS

Number Required:

401. (*a*) The number of anchors required for a given location can be fixed only by experience and judgment. The use of insufficient anchors can result in destruction of the track surface, and a waste of labor. Any evidence that the rail joints or the anchored ties are moving progressively under traffic should result in the application of additional anchors. The extravagant use of an excessive number of anchors must be avoided.

(*b*) Additional rail anchors as necessary shall be applied on the approach and leaving rails:

(1) To main track crossovers and turnouts.

(2) To track troughs.

(3) To railroad crossing frogs.

(4) To open floor bridges.

(c) Rail anchors shall not be used on open floor bridges, trestles and viaducts except where authorized by the Chief Engineer.

Application:

402. Rail anchoring devices shall be applied as follows:

(*a*) Rail anchors shall be applied to the first tie next to the joint ties and remaining anchors as evenly spaced in a rail length as practicable, and always at both ends on the same side of the tie.

(*b*) When laying rail the anchors must be applied before trains are permitted to pass over the rail.

(*c*) Apply rail anchors against sound ties.

(*d*) Where anchoring in both directions is required the reverse anchors shall be applied to ties already having anchors in the normal direction, in other words, the practice of boxing the tie shall be followed.

(*e*) On single track, or on other track used in both directions sufficient anchors shall be applied to avoid backward and forward motion of the boxed ties.

(*f*) In anchoring 78-ft. rail or other rails longer than 39-ft., additional anchors are required because of the relative reduction in expansion per foot of track. A minimum of 24 anchors per 78-ft. rail in the direction of normal traffic with one-fourth of the anchored ties boxed for reverse anchoring is required, in order to restrain the tendency of such track to gain expansion.

Maintenance:

403. (*a*) Rail anchors, when applied, must have full bearing against the tie or tie plate.

(*b*) In order to avoid damage to rail anchors, only the proper tools should be used for applying and removing.

(*c*) When the bearing of rail anchors against the tie is disturbed and when renewing ties, or respacing ties or rail, the rail anchors must be taken off and reapplied.

(*d*) Ballast and ice must be kept away from rail anchors, to avoid loosening of the anchor as the rail contracts, as well as interference with electric track circuits.

(*e*) Proper opening between rail ends at joints must be provided and maintained by the use of adequate rail anchors. When rail ends are open in excess of the expansion allowance prescribed in paragraph 313-(a), the rails shall be driven back against shims of proper thickness to provide the required space allowance for expansion, necessary rails of suitable length inserted and an adequate number of rail anchors applied to hold the rails against further running in either direction.

RAIL JOINTS

Application:

501. (*a*) Joint bars shall be applied with their full number of bolts, nuts and springwashers in accordance with standard plans and specifications.

(*b*) Before applying joints in laying new or fit rail, and in general maintenance, the rail ends shall be protected against corrosion as follows:

(1) At locations subject to excessive corrosion (heavy coal traffic, refrigerator traffic, sea atmosphere, heavy, industrial atmosphere, tunnels, in the vicinity of water pans, river valleys) where there is frequent fog, when laying rail and when renewing and replacing joint bars, the web, base and fishing surfaces of the rails within joint bar limits, the rail ends, the bolt holes, the inside surfaces of the joint bars, the fishing surfaces of the joint bars, and the bolts must be coated with a film not less than l/32" to l/16" thick of approved grease for rail end protection, Reference 37-333.

(2) At other locations, rail ends, joint bars and bolts shall be similarly protected, using approved grease for rail end protection, Reference 37-228.

If mechanical means of applying the grease are not available, and if it is applied by hand, to insure a good bond of the grease to the metal surfaces, it shall be applied by a vigorous scrubbing motion, rather than a painting motion, with a No. 00 roofing brush or stubby paint brush. If the grease is of too heavy consistency for brushing due to low temperature it should be thinned with 150 degree oil (carbon oil), Reference 37-46, but caution, should be used not to dilute the grease beyond a paste consistency.

In any case, care must be taken to coat the upper fillets at the extreme rail ends.

(3) At locations where experience has shown. rapid corrosion of rail, ends, the protective coating shall be renewed at intervals of not more than four years.

(4) Inspection of rail ends for web defects shall be made at regular intervals, using the Audigage, flaw detector as prescribed in Letter of General Practice No. 316-( ).

Maintenance:

502. (*a*) The ends of new rails are chamfered at the mills in accordance with Plan 71099-( ).

(*b*) To avoid spalling or chipping of rails in the joint under service, when it becomes necessary, the end faces must be crosscut by grinding with 1/8 inch wheel, to a depth of not less than 3/16 inch, so that the top edge and the gage side at the end face of the rail does not at any time extend beyond the rail end face.

(*c*) In order to prevent injury to the rail ends, joints should be kept tightly bolted at all times.

(*d*) When applying and subsequently tightening bolts in rail joints, the bolt tension shall be brought to 15,000 pounds.

(*e*) In newly laid rail the bolts shall be tightened at least four times during the first month (at the time it is laid, again the next day, again at the end of a week and again one month after it is laid).

(*f*) As service progressively reduces the tension, track bolts must be retightened periodically at intervals of about one year.

(*g*) If bolt threads are dry and corrosion is present, before proceeding with tightening a liberal application should be made of a mixture of approved grease for rail

end protection, Reference 37-228, in 150 degree oil (carbon oil), Reference 37-46, as prescribed in paragraph 502-(i), or other suitable and available penetrating lubricant.

(*h*) For procedure in adjusting Power Track Wrenches for specified bolt tension, see "Manual of Instructions—Maintenance of Way Equipment," Form M.W. 52-( ), Section 8500.

(*i*) All track bolts in main tracks shall be oiled once a year by applying with a long spout engine oil can, a mixture of approved grease for rail end protection, Reference 37-228, in 150 degree oil (carbon oil), Reference 37-46, in the ratio of 25-lbs, of grease to 2½ gallons of oil. The mixture must be stirred until it reaches a uniform consistency about that of thick cream. Under cold weather conditions it may be necessary to add additional 150 degree oil (carbon oil).

(*j*) To prevent undue stresses in rail due to contraction and expansion at change of seasons or sudden and wide changes in temperature, sufficient bolts and joint bars shall be loosened to permit the rails to adjust themselves, after which the bolts shall be immediately retightened. During hot weather, spacing between rail ends must be closely watched and, when necessary, rails driven back and piece or pieces of rail cut out to avoid "sun kinks" or buckling of track.

(*k*) Wear in the fishing spaces of rail and joint bars shall be compensated for by the application of reformed joint bars.

(*l*) Rail ends in main track should be maintained as near their original condition as possible, either by reconditioning or removing and cropping in accordance with Letter of General Practice No. 216-( ) .

Insulating Joints

Track Circuit Territory:

503. In track, circuit territory, insulating track joints shall be located as follows:

(*a*) (1) In main track wherever the track circuits adjoin, insulating joints shall be staggered not more than 56 inches nor less than 32 inches.

(2) Insulating joints may be staggered ½ rail length. not more than 20 feet, at—

Cut sections,

Starting point for highway crossing signals,

Highway crossing signal location,

provided such locations are not within interlocking limits, not at fixed signal locations, not in electrified territory, not in cab signal territory and not where foreign current is likely to be prevalent.

(*b*) To provide effectively for electric switch locking, insulating joints staggered as prescribed in paragraph 503-(a), shall be located opposite the dwarf signal as nearly as may be. At other signals the joints staggered as prescribed in paragraph 503-(a) shall be placed not less than 8 feet nor more than 13 feet in advance of the signal, except at locations where opposing high signals are provided on chord of bridge for traffic in either direction, where they shall be located as nearly as possible, midway between the two opposing signals and staggered as prescribed in paragraph 503-(a).

(*c*) Insulating joints need not be specially staggered at the end of a track circuit where there is no adjoining track circuit.

(*d*) Insulating joints in crossovers and turnouts shall

be located in accordance with Standard Signal Plan S-803-( ).

Application:

504. An insulating joint must not be applied to rails with battered or roughly cut ends as they will damage the fibre. The edges at rail ends which come in contact with the fibre parts of the joint, i.e., under the rail head, web and top and bottom of rail base, must be rounded to approximately 1/8 inch radius, by grinding or filing to reduce the tendency of cutting the fibre parts.

505. The rails must be spaced so the ends will bear firmly against the fibre end post, and thus avoid damage to bolts and fibre bushings. If the opening between rail ends is too small, do not force the ends apart with a track chisel or wedge, as it may damage the rail ends and leave rough edges, which will destroy the fibre parts. The fibre end post must not project beyond the rail head limits.

506. Ties must be spaced under insulating joints to meet the standard requirements and give uniform support to the joints. Parkway outlets ("boot legs") must be moved if they interfere with arranging the ties accordingly.

507. Abrasion plates must be used under insulating joints of the "Continuous" type, except joints located where the traffic is infrequent. Surface of tie must be adzed if necessary to provide a full bearing under the joint to keep the rails in line and surface.

508. Care in the application and maintenance of insulating joints is necessary to obtain satisfactory service.

509. Before. insulating joints are assembled, the parts of the rails covered by the insulating joint must be thoroughly cleaned to remove all rust, scale and dirt from under the rail head, the web, and the top and bottom of rail base. All metal parts of the joint must be thoroughly cleaned and all surfaces of the fibre head and base pieces, and adjoining inside surfaces of rail and joint bars, given a liberal and thorough coating of approved rust preventive. Care must be exercised not to damage the joint bars, bolts or fibre parts.

Note: Approved Rust Preventive is carried under Reference-

37-25 Grease, Temporary Rust Preventive. Approved. light color. (Furnish in 25-lb. or 35-lb. pails.)

510. If the joint is a "Continuous," i.e., of the base supported type, first apply the fibre base pieces and metal joint bars to each side of the rails (in the case of the Weber Joint the metal shoe angle, wood fillers and fibre and metal washer plates), and drive them on the rail with a sledge or hammer, striking only the lower edge of the bars until there is just room enough left to insert the fibre head pieces. After the fibre head pieces are in place, insert the fibre bushings in the bolt holes, and apply the fibre washer plates and metal washer plates with the bolts and nuts. Before placing the bolts in the joints they should be dipped in approved grease, thoroughly coating entire length of bolt except head as prescribed in paragraph 501-(b)-(2).

511. The joint bars shall be drawn into position by alternately driving with a sledge or hammer along the base of one bar and tightening the nuts by hand wrenches, beginning on the two center bolts and progressing to the end bolts and then proceeding in the same manner on the other joint bar. This procedure must be followed to avoid "cocking" the bars. Never drive the heads of the bars. They will draw into place under the bolt pressure. Bolts in insulating joints must be kept

sufficiently tight at all times to prevent movement of the rail in the joint.

512. A bolt should never be driven through a fibre bushing, as it will destroy the bushing. If the rails and joint parts are in correct relative position and the bolt holes lined up, the bolts can be easily inserted by hand.

513. Insulating joints within electrified territory and those in other locations which are subject to trouble due to rail cuttings shall have the space at the ends of the joints between the web of the rail and the joint filled with Car Cement, the surfaces being smoothed off with a trowel or glazing knife.

Note: The Approved Car Cement is carried under Reference—

47-556 Compound, Asphaltum, Approved. (For filling cracks in box cars by troweling or knifing, painting passenger car roofs and rail insulating joints.)

Care of Joint:

514. Insulating. joints require frequent and careful attention. When not in use, all joint parts must be kept dry and clean, as rusted bars and weathered fibre give poor results.

515. The nuts should be tightened the next day, after the joint is applied and again once a week for several weeks until all parts have become firmly set, at the same time using a sledge or hammer to tap the bars and bolt heads.

516. Insulating joints must be supported equally on sound, smooth ties, well tamped and well drained with clean ballast at all times, in order to prevent pumping and churning and excessive fibre wear.

SPIKING

Number Required:

601. The rails must be fastened to every tie by the number of spikes specified by the standards, except where otherwise authorized by the Chief Engineer. The standards are:

(*a*) On tangents, use two rail holding spikes, one inside and one outside, for fastening each rail to each tie.

(*b*) On curves three degrees and over where the traffic is 15,000,000 gross tons per year or over, use three 'rail holding spikes, two inside and one outside, for fastening each rail to each tie. On curves less than three degrees regardless of traffic, or on curves three degrees and over where the traffic is less than 15,000,000 gross tons, use the same spiking as prescribed for tangents, except that where in the judgment of the Supervisor an additional rail holding spike is necessary it shall be applied on the inside of the rail.

(*c*) On curves and tangents, for the purpose of holding tie plates firmly to the tie, two plate holding spikes shall be used at each plate, in addition to the rail holding spikes.

(*d*) Spiking shall be in accordance with Standard Plan 72050- ( ) , Appendix XIV.

(*e*) Plate holding spikes shall be driven with head pointed to the rail.

Application:

602. Spikes must be started vertically and square and driven straight. The shank of rail holding spikes must have full bearing against base of rail. The last few blows shall be given lightly so that, the spike head will not be damaged. Spikes must be kept driven home, being careful not to overdrive full throated spikes.

603. Care must be taken not to strike the rail, its fastenings or signal appliances when driving spikes.

604. Spikes in main tracks when badly throat cut or rusted must be promptly replaced.

605. If a piece of broken spike be driven through the bottom of the tie, but not clear of it, leakage of track circuit current may take place, and action to guard against it should be taken as follows:

(*a*) The new spike should be preferably relocated and the stub left undisturbed.

(*b*) Or, the stub should be driven through and clear of the bottom of the tie.

606. All old spikes shall be collected and sorted for further use, reclamation or scrapping.

BALLAST

Use:

701. Ballast is used to obtain:

(*a*) A uniform bearing for the ties.

(*b*) Resistance against lateral movement of the track and to maintain uniform tie spacing.

(*c*) Distribution of the weight of trains by means of the ties over the maximum area of the roadbed.

(*d*) Rapid and effective drainage to provide proper roadbed conditions and increase the life of the ties.

(*e*) Reduction of vibration of ties and thereby prevent the loosening of the tamping.

(*f*) Hindrance, as far as possible, of the freezing of the roadbed.

Specifications:

702. Ballast shall conform to the standard specifications. If ballast of an inferior quality, or containing quantities of screenings, dirt or other foreign matter is delivered, the attention of the Regional Engineer shall be directed to it in order to bring about improvement in manufacture.

703. At track pans and for filling between tracks, larger ballast than standard may be used, but coarse stone must be kept away from the ends of the ties.

704. Where new tracks are constructed, sub-ballast of approved material shall be used as shown on the standard plan. Where tracks ballasted with gravel, or cinders are being raised and reballasted with stone, or slag, the old ballast, or cinders that are clean and suitable shall be used as sub-ballast.

Distribution:

705. Before ballast is distributed, the sub-grade shall properly prepared by widening the cuts and fills and constructing ditches in accordance with standard plans, being careful not to form any water pockets.

706. Newly distributed ballast should be removed promptly after distribution from inside the rails down to ½ inch below the top of ties, and the outside leveled down so as to provide ample clearance for rolling stock. If, however, the track will be raised in a few days, it will be sufficient to provide an ample flangeway along each rail.

Filling Cross Section:

707. Clean, well compacted ballast must be placed around the ends of all ties up to not less than two-thirds of the height of the tie, as soon as the work which necessitates its removal is completed, to prevent deterioration and loosening of the tamping and resulting center bound track before ballast can be trimmed to standard cross section. In trimming to the standard cross section, ballast shall be leveled, lined and faced by mechanical means to the greatest extent possible, leaving the minimum to be done by hand labor.

708. Without speed restrictions having been provided for, the track shall not be lifted to such a height, or stripped to such a depth, as to result in more than one-half the thickness of the ties extending above the level of the ballast. As soon as practicable after the track has been lifted the ballast shall be filled in between the ties as shown on the standard plan. (See paragraphs 902-[e] and [h]).

709. Ballast must be kept from touching rails, a space of at least 1 inch between the ballast and base of rail being maintained.

710. Economy is promoted by making renewals of rails, ties and ballast in correct sequence in the same year.

Cleaning:

711. (*a*) When stone ballast becomes so filled with cinders, dirt and other substances that the drainage is

impaired and it does not properly perform its functions it must be cleaned.

(*b*) Where practicable ballast shall be cleaned by approved mechanical devices. Where impedance bonds are mounted on movable foundations, they should be shifted clear of the seven-foot where they will not be damaged by the mechanical device, and returned to their former location after ballast cleaning is completed.

712. All track raises should be made on clean ballast.

713. The dirt cleaned from the ballast must, under no condition, be left in piles along the track or in the ditches, or be thrown upon the slopes of cuts.

714. The following general rules should govern the cleaning of ballast:

A. Stone or Slag Ballast:

(*a*) Clean the center space between tracks to a depth of eight inches or more below the bottom of the ties.

(*b*) Clean the outside shoulder to a depth of not less than twelve inches below the, bottom of the ties and where practicable to the bottom of the ballast.

(*c*) Clean or construct cross drains as may be needed and of sufficient depth to assure good drainage, but avoid locating them at joints. (See paragraph 5.)

B. Gravel Ballast:

(*a*) Skeletonize the track by stripping or by raising the track on the old ballast, provided such ballast is of suitable quality, so that no old ballast is above the bottom of the ties. (See paragraphs 902-[e] and [h].)

(*b*) Remove to the plane of the bottom of the ties the old material from the space between the tracks and from the outside shoulder.

(*c*) Clean or construct cross drains at intervals and to a depth sufficient to assure good drainage, but avoid locating them at joints.

(*d*) Distribute sufficient ballast to provide for the lift desired and dressing the track to standard.

(*e*) Lift the track out-of-face and dress in accordance with standard plan.

715. (*a*) Extreme care must be exercised when cleaning ballast during very hot weather, as the lack of support by the ballast when the track is skeletonized may result in "sun kinks." (See paragraph 902-[h].)

(*b*) Skeletonized and track weakened by disturbed ballast must be restored to normal conditions as promptly as possible.

GAGE

Standard:

801. The Standard Gage of track shall be:

(*a*) Tangent:

4 feet 8¼ inches (except through Turnouts, Rigid Crossings, Movable Point Crossings and Slip Crossings).

(*b*) Curves:

Up to and including 10 degrees, 4 feet 8½ inches.

Over 10 degrees, 4 feet 9 inches.

(*c*) # Turnouts:

Main track run, 4 feet 8½ inches from point of switch to heel of frog.

Turnout run from tangent track—

No. 10 to No. 30 inclusive, 4 feet 8½ inches.

Less than No. 10, 4 feet 9 inches, except through guard rail the gage shall be 4 feet 8½ inches.

Turnout run from curved track—in accordance with the degree of turnout curve as prescribed in (b) above.

(*d*) # Rigid, Movable Point and Slip Crossings:

As authorized by the Chief Engineer.

Note:—

The setting of Guard Rail opposite frog shall be in accordance with Standard Plan 71800-( ), Appendix XII.

802. (*a*) Change in gage from 4 feet 8¼ inches to 4 feet 8½ inches shall be made in not less than 30 feet.

(*b*) Gage shall be changed by suitable adjustment of the rail opposite the line rail.

Maintenance:

803. Provided the gage is uniform, correction need not be made until the excess from that maintained is $^{3}/_{16}$ inch on tangent main track, ½ inch on tangent side track, and ½ inch on curves where the rails are securely fastened to the ties and in correct alinement. Any variation causing tight gage is prohibited.

804. The standard track gage must always be used in maintaining correct gage of all tracks. Track gages must be tested on the standard template at frequent intervals.

TRACK—CONSTRUCTION AND MAINTENANCE

Speed Limit Signs

See Rule 38—Book of Rules.

Installation:

901. Advance Speed Limit Speed Limit, and Resume Speed signs illustrated in Fig. 901-1 shall be used in complying with Rule 38, Book of Rules.

(*a*) The general arrangement of signs shall be as illustrated in Fig. 901-2

(*b*) Details of construction and assembly of sign are shown on Standard Plan 78405-( ), Appendix XV. Height of sign and distance from track are to be in accordance with Plan 78405-( ).

(*c*) Signs are to be placed so as to give the greatest practical unobstructed view, considering alinement and other physical, conditions.

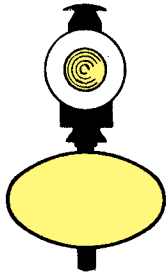
(*d*) The distance from the Advance Speed Limit sign to the Speed Limit sign shall be not less than that shown in Table 901-3 for the authorized speed in the territory and the reduced speed provided for by the Train Order or General Order.

(*e*) The table provides adequate distance for ascending grades, level track, and descending grades up to one percent. For descending grades greater than one percent, additional distance between Advance Speed Limit sign and Speed Limit sign must be provided in accordance with local conditions. District Engineers having territory with grades in excess of one percent will obtain from the regional Engineer and have readily available information as to distance required for such territory and will furnish this information Supervisor Track.

(*f*) Reflecting surfaces of signs must be kept clean to preserve their reflecting ability.

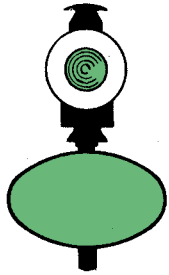
ADVANCE SPEED LIMIT SIGN

This sign with numerals in multiples of 10 miles per hour indicating the restricted speed shall be placed a sufficient distance in advance of restricted territory to permit a train to reduce from maximum authorized speed to the restricted speed. (See Table 901-3).



SPEED LIMIT SIGN

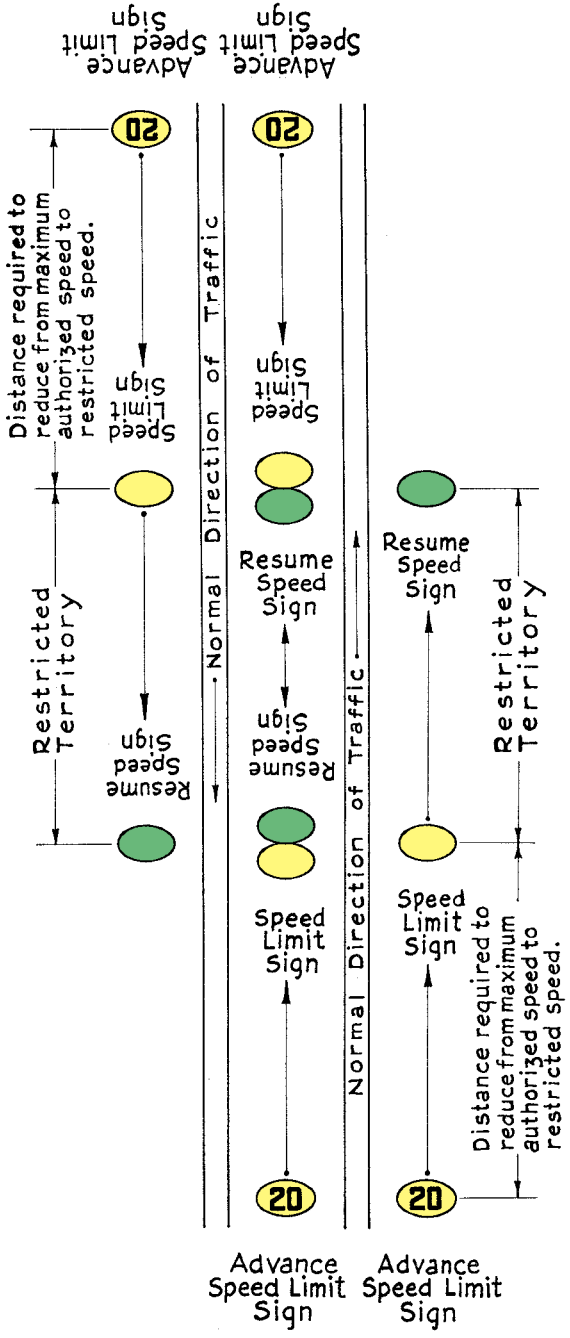
This sign shall be placed to mark the entrance to the restricted territory.



RESUME SPEED SIGN

This sign shall be placed to mark the end of the restricted territory.

Fig. 901-1



LOCATION DIAGRAM
FOR
SPEED LIMIT SIGNS

Fig. 901-2

Authorized Speed M.P.H.	Distance Required to Reduce to:									
	70 MPH. Psgr	60 MPH. Psgr.	50 MPH. Psgr.	40 MPH.		30 MPH.		20 MPH.		10 MPH.	
				Psgr.	Freight	Psgr.	Frt.	Psgr.	Frt.	Psgr.	Frt.
80	1400'	2800'	3900'	4800'	....	5500'	....	6000'	....	6300'	....
75	800'	2100'	3200'	4100'	....	4800'	....	5300'	....	5600'	....
70	....	1300'	2100'	3300'	....	4000'	....	4500'	....	4800'	....
65	....	700'	1800'	2600'	....	3400'	....	3900'	....	4300'	....
60	....	....	1100'	2000'	...	2500'	...	3200'	...	3500'	...
55	...	...	600'	1500'	...	2200'	...	2700'	...	3000'	...
50	...	...	...	900'	3200'	1600'	5600'	2100'	7400'	2400'	8400'
45	...	...	...	500'	1800'	1200'	4200'	1700'	6000'	2000'	7000'
40	...	...	...	...	...	700'	2500'	1200'	4200'	1500'	5300'
35	...	...	...	...	...	400'	1400'	900'	3200'	1200'	4200'
30	...	...	...	...	...	...	...	500'	1800'	800'	2800'
25	...	...	...	...	...	...	...	300'	1100'	600'	2100'
20	...	...	...	...	...	...	...	...	...	300'	1100'
15	...	...	...	...	...	...	...	...	...	200'	700'
10	...	...	...	...	...	...	...	...	...	...	...

TABLE 901-3

Track Obstruction

See Rule 101-Book of Rules

Description:

902. Whenever necessary to leave the main track in other than safe condition for the passage of trains at authorized speed, provide full protection and notify the Superintendent Transportation by wire. Any track must be regarded as unsafe for the passage of trains at authorized speed when any of the following conditions exist:

(*a*) Rail Renewals:

With all rail holding spikes in place on one rail, if spikes are withdrawn from other rail of the same track from more than every third tie on tangent track and curves up to 5 degrees, or from 'more than every fifth tie on curves over 5 degrees.

Where, in doing the above work, a space between rail holding spikes of more than 4 feet exists along either inside or outside line of these spikes.

Where, in doing the above work, any rail holding spikes are out or not in place on the rail opposite the rail from which spikes are being withdrawn.

Where three rail holding spikes (two inside and one outside) for each cross tie are not applied:

Within limits of shimmed rail adjacent to compromise joints.

On curves of 2 degrees 30 minutes or over.

Where broken. or defective rails are temporarily spliced and left in track for the passage of trains.

(*b*) Tie Renewals: (Based on assumption that ties are spaced uniformly in accordance with paragraph 101-[b]).

Where two or more adjoining ties are removed. Where two adjoining ties on tangent; or three adjoining ties on curves up to 5 degrees; or four adjoining ties on curves over 5 degrees, on each side of the tie removed are not fully spiked, tamped and in good condition.

Where in extremely hot weather each tie unspiked or removed is not flanked on both sides by at least four ties fully spiked, tamped and in good condition.

(*c*) Joints:

Where one joint bar is removed; or

Where one joint bar is broken entirely through between the two middle holes; or

Where both bars at a joint are cracked between the two middle holes; or

Where there are less than two bolts in a joint; or

Where one rail end is unbolted.

(*d*) Lining Track:

Where lining, other than that of maintaining ordinary alinement, and until the track is ballasted in cribs and on shoulder in accordance with paragraph 708 and all ties affected are fully tamped.

(*e*) Raising Track and Maintaining Cross Level:

Where the line and surface has not been completed and the track has not been ballasted in cribs and' shoulders in accordance with paragraph 708 and the following limits are exceeded:

	Speed in Miles per Hour			
	Up to 20	21 to 50	51 to 70	Over 70
Run-off per 31 feet at end of raise	2"	1½"	¾"	½"
The change in cross level on curves, spirals or of opposite rails on tangents in 31 feet	1¼"	1"	¾"	½"
Difference in cross level at any two points less than 62 feet apart on curves between spirals and tangents	1½"	1"	¾"	½"
Variation in super-elevation on the spirals on curves from that designated	¾"	½"	½"	½"

(*f*) Gaging

On tangents and curves up to 2 degrees 30 minutes:

Where all spikes are removed from more than two adjoining ties under one rail and the inside rail-holding spikes are removed from more than four adjoining ties, which four adjoining ties must include the above two adjoining ties from which all spikes are removed. (Based entirely on ties being spaced uniformly in accordance with paragraph 101-[b]).

On curves over 2 degrees 30 minutes:

All gaging.

In extremely hot weather:

All gaging.

(*g*) Where track has been skeletonized during process of cleaning ballast.

(*h*) Where in extremely hot weather any of the above items of work enumerated under paragraph 902 are undertaken without the following precautions being taken to avoid buckled track:

Proper expansion for rail provided at location to be worked and for one-quarter mile in each direction.

Joint bars examined for frozen joints at location to be worked and for one-quarter mile in each direction and all joint bars found frozen have been freed.

Where progressing track raising, skeletonizing, and extraordinary lining work, track must be backfilled currently with ballast in accordance with paragraph 708.

Surface and Line

Standard Requirements:

903. Track must be laid and maintained to correct surface and line, and the established elevations.

904. Track must not be raised above established elevations except under instructions from the Regional Engineer, who will give consideration to the required elevations and clearances at interlocking plants, under overhead structures, coal and water stations, platforms, bridges, road and street crossings and in tunnels.

905. Alinement consists of a series of straight stretches of track (tangents) connected by curves.

906. Correct surface, is a plane across the top of the rails which, measured square too the rails, is level on tangents and inclined on curves where super-elevation is required.

Working Requirements:

907. To maintain correct surface, the standard track level must be used.

908. Track levels must be tested by the Supervisor at least once every three months and by the Foreman each day the tool is in use, and if found incorrect it must be adjusted or replaced.

909. When making a general, raise where the profile is irregular, stakes must be set to establish the new grade.

910. The inner rail on curves and the line rail (rail to which ends of ties are lined—see paragraph 104) on tangents are the grade rails, and the other rail must be brought to surface with the aid of the track level.

911. When the track is being given a general raise the jacks should be placed opposite each other, and both rails raised together.

912. Jacks shall generally be placed in the crib ahead of the joint so as to avoid bending or straining the joint bars. They must be set true in order not to disturb the line.

913. Jacks must not be used between the rails, except where absolutely necessary and then only under proper protection. When so used, they shall always be in the hands of experienced men.

914. The work of raising tracks should always be done against the current of traffic, except on heavy grades, where it is desirable to work up grade,

915. Before raising track during hot weather, there must be assurance that the track will not warp or buckle. Consideration must be given to the conditions of rail openings at joints, (see paragraph 502-[j]) tightness of bolts, position of rail anchors, and the amount of ballast in the cribs and at the ends of the ties. In most cases track shall be filled with ballast ahead of the raise.

916. Never work so close to the time of a train that the proper run-off cannot be made to permit the train to pass without delay Before a train is allowed to pass, the run-off and track must be in safe condition.

Tamping:

917. Systematic and uniform tamping is of the greatest importance in maintaining correct surface and line.

918. All ties must be thoroughly tamped, paying special attention to the joint ties and ties of extra width.

919. (*a*) Always start tamping directly under the rail. Pack the ballast under the tie solid, being careful not to shatter the material.

(b) Tamp both sides of each tie. The best results will be obtained by tamping outside of the rail to within 3 inches from the end of the tie and inside the rail for 12 inches from the rail.

(*c*) When tamping, the ties adjoining the joint ties should be fully tamped and the joint ties then be brought to a proper bearing.

(*d*) The ties of new track ballasted with gravel should be tamped for their entire length.

Special Attention:

920. Special attention must be given to the surface and line of track at the ends and approaches of bridges and culverts, through tunnels, track troughs, switches, crossings and through platforms.

921. When placing or tamping ties around interlocking plants or trunking, or in working around joints, care must be exercised not to break or damage bond wires, pipes or wire lines or connections to the track.

922. When track has to be lined or raised at switches in interlocking or automatic signal territory, or any work done that will change their adjustment, notice must be given to the signal maintainer so that he can co-operate in the work.

923. (*a*) During very hot weather—

(1) Special attention must be given to creeping rail, frozen joints, skeletonized track; also raising and lin-

ing of track at the foot of heavy grades or in sags, to avoid, the possibility of "sun kinks."

(*b*) During freezing and thawing weather—

(1) Special attention must be given to surface of track where it is likely to be affected by the heaving action of frost.

(2) Irregularities of surface, due to frost, that cannot be corrected by the customary procedure may be temporarily corrected by the use of shims.

(3) When shimming must be resorted to, shims not exceeding 1 inch in thickness, in accordance with Plan 69977-( ) must be used; they must be securely attached to the tie with 10d or 20d nails, depending on the thickness of the shim.

(4) Tie plates must not be removed from the ties as a means of adjusting surface or cross level when shimming track unless ties are sound.

(5) If safe conditions, (paragraphs 901 and 902-[e]) cannot be obtained by the above procedure, a slow order must be issued at once restricting the movement of trains to a safe speed over the portion of track affected, until the irregularities of surface have been corrected.

(6) Shimmed track must be watched carefully to see that the shims are secured in place and that proper gage and level is being maintained. Special attention should be given when frost is thawing, as the action is frequently quicker than when freezing.

(7) When spikes are drawn to place or remove shims, all spike holes in the ties must be plugged with treated plugs.

(8) Shims must be removed as soon as conditions permit, the track properly surfaced, and the ties tamped to a solid bearing.

(9) During the Winter and Spring seasons, locations where the action of frost disturbs the surface of the track should be designated, and, if possible, the drainage conditions should be improved during the following Summer.

Alinement and Grades

Established by District Engineers:

924. The District Engineer and Supervisor shall give close and constant supervision to maintenance of alinement and super-elevation on curves. They will make frequent examination of the curves and Supervisors will instruct Foremen in the methods for correcting irregularities that may develop.

925. The proper super-elevation shall be fixed by the District Engineer by taking into consideration the degree of curvature, character of traffic, location, grade and speed. Generally the super-elevation should be made to result in smooth riding for high speed trains. Local conditions, such as proximity of curve to, station at which all trains reduce speed or stop, water stations, railroad crossings and junctions affecting speed are factors in determining the proper super-elevation.

926. (*a*) The District Engineer and Supervisor must know that the Foremen are instructed, as to the established super-elevation for all curves and see that the track is maintained in conformity therewith.

(*b*) Super-elevation on curves or the alinement of tracks under the catenary must not be changed until proper notice has been given the Supervisor Communications & Signals and his approval received.

(*c*) A permanent record of the approved super-elevation and other properties of curves must be maintained.

927. In all changes of alinement or reballasting present main tracks, the District Engineer shall establish the alinement and grades.

Super-elevation and Spirals—Speeds on Curves:

928. (*a*) Spirals shall be provided at the ends of all curves and between branches of compound curves and be of such lengths as to give a rate of change in super-elevation not exceeding:

(1) For speeds up to and including 50 M.P.H., ½ inch in 31 feet.

(2) For speeds 50 to 70 M.P.H., inclusive, 3/8 inch in 31 feet.

(3) For speeds over 70 M.P.H., ¼ inch in 31 feet.

(*b*) Super-elevation at any point on a spiral shall bear the same relation to the ordinate at that point as the super-elevation at any point on the full curve bears to the ordinate at that point.

(*c*) A spiral shall be used in which the degree of curvature varies directly with the distance.

(*d*) Where it is impracticable to use a spiral of the length recommended, the longest practicable should be used and speed regulated accordingly.

(*e*) Where there is not room for a spiral of proper length a portion of the change from level rails on tangent to super-elevation on the curve will necessarily have to be made on tangent track.

929. On a circular curve with spirals the outer rail shall have the full super-elevation at the beginning and end of circular curve.

930. The super-elevation shall not exceed 6 inches and speed shall be regulated accordingly,

931. The speeds given in the following table for various degrees of curves with various amounts of super-elevation are for the guidance of the District Engineer in establishing the super-elevation on curves and restricting the speed of train where that procedure may be necessary.

Degree of Curve	Super-Elevation in Inches												
	0	½	1	1-½	2	2-½	3	3-½	4	4-½	5	5-½	6
	Speed in Miles Per Hour												
0° 10′	74	117											
0° 20′	52	82	98	111									
0° 30′	43	67	80	91	99	107							
0° 40′	37	58	70	78	86	93	99	105					
0° 50′	33	52	62	70	77	83	89	94	99	104			
1° 00′	30	48	57	61	70	76	81	86	90	95	99	103	
1° 15′	27	43	51	57	63	68	73	77	81	85	88	92	95
1° 30′	25	39	46	52	57	62	66	70	74	77	81	84	87
1° 45′	23	36	43	48	53	57	61	65	68	72	75	78	80
2° 00′	21	31	40	45	50	54	57	61	64	67	70	73	75
2° 20′	20	31	37	42	46	50	53	56	59	62	65	67	70
2° 40′	18	29	35	39	43	46	50	53	55	58	60	63	65
3° 00′	17	27	33	37	41	44	47	50	52	55	57	59	61
3° 30′	16	25	30	34	38	41	43	46	48	51	53	55	57
4° 00′	15	24	28	32	35	38	41	43	45	47	49	51	53
4° 30′	14	22	27	30	33	36	38	40	43	45	47	48	50
5° 00′	13	21	25	28	31	34	36	38	40	42	44	46	48
6° 00′	12	19	23	26	29	31	33	35	37	39	40	42	44
7° 00′	11	18	21	24	27	29	31	32	34	36	37	39	40
8° 00′	11	17	20	23	25	27	29	30	32	33	35	36	38
9° 00′	10	16	19	21	23	25	27	29	30	32	33	34	35
10° 00′	10	15	18	20	22	24	26	27	29	30	31	32	34

Maintenance of Alinement:

932. The "string line" method shall be used for determining the alinement of curves and for calculating the throws needed to obtain smooth riding track.

(a) Measurement of chords and ordinates:

Degree of curve	Length of Chord	Ordinate Measured in	Ordinate Equivalent
0 to 1	85-ft.	sixteenths of an inch	$1\frac{7}{8}$" =1 deg. $\frac{1}{16}$" =2 min.
1 to 6	62-ft.	eighths of an inch	1" =1 deg.
Over 6	44-ft.	eighths of an inch	½" =1 "

(*b*) The string shall be held $\frac{5}{8}$ inch below top of the rail by the holder shown on Plan 69376-( ).

(c) The method of making calculations is shown on Plan 69350-( ). Appendix II.

933. For correcting the line of tangents the transit shall be used.

Markers:

934. The super-elevation on run-offs, spirals and adjustments between branches of compound curves shall be marked at each string line station on an elliptical check of monel metal or low carbon stainless steel, fastened to the tie by two 1 inch No. 7 gage oval head, galvanized nails, Reference 45A-1462, located approximately 12 inches inside the outer rail on the curve nearest the station used in string lining the curve. The elliptical check shall be 2¾ inches x 1½ inches x $\frac{3}{32}$ inch, with whole figure $\frac{7}{8}$ inch high and figures in fraction ½ inch high, and have two holes ¼ inch in diameter on the center line, $\frac{3}{16}$ inch clear from each end.

935. Where required, center line markers shown by Standard Plan 78470-( ), or iron pins 2 inches in diameter of suitable length, shall be established on an offset line clear of the roadbed.

New Work:

936. It is the duty of the District Engineers and Supervisors to see that these specifications are observed in new work.

Track Centers:

937. Existing tracks must be carefully maintained to avoid any decrease in the distance between their center lines.

938. The following spacing of tracks shall be used, in NEW CONSTRUCTION OR RECONSTRUCTION work, unless otherwise ordered. (See paragraph 941.)

DESIGNATION OF TRACK SYSTEMS Free from Clearance Limiting Objects	Distance in Feet Between the Center Lines of Adjacent Tracks on Tangent				
	13½	14	16	17	19
1. Two Main Tracks	.....	x	.....	.....	.....
2. Four Track Systems.... The Two Middle Tracks	.....	x	.....	.....	.....
2. Four Track Systems.... The Two Outside Tracks	.....		x	.....	.....
3. Six Track Systems.... The Two Middle Tracks and the Outside Tracks Respectively	.....	x	.....	.....	.....
3. Six Track Systems.... The Two Tracks Adjacent to the Two Middle Tracks	.....	.....	x	.....	.....
4. The additional Track Adjacent to the Outside Main Track of One, Two, Four, or Six Track Systems, whether it be an Auxiliary Main Track, a Running Track, a Siding, a Side or Industrial Track (but excepting a Yard Ladder Track)	.....	.....	.....	x	.....
5. A Main and Yard Ladder Track	.....	.....	.....	.....	x
6. Two Adjacent Parallel Ladder Tracks, whether the switches in either or both are or are not operated mechanically	.....	.....	.....	.....	x
7. Sidings, Yard and Other Side and Industrial Tracks*	x	.....	.....	.....	.....
8. Any Track Parallel to a Ladder Track	.....	.....	.....	.....	x

*—In the District of Columbia 14 ft. if practicable

939. WITH CLEARANCE LIMITING OBJECTS between the tracks, the following spacing for track centers shall govern:

(*a*) For position light signals the distance shall be not less than 25-ft.:—

(1) Where one-arm signals are used and the center of the background is less than 18-ft. above top of rail.

(2) Where two-arm signals are used with bottom arm displaying aspects 4 and/or 7, and the center of bottom arm aspect is less than 18-ft. above top of rail.

(*b*) For position light signals, except as in paragraph

(a), the distance shall be not less than 19-ft.

(*c*) For signal bridge supports; pedestal signals, stand pipes; or switch stands with intermediate or high staff, the distance shall be not less than 19-ft.

(*d*) For Minimum Roadway Clearances, see Standard Plan 70050-( ), Appendix XVI.

940. A clearance between sides of rolling stock equivalent to that obtained on tangents should be provided for on curves, as follows:

(*a*) Where the super-elevation is the same on adjacent tracks, this increase in distance between the center lines of adjacent tracks on curves is 1 inch for each 30 minutes of degree of curve, beginning with a 30 minute curve.

(*b*) Where super-elevation is not the same on adjacent tracks, and the track of greater radius of any two concentrically curved tracks (the outer one of the two) has greater super-elevation than the adjacent track of shorter radius (the inner one of the two), the distance between the centers of these tracks shall be as required by paragraph 940-(*a*) for tracks of curve and elevation of the outer track of the two, plus 3½ inches for each 1 inch difference in super-elevation of the two tracks considered.

(*c*) With conditions same as paragraph 940-(*b*), except the outer track has less super-elevation than the adjacent inside track, the track centers shall be as required by paragraph 940-(*a*) for curve and elevation of the outer track of the two considered.

941. Where, on account of the cost or otherwise, it appears impracticable to space tracks at the distances specified, the distance should be decided upon by the Chief Engineer.

Grades:

942. No grades shall be introduced exceeding in rate the maximum established for the engine district in which the grade is located.

Compensation on Curves:

943. Where a curve is located on a grade and the combined curve and grade resistances control the train load, the curve on the grade should be compensated, as follows:

(*a*) At places where trains frequently stop the grade on curves should be reduced at the rate of 0.05% for each degree of curve.

(*b*) At other places the grade on curves should be reduced at the rate of 0.04% for each degree of curve.

Vertical Curves:

944. Where changes of grade occur, gradient lines should be connected by vertical, curves, observing the following rules:

(*a*) A vertical curve shall consist of as many equal chords as there are whole tenths of a foot in the algebraic difference of the two gradient lines, such gradient lines being expressed in feet per 100 feet.

(*b*) The length of the chords should be 100 feet, except where for a special reason it is necessary to use a shorter vertical curve, in which case the chord lengths may be reduced.

(*c*) The change from one gradient to another should be made by a change of rate in grade for adjacent chords, equal to the algebraic difference between the rates of the two gradient lines divided by the number of whole tenths in the algebraic difference, except that the change from main gradient to the first chord and from the last chord to the second main gradient shall be one-half the rate of change between grades of curve.

(*d*) In sags; a vertical curve twice the length of the curve above so specified, should be used.

(*e*) Grade stakes should be used to insure uniform surface. On curves the low rail will be kept to the established grade.

(*f*) The minimum radii which may be used on vertical curves of hump tracks in gravity yards are as follows:

(1) 1,200 feet where locomotives are operated over the hump.

(2) 400 feet where cars only are operated over the hump.

(The last figure also applies to the vertical radius at the top of inclines leading to car dumpers.)

GUARD RAILS ON BRIDGES AND AT RETAINING WALLS AND OTHER STRUCTURES

Guard Rails:

1001. Bridge Guard Rails shall be applied between running rails of main tracks in accordance with following instructions. They shall be applied on Secondary Tracks and Sidings only where speed or hazardous conditions warrant, subject to approval of Chief Engineer.

Two Bridge Guard Rails on:

(*a*) Drawbridges.

(*b*) Through bridges (open and solid floor).

(*c*) Half through bridges (open and solid floor).

(*d*) Deck bridges (open floor)—on curves, also on tangents where distance is over 40 feet from backwall to backwall.

(*e*) Single track deck bridges (solid floor)—

On curves—Where inside edge of coping is less than 8 feet from gage of nearest rail.

On tangents—where inside edge of coping is less than 8 feet from gage of nearest rail and distance from backwall to backwall is over 40 feet, or wing walls constructed with a wide flare; making a hazardous opening close to track.

Where inside edge of coping is 8 feet or over from gage of nearest rail, where a derailment could seriously damage equipment and lading, or traffic adjacent to bridge.

(*f*) Single track arches—

On curves—where inside edge of parapet is 1ess than 8 feet from gage of nearest rail.

On tangents—where inside edge of parapet is less than 8 feet from gage of nearest rail and distance from outside edge to outside edge of masonry is over 40 feet or wing walls constructed with a wide flare; making a hazardous opening close to track.

Where inside edge of parapet is 8 feet or over from gage of nearest rail, where a derailment could seriously damage equipment and lading, or traffic adjacent to arch.

(*g*) Single track—on fill; with retaining wall on each side, where inside edge of coping is less than 8 feet from gage of nearest rail.

(*h*) Single track—on fill; with retaining wall on each side, where inside edge of coping is 8 feet or over from gage of nearest rail, where a derailment could seriously damage equipment and lading, or traffic adjacent to the retaining wall.

1002. One bridge guard rail shall be applied in the Outside Track only, adjacent to the running rail farthest from inside edge of coping or parapet on the following structures on curves, also on tangents where distance is over 40 feet from backwall to backwall, or from outside edge to outside edge of masonry, as the case may be.

(*a*) Two, or more track deck bridges (solid floor):

(1) Where inside edge of coping is less than 8 feet from gage of nearest rail.

(2) Where inside edge of coping is 8 feet or over from gage of nearest rail, where a derailment could seriously damage equipment and lading or traffic adjacent to the bridges.

(*b*) Two or more track arches:

(1) Where inside edge of parapet is less than 8 feet from gage of nearest rail.

(2) Where inside edge of parapet is 8 feet or over from gage of nearest rail, where a derailment could seriously damage equipment and lading or traffic adjacent to the arches.

(*c*) Where roadway is supported by a retaining wall where inside edge of coping is less than 8 feet from gage of nearest rail.

(*d*) Where roadway is supported by a retaining wall where inside edge of coping is 8 feet or over from gage of nearest rail where a derailment could seriously damage equipment and lading or traffic adjacent to the retaining wall.

1003. Bridge guard rails shall be applied in accordance with these instructions, subject to approval by Chief Engineer, to provide protection at the approach end of structures such as abutments, piers, tunnels, signal and catenary supports, high platforms, etc., and at other particularly hazardous locations, where in event of derailment, contact with the structure would cause damage to equipment and lading or the structure.

1004. Bridge guard rails shall extend beyond the structure:

(*a*) At the approach end and at both ends where traffic is run in both directions:

(1) Where speed is 40 M.P.H. or over:

100 feet on tangent and curves up, to 2 degrees inclusive.

300 feet on curves over 2 degree.

(2) Where speed is less than 40 M.P.H.:

75 feet on tangent and all curves.

(*b*) At the trailing, end:

(1) At any speed:

30 feet in all cases.

(The Above distances are measured from backwall of bridges, from a point over springline of arches, from a point opposite end of retaining walls, or end of structure).

1005. The end rails of bridge guard rails must be at least 27 feet in length.

1006. The relationship, in weights of running rails and bridge guard rails, shall be:

Where Running Rail Is	Bridge Guard Rail Must Not Be Less Than
155 lb.	130 lb.
152 lb.	130 lb.
140 lb.	100 lb.
133 lb.	100 lb.
131 lb.	100 lb.
130 lb.	100 lb.
112 lb.	100 lb.
100 lb.	85 lb.
85 lb.	70 lb.

1007. The guarding face of bridge guard rails shall be spaced 11 inches from the gage of the running rail, except for a distance of 21 feet from each end, which shall be curved to bring the ends to the center line of track.

1008. Where two bridge guard rails are applied at the approach end and at both ends where traffic is run in both directions, they must he equipped with a Nose for Bridge Guard Rails, Plan 71790-( ), except where speed is less than 40 M.P.H. an old frog point may be used, with the point chamfered to 45 degrees or less. At the trailing end, where traffic is in one direction only, the rail ends must be beveled to a slope of 45 degrees less.

1009. The approach end of nose guard, frog point and single guard rail and the trailing ends of all guard rails, must rest on a sound tie and be securely spiked.

1010. Where one bridge guard rail is applied, both ends must be beveled to a slope of 45 degrees or lees and the head of rail made "V" shape.

1011. Bridge guard rails must be held in place by a spike on each side of the base of the rail at each tie and spliced with proper joint bars, securely bolted with four bolts. Where bridge guard rails are 130 lb. P. S. rail, the joint bars on the side nearest the running rail

shall be of the L-1 type or suitable bars which will not present an obstruction to derailed wheels, also rail ends in the joints must be in line on the guarding face.

1012. Whenever available; "Fit" material shall he used for all bridge guard rails and supplemental parts. Degraded heat rails may be used, except in approach and trailing curved portions.

1013. Bridge guard rails must be reinforced by bridge guard rail braces, fully spiked:

(*a*) Where a track is on tangent or curves up to 2 degrees inclusive; brace on every third tie, and where two bridge guard rails are required, braces shall be applied on the same ties.

(*b*) Where a track is on a curve of over 2 degrees:

(1) Bridge guard rail on inside of curve; brace on every tie.

(2) Bridge guard rail on outside of curve; brace on every third tie.

(*c*) The curved approach and trailing ends of all bridge guard rails; brace on every tie.

(*d*) Type "B" braces; which provide a plate under bridge guard rails, shall be applied throughout the length of the curved approach ends and at both ends where traffic is run in both directions.

(*e*) Type "A" braces; which do not provide plates under bridge guard rails, shall be applied throughout the balance of the bridge guard rails.

1014. Where the distance between two adjacent bridges, on which bridge guard rails are required:

(*a*) Is less than 500 feet:

(1) Where two bridge guard rails are required on both bridges, the bridge guard rails shall be continuous between bridges.

(2) Where two bridge guard rails are required on one bridge and one bridge guard rail is required on the other bridge, that one bridge guard rail shall be continuous between bridges and the end of the bridge guard rail which is not continued shall be terminated as prescribed for one bridge guard rail.

(3) Where one bridge guard rail is required on both bridges, that bridge guard rail shall, be continuous between bridges.

(*b*) Is 500 feet or over:

(1) Where one bridge guard rail is required between bridges and two bridge guard rails are required on each bridge, that one bridge guard rail shall be continuous with those on the bridges and the ends of the bridge guard rails which are not continued shall be terminated as prescribed for one bridge guard rail.

(2) Where one bridge guard rail is required between bridges and two bridge guard rails are required on one bridge and one bridge guard rail is required on the other bridge, that one bridge guard rail shall be continuous with those on the bridges and the end of the bridge guard rail which is not continued shall be terminated as prescribed for one bridge guard rail.

(3) Where one bridge guard rail is required between bridges, and also one bridge guard rail on each bridge, that bridge guard rail shall be continuous with those on the bridges.

1015. Bridges and trestles on industrial side tracks shall have spacing timbers only, except that where wooden guard rails on industrial side tracks are replaced by metal tie spacing bars, guard rails shall be added where speed or hazardous conditions warrant, subject to approval of the Chief Engineer.

SPACING BARS ON BRIDGE DECKS

Tie Spacing Bars:

1050. Tie spacing bars for holding the ties in place on open floor bridges shall be in accordance with Standard Plan 79400-( ).

CROSSINGS AND TURNOUTS

Crossings

Manganese and Bolted Heat Treated Rail:

1101. Crossings of manganese steel or bolted heat treated rail construction, subject to approval of Chief Engineer, shall be used at intersections where the traffic is heavy and/or high speed in either run.

Bolted Rail:

1102. Bolted rail crossings (not heat treated) shall only be used where traffic is light and infrequent on both runs or in an emergency.

Installation:

1103. When installing crossings, especially those of manganese steel, either of the solid or rail bound types, each crossing consisting of four frogs shall be handled as one piece with a crane when practicable; when there is more than one track over one track, the crossings shall be bolted together after they are in place. At any time when necessary to use jacks on crossings, they must be applied to the frog proper and never applied to the arms of the frog.

1104. Crossings must be installed on sound creosoted timber, and where suitable, continuous longitudinal support provided under the runs of heavy traffic. Timber must be so located as to permit satisfactory tamping under the intersections and arm ends.

1105. An ample bed of clean, well drained ballast must be provided.

Maintenance and Repairs:

1106. (*a*) All rigid crossings, slip and movable point crossings must be carefully maintained to the alinement and to the ordinates from the diagonal as prescribed by the plan.

(*b*) All fins and lips of flowed metal must be ground from the frogs promptly, and the gage and guard edges of the casting rounded to meet the requirements of gages prescribed by the Chief Engineer.

(*c*) All bolts must be kept tight and broken bolts be replaced immediately.

(*d*) The threads of all bolts must be kept thoroughly oiled.

1107. (*a*) Consideration should be given to repairing worn frogs in place by approved method of welding.

(b) All frogs requiring repairs, which cannot be made in place, shall be shipped to the designated point for reclamation.

(c) Ballast must be kept well tamped under frogs at all times so that the surface of the frog is maintained at a uniform grade with the adjacent track.

Placing Turnouts

Consecutive Operations:

1108. Turnouts, crossovers and their appliances shall be placed and maintained as per Appendices III, ,IV, V, VI, VII, VIII, IX, and X.

1109. (*a*) ,Locate the point of the frog, the points of the switch and the ends of the stock rails, using design L stock rails, Appendices VI and X, wherever practicable to do so.

(*b*) Relocate main track joints as may be made necessary on account of the stock and guard rails.

(*c*) Stock and lead rails, Appendices V, VI, IX, and X for 3-hole 130 lb. rail and heavier, must be secured from a central shop. For other rail sections the above Appendices should be followed insofar as practicable.

(*d*) Put in then headblock, with the gage plate or two slide plates first, and then all the switch ties for the switch rails and frog, and their slide plates, braces, heel plates, one piece guard rail (or guard rail plates if other than one piece type is used), those for the unbroken line of rail being lined and full spiked in position, while those on the turnout side are held in place temporarily.

(*e*) Bend the stock rail for the turnout side in accordance with the following table:

	Length of Switch Rail	Bend Stock Rail	Offset from Straight Line at 10 ft. From Bend
130 lb. 2-Hole and Lighter Rails	30 ft.	8 inches ahead of Point of Switch	$1^{7}/_{8}$ inches
	18 ft.	$4^{13}/_{16}$ inches ahead of Point of Switch	$3^{1}/_{8}$ inches
130 lb. 3-Hole Rail	30 ft.	At Point of Switch	$1^{29}/_{32}$ inches
	18 ft.	At Point of Switch	$3^{3}/_{16}$ inches
131 lb. Rail and Heavier	45 ft.	At Point of Switch	$1^{1}/_{64}$ inches
	30 ft.	At Point of Switch	$1^{49}/_{64}$ inches
	20 ft.	At Point of Switch	3 inches

(*f*) Couple up the stock rail, main track switch rail (heel block to be placed later), lead rails and frog on the ends of the ties on the turnout side, doing such cutting and drilling as may be necessary to complete the main track to proper length from the point of switch to the heel of the frog.

(*g*) Open the track, throw out the old main track rail, set in the switch rail with the stock rail, the lead, rail and frog, and make the connections at the heel of the frog and at the stock rail, after which first spike to exact gage the frog at the heel, point and toe, then before completing the spiking from frog to and including the heel of the switch rail, place the heel block with bent splice and proper length thimble on heel block bolt.

(*h*) Before letting a train over the main track, the guard rail must be correctly placed and spiked, all switch plates on the turnout side must be fully spiked in correct position, the switch rail spiked against the stock rail, and the free end of the stock rail fastened to prevent movement.

(*i*) In applying the switch plates on the turnout side:

(1) Correct gage must be obtained 12 inches ahead of the point of switch.

(2) Put a slide plate on the tie nearest the part of the switch rail where the planing begins at separation of the heads, and adjust the stock rail so that it does not bind against the switch rail and thus cause it to open at the point. (To test this, the switch rail should be operated so that its point will be seen to touch the stock rail before any other part). After this has been properly adjusted spike the slide plate and then the remaining slide plates and braces, working each way from the center one.

(*j*) When putting on Slide plates, use a bar (not a pick), and do not attempt to "draw the gage" with a spike.

(*k*) Put in the rest of the switch ties and line and surface the main track in good condition.

(*l*) Couple up the switch rail for the turnout lead, set the lead rails, and spike the turnout lead to the

proper line for the turnout curve, Appendices IV and VIII.

(*m*) Complete the work by setting the remaining guard rail (and switch point guard rail if staggered switch rails are being installed), setting and adjusting the switch operating mechanism, checking the line, gaging, spiking and surfacing.

1110. If possible, avoid placing turnouts for sidings, side tracks and crossovers on curves or to face the current of traffic in present or possible future two or more tracks.

Frogs

Use:

1111. These several instructions are supplemented and illustrated by Standard Plans and Specifications for the construction of frogs, and Appendix XI.

1112. (*a*) The frogs of various angles as designated by the frog number shall be used as follows:

(1) No. 20 Frogs: At interlocking plants for crossing over of high speed trains from one main track to another main track normally used in the same or reverse direction, in districts where the authorized speed is over 50 miles per hour, and where it is feasible to obtain the distance required for the layout on tangent or light curve.

(2) No. 15 Frogs: At interlocking plants for occasional movements of high speed trains to another main track normally used in the reverse direction, where conditions do not afford the distance required for No. 20 Frogs.

For diverting trains to sidings or other tracks and returning trains to the main tracks, where such movements are frequent or where smooth riding is desired.

(3) No. 10 Frogs: For all other turnouts from main tracks and sidings where practicable and in yards and terminals where steam locomotives of the heaviest types are used.

(4) No. 8 Frogs: For turnouts from main track where the use of a No. 10 Frog is not practicable and for yard turnouts in Diesel territory.

(*b*) The maximum permissible speeds through turnouts without super-elevation, when located in tangent tracks, will be as follows:

Frog No.	Length	Speed M.P.H.
20	45 ft.	45
20	30 ft.	35
15	30 ft.	30
10	20 ft.	15
10	18 ft.	15
8	20 ft.	10
8	18 ft.	10
6	10 ft. or 11 ft.	5

(c) When turnouts are located in curved tracks with the turnout leading in the same or opposite direction as the curvature of the parent track, the elevation of the rails in the turnout with respect to each other both in the lead and back of the frog must be so adjusted that the rate of run-off does not exceed ½ inch in 31 feet. Speed must be adjusted to agree with table, paragraph 931.

Manganese:

1113. Where economical, frogs of manganese steel center construction shall be used. Spring frogs in service may be continued in service until such time as their replacement becomes necessary.

Bolted. Rigid:

1114. Carbon steel rail bolted rigid frogs may be used on branch lines of light freight traffic at moderate speed and in yard tracks when fit manganese frogs are not available, and where it is known they will give satisfactory service.

Self Guarded Frogs:

1115. Self guarded frogs may be used at locations in yard tracks, or industry tracks, where experience indicates they will give satisfactory service, subject to approval of the Chief Engineer.

Maintenance and Repairs:

1116. (*a*) All fins and lips of flowed metal must be ground from the frogs promptly, and the gage and guard edges of the castings rounded to meet the requirements of gages prescribed by the Chief Engineer.

(*b*) All bolts must be kept tight and broken bolts be replaced immediately.

(*c*) The threads of all bolts must be kept thoroughly oiled.

1117. (*a*) Consideration should be given to repairing worn frogs in place by approved methods of welding.

(*b*) Frogs not fit for main tracks shall be used in yard and other slow speed tracks when their condition warrants.

(*c*) All frogs requiring repairs, which cannot be made in place, shall be shipped to the designated point for reclamation.

Switches

Standards:

1118. These instructions are supplemented and illustrated by the Standard Plans and Specifications for the construction of switches and Appendix XI.

Lengths:

1119. The following table indicates the length of switch to be used with the designated frog.

Frog	Length of Switch	
Number	130 lb. Rail and Less	131 lb. Rail and Over
20	30 ft.	45 ft.
15	30 ft.	30 ft.
10	18 ft.	20 ft.
8	18 ft.	20 ft.
6	10 ft.	11 ft.

Maintenance:

1120. Any fin or lip on stock rail side of switch rail or knuckle rail side of movable point rail which interferes with the fit against the stock rail or knuckle rail; also any slight turning over of the thin metal at extreme point of spring switch rail must be removed, preferably by grinding or filing.

1121. Switch point rails and movable point rails shall be kept in good line and surface, and in good order with bolts tight and cotter pins in place.

1122. Switch point rails and movable point rails must fit the stock rails closely and accurately, with a full bearing against the head. This Condition, is shown by evidence of wear over the contact surface, which can be seen when the point is in the open position. If the wear indicates bearing only along the top edge of the point, cor rection must be made by grinding. The upper edge of the stock or knuckle rail shall be rounded to conform to 7/16 inch radius.

1123. Creeping of switch rails must be prevented by adequate anchorage of the lead rails in the turnout.

1124. Creeping of stock rail must be prevented by adequate anchorage of adjacent track rails.

1125. Switch rod bolts shall be placed with the nuts up and be provided with cotters.

1126. Slide plates and movable parts of all switches and movable point crossings must be kept clean and well lubricated. Where there is excessive abrasion of switch rails oil shall also be applied on the gage side for a distance of 3 or 4 feet from the point. Where there is excessive abrasion of switch rails in interlockings the maintainer shall apply the oil when cleaning and lubricating slide plates. For use of graphite lubricant see Letter of General Practice No. 342( ).

1127. Unusual wear of switch rails must be investgated to determine and eliminate the cause. Approved methods of reducing unusual wear of switch rails under facing point traffic are:

(*a*) In Main Tracks:

(1) The stock rails for 3-hole 130 lb. rail and heavier as furnished from the central shop are provided with a recess for this purpose. For other rail sections this recess to house the point may be cut with a milling machine or precision grinder, but not with a track chisel or cold chisel, ¼ inch in depth at point of switch, starting from zero at separation of heads, extending to 1½ inches ahead of point of switch, then tapering to zero in 4½ inches. The top of the cut shall be rounded to 7/16 inch radius. Recesses must not be cut for switch rails unless they are provided with heel blocks. Recesses once cut shall not be deepened.

(2) Staggered switch points, with switch point guard rail and special heel block, and both points locked mechanically, only where the authorized main track speed does not exceed 40 M.P.H.

(*b*) In Other Than Main Tracks:

(1) Approved types of switch point protector of high manganese steel where the authorized speed does not exceed 15 M.P.H. Where installed, the stock rail must be changed when it becomes worn vertically or laterally to an extent that results in excessive and unusual flange pressure upon the protector.

(2) Switch point guard rails of approved type, designed to be applied outside the stock rail, and to deflect the rim of the wheel.

(3) A reverse bend placed in the stock rail to house the point and providing a 3/16 inch offset in 4 inches beginning 1½ inches ahead of the point of switch and running out 5½ inches ahead of the point of switch. The reverse bend shall be used only at switch rails provided with heel blocks. Bending of stock rail shall only be done at a central shop.

(4) A recess in the stock rail to house the point, cut with a milling machine or precision grinder, but not with a track chisel or cold chisel, ¼ inch in depth at point of switch, starting from zero at separation of heads, extending to 1½ inches ahead of point of switch and then tapering to zero in 4½ inches. The top of the cut shall be rounded to 7/16 inch radius. Recesses must not be cut for switch points unless they are provided with heel blocks.

1128. Switch rails in main tracks which divert flanges, including switch rails in normal position which are against the outer rail on curves, must be replaced when worn down so that the top is, at any place, more than $^{7}/_{8}$ inch below the top of the stock rail.

1129. Chipping along the top of the switch rail must be investigated and cause determined. Such chipped switch rails must be replaced promptly, unless it is positively known that the chipping was caused by a lip on the stock rail in which case the lip must be removed at once and the switch rails may be retained in place, provided the chipping is not serious. Switch rails may be maintained by grinding in accordance with Letter of General Practice No. 222-( ).

1130. Switch rails and connections must be examined frequently. It is important that the stock rails have no play. Regular inspections shall be made as required by C.E. 40-( ), and necessary adjustments made at once.

1131. When necessary to disconnect a switch, movable point crossing or derail from its operating mechanism, or to disconnect No. 1 switch rod, the following, in addition to providing complete protection for trains, must be done:

(*a*) The closed switch point rail, or movable point rail must be held securely against the stock rail or knuckle rail, by a spike driven in each of the first two ties, back of the point, and where possible the spikes must pass through the tie plates.

(*b*) A wooden wedge, not less than 18 inches long, must be driven between the open switch or movable point rail and the stock or knuckle rail and be secured by (1) a lag screw or heavy nail through one of the clip bolt holes; or (2) a piece of wood spiked to the first and second ties ahead of the point; or (3) a light flat headed bolt through a hole in the wedge adjacent to the side of the first tie under the point and between this tie and the No. 1 or head rod. The bolt must be secured in place by a cotter pin or split key below the bottom of wedge.

1132. If necessary to disconnect both No. 1 and No. 2 switch rods, train movements shall not be made over the switch or movable point crossing until one, or both rods are properly connected to the switch or movable point and the rails have been secured as in paragraphs 1131 (a) and (b). If the open rail is removed, trailing movements may be made after closed rail has been secured by a spike driven through holes in tie plates on each of the first two ties back of the point; for facing movements, end of lead or connecting rail must be moved away from running rail to provide at least 5 inches clearance, be protected with a riser wedge fastened to tie and movements restricted to slow speed.

1133. If switch, movable point crossing or derail is in an interlocking; or protected by signals or switch point indicator, the work of disconnecting the switch rods must be done in charge of the Track Foreman in co-operation with the Signal Maintainer.

1134. Switch rails, but not including movable point rails, shall be replaced when the raised portion of the switch points are worn down to the level of the top of the stock rail.

Frog Guard Rails

Standards:

1135. One-piece type of frog guard rail shall be furnished in accordance with Specification C.E. 72-( ) and of Manufacturer's design approved by the Chief Engineer.

Material. Type and Use:

1136. One-piece and Hook Flange Type:

(*a*) The One-Piece Manganese type of cast Hadfield or High Manganese Steel, marked Manganese, MS, or M, shall be used in main track and for the main track side of turnouts on the outside of curves generally. They are especially suitable in other places where abrasive action is severe.

(*b*) The Hook Flange type may be used in yards and side tracks, and in main track territory except at certain interlockings where there are frequent and regular diversions of scheduled trains.

(*c*) Repaired one-piece Manganese guard rails may be used in side tracks and yards.

1137. Tee Rail Type:

(*a*) Tee Rail type of Open Hearth rail, Standard Plan 71805-( ), Appendix XIII, may be used in yards and side tracks, on the turnout side in main track under light traffic, or where guard rails of unusual dimensions are required to suit special local conditions.

1138. Table showing use of guard rails for new work and renewals:

Frogs	Main Track					Side Track and Yards
	Heavy Traffic			Light Traffic Speed Under 50 M.P.H.		
	Main Track Side	Turnout Side		Main Track Side	Turnout Side	Both Sides
		Hard Use	Light Use			
No. 20	Manganese or Hook Flange	Manganese	Manganese or Hook Flange	Manganese or Hook Flange	Manganese Hook Flange or Tee Rail	Tee Rail or Hook Flange
No. 15	"	"	"	"	"	"
No. 10	"	"	"	"	"	"
No. 8	"	"	"	"	"	"

NOTE: (1) Where other types are giving satisfactory service, changes to meet the above requirements are not necessary.

(2) See paragraph 1115 for use of self guarded frogs.

Lengths:

1139. (*a*) The length of Manganese or Hook Flange guard rails for general use, shall be not less than 9 feet 1 inch.

(*b*) The length of Guard rails of Tee rail type for use in yards and side tracks, and in main tracks as specified above, shall be not less than 11 feet 0 inches.

(c) Tee rail guard rails not less than 14 feet long shall be used on the inside of curves of 13 degrees or over in order to lessen the flange wear on the toe rail of the frog.

Gage:

1140. The distance from wheel flange face of guard rail to the gage line of the frog point must be as follows:

(*a*) One-piece Manganese guard rails, 4 feet $6^5/_8$ inches, except where the curvature through the turnout lead exceeds 8 degrees it must be 4 feet 6¾ inches. Standard Plan 71800-( ), Appendix XII.

(*b*) Hook Flange and Tee guard rails 4 feet 6¾ inches, except as otherwise specified.

(*c*) The distance between the wheel flange face of the guard rail and the wheel flange face of the frog wing rail must never exceed 4 feet 5 inches.

Setting:

1141. Guard rails shall be set as follows:

(*a*) One-piece guard rails in accordance with Standard Plan 71800-( ), Appendix XII.

(*b*) Tee and Hook Flange guard rails shall be set in accordance with Standard Plan 71805-( ), Appendix XIII.

1142. The ends of guard rails shall always be placed upon a tie or be protected otherwise, so that no loose or dragging object may become hooked under the guard rail ends.

Switch Point Guard Rails

Approved Type:

1143. One-piece guard rails for protection of switch points shall be furnished in accordance with Specification C.E. 72-( ) and of manufacturer's design approved by the Chief Engineer. They will be marked right hand or left hand. (Example: The right hand guard rail is to protect the left hand switch point).

SWITCH OPERATING MECHANISMS.

Types:

1201. Switches shall be operated by approved types of mechanisms, as:

(*a*) Manual or power operated mechanisms in accordance with "Specifications for Signal and Interlocking Systems," C.E. 234-( ).

(*b*) Hand operated mechanisms, commonly called "switch stands," as:

(1) A mechanism, contained in one unit, which throws the switch rails and also provides for locking them in normal or reverse position, or both, hereinafter referred to as a "locking switch stand." Approved type is U.S. & S. Style T-20.

(2) A mechanism which throws the switch rails only, hereinafter referred to as a "switch stand." Approved type is shown on Standard Plan 73900-( ).

(3) (A) Mechanisms which throw the switch rails and are supplemented by approved type slow acting spring mechanisms, used only at locations approved by Regional Manager and Chief Engineer, are of two types:

(I) In Tracks other than Yard—a mechanism of approved type which throws the switch rails and also provides for locking them in the position for which the switch is normally set, together with Circuit Controller, providing protection by signals, aspects Rules 292, 291, 285A and 296, Electric Switch Lamps (approved type) in accordance with "Specifications for Signal and Interlocking Systems," C.E. 234-( ). An "SS" marker, in accordance with Standard Signal Plan S-545-( ), must also be displayed at each Spring Switch.

(II) In Yard Tracks—a Switch Stand, Standard Plan 73900-( ), which throws the switch rails and does not include Electric Switch Lamp, Signals, or Switch Point Indicator.

(B) Switches for use with slow acting spring switch mechanisms are shown on Standard Plan. 73150-( ).

(C) Where slow acting spring switch mechanisms are in service, permissible speeds shall be as follows:

MOVEMENT	SPEED	
	Specifications (3)-(A)-(I)	Specifications (3)-(A)-(II)
Facing	As otherwise authorized for turnout or track.	As otherwise authorized, but not to exceed 20 M.P.H.
Trailing—Not Springing Switch		
Trailing—Springing Switch Through Turnout	As authorized for turnout, but not to exceed 30 M.P.H.	As authorized for turnout, but not to exceed 20 M.P.H.
Trailing—Springing Switch Through Main Track	As authorized for turnout or track, but not to exceed 30 M.P.H.	As authorized for turnout or track, but not to exceed 20 M.P.H.

Locking Switch Stands, Use:

1202. Locking switch stands shall be used:

(*a*) With circuit controller in main tracks:

(1) In automatic block territory.

(2) In manual block territory, at switches protected by signals, aspects Rules 292, 285A and 296.

(*b*) Without circuit controller in-main tracks:

(1) In manual block territory only where local conditions warrant mechanical switch locking and when approved by the Regional Manager and Chief Engineer.

1203. Switch stands, without the locking feature, shall be used for operating all switches except where the locking switch stand is required or warranted, as outlined in 1202.

Padlocks:

1204. (*a*) The throw levers of switch stands at all non-interlocked main and secondary track switches shall be locked by a standard switch padlock, and two latches, the padlock to be fastened by the chain to the switch stand or to the tie so that the switch can be locked in the normal position only, as follows:

(1) Where the switch is provided with a separate facing point lock not operated by the throw lever of the switch stand, the padlock shall be placed for locking the facing point lock lever only.

(2) Where the switch is provided with "locking switch stand," the padlock shall be placed for locking the throw lever.

(*b*) The throw levers of switch stands in other than main and secondary tracks shall be provided with the latches but shall be provided with padlocks only when authorized by the Superintendent Transportation.

Position Indication of Switch Points:

1205. In order to give a clear and distinct indication of the position of the switch points when non-interlocked, colored targets, lamps with colored enameled discs, or reflectorized targets, Standard Plan 73915-( ), in lieu of lamps in locations approved by the Regional Manager, shall be provided in addition to the switch stands, except in cases where it has been decided that the indication is not of sufficient importance, as possibly, in yards, tabulation follows :

(*a*) Day and Night Indications:

Display of Switches	Color of Position Indicators for Switch Points					
	Switch Normal		Switch Reverse			
	Day	Night	Day		Night	
	Disc or Target	Colored Lenses or Reflectors	Disc or Target		Colored Lenses or Reflectors	
1. In Main Tracks	White	Green	Red		Red	
2. At ends of Two Main Tracks	White	Green	Red		Red	
3. In all other tracks, including siding switch or, crossover between siding and main track	White	Green	Yellow		Yellow	
	Switches Set to Derail		Switches Set for Movement with Current of Traffic		Switches Set for Movement against Current of Traffic	
	Day	Night	Day	Night	Day	Night
4. Siding switch at ends of middle sidings	Disc or Target	Colored Lenses or Reflectors	Disc or Target	Colored Lenses or Reflectors	Disc or Target	Colored Lenses or Reflectors

Note: Regulations issued by public authorities require the use of lamps under certain circumstances, and must be complied with.

1206. Switch point indicators, targets, lamps and reflectorized targets shall be of three types according to the height of mast above the track ties measured to the center of the target or colored enameled discs.

(1) "Low", or not to exceed 20 inches.

(2) "Intermediate", or 7 feet 3 inches.

(3) "High", or 17 feet.

Type of indicators to be Used:

1207. Indicators shall be used at non-interlocked switches in accordance with the following guide rules for deciding upon the height of indicator desirable at different locations of turnouts:

(*a*) (1) Use Low Type with Lamp and Colored Enameled Discs, or Reflectorized Target:

With switches in main tracks in automatic signal territory.

With main track switches that are normally trailing switches.

In non-automatic signal territory, with switches protected by signals, aspects Rules 292, 285A and 296.

With switches requiring intertrack location for the indicator where the tracks are spaced less than 19 feet center to center.

With branch track switches where the speed of trains is slow.

With all siding and side track switches not included above.

(2) Use Low Type with Target, but no Lamp or Reflectorized Target, on Switches where only day indication is necessary:

If target is used on low switch signal stand, shown on obsolete Plan 54642-( ), Sleeve Adapter as shown on Plan 69512-( ) must be used.

(*b*) Use Intermediate Type with Target and Lamp or Reflectorized Target, but no Colored Discs:

In non-automatic signal territory at facing point switches, where sufficient visibility is not afforded by the low type, and where a high type is not warranted.

(c) Use High Type with Target and Lamps or Reflectorized Target, but no Colored Discs:

In non-automatic signal territory at facing point switches, where sufficient visibility is not afforded by the intermediate type.

Switch Stands, Use:

1208. Hand operated switch stands shall be placed so that:

(*a*) (1) At main track switches and at the siding end of crossovers between main track and siding, the operating rod must be in tension when the switch is set in normal position.

(2) At crossovers there shall be a switch stand for each switch.

(*b*) Where crossover switches are protected by signal an arrangement of locking shall be provided.

(1) Between main tracks, in accordance with Standard Signal Plan S-228-( ) .

(2) Between Main Track and siding in accordance with Standard Signal Plan S-228-( ).

(*c*) Where crossover switches between main tracks or between main track and siding are not protected by signal, when approved by Regional Manager and Chief Engineer, mechanical switch locking shall be provided in accordance with Standard Signal Plan S-228-( ).

(*d*) Switch stands for all other tracks shall be located to serve the safety and convenience of employes in the best way.

(1) Where practicable and warranted, the switch throw rod and the lock rod in the runway shall be covered over with trunking having the top surface on a level with the ballast or ground for safeguarding employes.

Location of Switch Point Position Indicators:

1209. Switch point indicators shall be placed so that:

(*a*) The colored targets and the lamps with colored enameled discs shall, if possible, be on the right hand side of the switches in all tracks, when viewed as facing points from an approaching train.

(*b*) The targets and lamps shall be set at right-angles to the track, and be perpendicular to the head ties. When the switch is set normal for the main track, the upward point of the inclined blade, where targets are used, shall be away from the track.

(*c*) The indicator must be placed on a Low Switch Lamp Stand and connected to the switch points in accordance with Standard Plan 73910-( ).

(*d*) Electric switch lamps connected to spring switch indicates :

(1) Green when switch point is closed and locked.

(2) Red when switch point is unlocked or point open.

Distance from Rail for Switch Stands and Switch Point Indicators:

1210. (*a*) Switch stands, with or without switch point indicators, and stands carrying switch point indicators, must be placed so that the distance from the gage of the nearest rail to the center of the spindle or mast shall be:

(1) With low mast and where located between tracks whose center to center distance is:

(A) 12 feet 2 inches or more, but less than 13 feet 0 inches, a minimum of 3 feet 8¾ inches.

(B) 13 feet or more but less than 14 feet, a minimum of 4 feet 1¾ inches.

(C) 14 feet or more but less than 17 feet, a minimum of 4 feet 7¾ inches.

(D) 17 feet 0 inches or more, a minimum of 7 feet 0 inches.

(2) For all stands with low, intermediate or high mast, when not between tracks, a minimum of 7 feet 0 inches.

(3) In cases where two switches are so close together that switch point indicators, if of the same height, will not be visible separately from the engine cab, one marker shall be located at a distance of 18 inches greater than the other from the track.

(b) "Locking switch stands" shall be placed so that the center line of the lock bar is 30 inches from the gage of the stock rail.

Maintenance:

1211. Switches, switch stands and throwing rods must be examined frequently. All broken, damaged or missing parts shall be renewed immediately. Regular inspections shall be made as required by C.E. 40-( ), and if necessary take corrective action at once.

1212. Worn switch latches must be replaced before the wear is sufficient to permit the switch to be opened without removing the padlock.

1213. Switch point indicators shall be kept clean and of uniform brightness and visibility. Targets and discs which were not enameled shall be painted at necessary intervals.

SECONDARY TRACKS, YARD TRACKS AND SIDINGS

Construction and Maintenance:

1301. No curves shall be constructed or realined with curvature greater than that adopted as the limit for permanent use in the district where located. Every opportunity should be taken to lessen the curvature in existing track. In no case will tracks be constructed with radius less than 176 feet (33 degree curve).

1302. (*a*) The unconnected end of secondary and yard tracks must be curved away from the main track to which it is adjacent.

(*b*) Where there is danger of injuring persons or property if cars should be run off the end of the track, a bumping post or wheel stop, of approved type, may be provided. Wheel stops shall not be used on tracks used by passenger equipment.

DERAILS

Normal Position:

1401. The "Normal. Position" of derail shall be "to derail" the wheels of rolling equipment, and the "Reverse Position" to leave the rails in condition for free movement of equipment.

1402. Derails shall be used as follows:

(*a*) In main tracks, secondary tracks and sidings only where required by Federal or State Authorities or where authorized by the Chief Engineer.

(*b*) In all other tracks connected with main tracks except:

(1) Where on account, of ascending grade or other local conditions there is no possibility of rolling equipment drifting beyond a determined point of safety, which shall be indicated by a yellow stripe about 10 inches wide painted on the inside and outside of head, web and base of both rails, which must be kept clear of snow, ice, dirt and weeds, and repainted as often as necessary. (In determining the ascending grade which will prevent equipment from drifting beyond the point of safety, the grades on the entire track must be considered. Wind pressure will cause rolling equipment to move against any ascending grade less than 0.5%.)

(2) Where a track is located between main tracks and connected with both at the same end, in which case the "Middle Siding Layout for Hand Operated End Switches," Standard Plan 73930-( ) and Plan 69479-( ) shall apply. If such track is temporarily used to store cars, place a car stop close to the stored cars while the track is so occupied, unless made unnecessary by reason of an ascending grade.

(3) Where slow acting spring switches are authorized.

(*c*) With guiding rail guards where track is located between main tracks not connected with both at the same end, to make sure that derailed rolling equipment will not foul the adjacent track. If such track is temporarily used to store cars, place a car stop close to the stored cars while the track is so occupied, unless made unnecessary by reason of an ascending grade.

(*d*) At other points (as car repair yards) where deemed necessary, and authorized by the Chief Engineer.

(*e*) In an outside main track, if temporarily used to store cars, place a derail close to the stored cars while the track is so occupied unless made unnecessary by reason of an ascending grade. If the main track on which cars are stored is between other main tracks, place a car stop close to the stored cars instead of a derail, unless made unnecessary by reason of an ascending grade.

Location:

1403. The location, generally, for derails, except in main tracks, shall be the clearance point. The variations are as follows:

(*a*) Track spacing and clearances are defined in paragraphs 937 to 941, both inclusive.

(*b*) Where the tracks are not parallel at the clearance point, the derail shall be placed a sufficient distance back of the clearance point (with the use of deflecting rail guards where necessary) to make sure that derailed rolling equipment will not foul the main track.

(*c*) Where guiding rails are used, the minimum length of guiding rail shall be 18 feet. The nearest end of the guiding rail shall be located 10 feet from the derails.

The flangeway at end of guiding rail nearest derail shall be 4 inches.

End of guiding rail farthest from derail shall be set to give a clear opening between rail heads of 12 inches unless a different alinement is required due to local conditions.

The guiding rail shall be spiked to each tie with two rail holding spikes. Tie plates need not be used. Type "A" bridge guard rail brace shall be used on alternate ties to support the guiding rail. The guiding rail shall be of a section and weight not greater than that in track, preferably less.

Existing installations (December 31, 1954), need not be changed to meet these requirements until renewals are otherwise necessary.

Types:

1404. Derails are generally of two types, the Split Switch and Sliding.

1405. Where derails are prescribed, the Split Switch type of derail shall be used as follows:

(*a*) Within interlocking limits, only in main tracks and secondary tracks.

(b) At branch line junctions, non-interlocked and non-signaled.

(*c*) In all other tracks where it is possible under any circumstances for the speed of rolling equipment to exceed 15 M.P.H.

1406. Where derails are prescribed, approved types of Sliding Derails shall be used at locations other than included in the next above.

Operation:

1407. In territory outside of interlocking limits:

(*a*) Where the main track switch is protected by a facing point lock, the derail shall be operated by a pipe line from the switch throwing and locking mechanism (located at the main track switch) which operates both the switch and the facing point lock, in accordance with Standard Signal Plan S-232-( ).

Where local conditions prevent the use of a pipe connnected derail, an independently operated fouling point derail, may be used, which must be equipped with circuit controller as provided in paragraph 1407-(b).

(*b*) On lines of minor traffic, without passenger service, the pipe lines shall not be used, and the derail shall be operated by lever stand or without lever stand. Where protected by a signal, an independently operated fouling point derail must be equipped with circuit controller so connected that the signal will display its most restrictive indication if derail is misplaced or not in derailing position.

(*c*) The derail may be operated in manual block territory by a pipe line connected with the main track switch stand in accordance with Plan 61490 ( ) where deemed necessary and authorized by the Chief Engineer.

1408. Lever stands of approved types may be used for operating derails.

1409. All derails not operated by pipe lines shall be provided with standard switch padlocks fastened to the tie by the chain and staple, so that the lever or derail can be locked in the normal position only.

1410. The distance, from the center of the lever stand spindle to the gage line of the nearest rail shall, where practicable, be at least 4 feet 1¾ inches.

Position Indicated:

1411. The position of non-interlocking derails, normal or reverse, shall be indicated, as follows:

(*a*) Where train movements are made at night, the derail shall be equipped with standard switch lamp, with discs removed, displaying a purple light when it is in normal position to derail, and a yellow light when in reverse position.

(*b*) In daytime, no other indication than the position of the derail itself is necessary.

Maintenance:

1412. The derailing block of sliding derails shall be painted yellow where non-interlocked and black where interlocked. Other parts of derails shall be painted black.

1413. Pipe connections for operating derails must be kept free from lost motion. All the fastenings must be tight and in correct alinement, and the ties under the supports must be sound. Frequent tests shall be made to ascertain if any switch levers can be thrown and latched without the derail going to correct position, either normal or reverse.

1414. Snow, ice, dirt and weeds must be kept away from the derail.

1415. When derails other than those herein specified are in use and giving satisfactory service, they should be retained until replacement is necessary.

HIGHWAY CROSSINGS

Authority for Protection:

1501. In addition to the signals prescribed in "Book of Rules," of The Pennsylvania Railroad, public highway and street crossings over tracks at the same elevation shall be protected according to the degree of hazard, state statutes, township and municipal ordinances and public service commission regulations, with the sign or device prescribed or approved by the governing body.

Forms of Protection:

1502. Highway Crossing Sign conforming to Standard Plan 78300-( ).

1503. (*a*) Flashing Light Signals conforming to Standard Signal Plan S-463-( ).

(*b*) Automatic Crossing gates and Flashing Light Signal Assemblage conforming to Standard Signal Plan S-462-( ).

(*c*) Where track circuits for crossing protection are applied to sidings or yard tracks, the limits of the circuits on sidings or yard tracks shall be indicated by a yellow stripe as prescribed in paragraph 1402-(b)-(1) or by "CC" sign as prescribed in Rule 4103-B Book of Rules.

1504. Crossing Gates:

(*a*) Painted in accordance with Standard Plan 78320-( ).

(*b*) Provided with one approved oil, or electric lamp and one red reflector glass signal on each side of the railroad. For gates already equipped with two oil lamps in accordance with Standard Plan 70995-( ), or two electric lamps, the red reflector glass signal need not be substituted for the left hand lamp; except as replacement of this lamp becomes necessary. Where deemed necessary on account of density of highway traffic, additional lights or red glass reflectors, so as to provide four on each side of the railroad, is permitted. Installations shall be made in accordance with Letter of General Practice No. 213-( ).

1505. Whistle and Ring Signs shall be in accordance with Standard Plan 78408-( ): except that in overhead electrified territory they shall be attached to a catenary pole in accordance with Plan 69675-( ).

Maintenance:

1506. All signs and other forms of protection at grade crossings must be immediately repaired or replaced when damaged.

1507. All crossings must be kept clean, and attention given to the following:

(*a*) Drainage; slope the surface if necessary, and construct underground drains. (See paragraph 5).

(*b*) Surface water flowing along the highway toward the tracks shall be diverted before it reaches the track.

(*c*) The width of the crossing shall be sufficient to accommodate the width of the highway. Place shoulder along the edges of the crossing in the space between the tracks.

(*d*) Approaches to the track shall be on smooth grade, with no abrupt breaks, so that heavy machinery moving on vehicles with low road clearance may pass over the crossing without touching the rails or surface of crossing.

(e) Flangeways shall be 2½" wide and not less than 4" deep. Flangeways must be kept clean at all times.

(*f*) The view in both directions from vehicles approaching the track shall be kept as clear as practicable.

(*g*) When installing or making general repairs to crossings, track alinement on tangents should be fixed by transit line and on curves by string line calculations

(*h*) Where installing crossings or platforms in which cinder filling is in contact with the rails, or making such repairs that it may be applied, new or fit rails in good condition and not excessively corroded shall be dry and free from oil and painted with a good coat of bituminous paint (Approved brand for battery boxes, Reference 47-2315).

Conduct of Work:

1508. Work on highway crossings, public streets and roads shall be done with the least inconvenience possible to the highway travelers. Care must be taken to protect the work in compliance with safety and the law, and if necessary to construct temporary footwalks or driveways, they must be kept in safe condition.

WIRE LINES

Safety:

1601. (*a*) When repairing or working on wire lines, all SAFETY RULES must be rigidly observed.

(*b*) The Track Foreman shall be informed which wires carry voltage higher than required for telegraph and telephone service.

Emergency Duties:

1602. Wire lines, whether for transmission of telegraph, telephone, signal power, or light current, are of such supreme importance that every effort must be exerted by every employe to keep them in service.

1603. Trees near wire lines should be kept trimmed, or removed when decayed to such extent as to be unsafe, to prevent interference with the wires, or with the view of signals.

1604. If the wire line is knocked, or blown down, causing the wires to touch each other, or the ground, the poles must be raised, or propped up so that all of the wires clear the ground and no wire swings to, or touches another.

1605. The Superintendent Transportation must be promptly informed of the repairs needed, and what will be done by the trackmen for temporary service.

Telegraph and Telephone Lines:

1606. In the event of interruption, or damage to telegraph or telephone lines by storm, or otherwise, trackmen are required to make such temporary repairs as they can, so that the service will be restored with the least delay possible, the first work being done on the "train wires." The Track Foreman shall be informed which are the "train wires."

1607. If the telegraph or telephone wires are broken, the ends should be reunited, pulling them as nearly together as possible, so that they at least clear the ground, inserting the necessary wire to fill up the gap, scraping the ends bright and twisting them together. Care must be taken to connect the two ends of the same circuit by observation of the position of the wires on the cross arms or brackets.

ISSUED
October 1, 1957

C. J. Henry
Chief Engineer

L. E. Gingerich
Assistant Chief Engineer—
Maintenance

C. J. Code
Assistant Chief Engineer—
Tests, M.W.

APPENDIX I

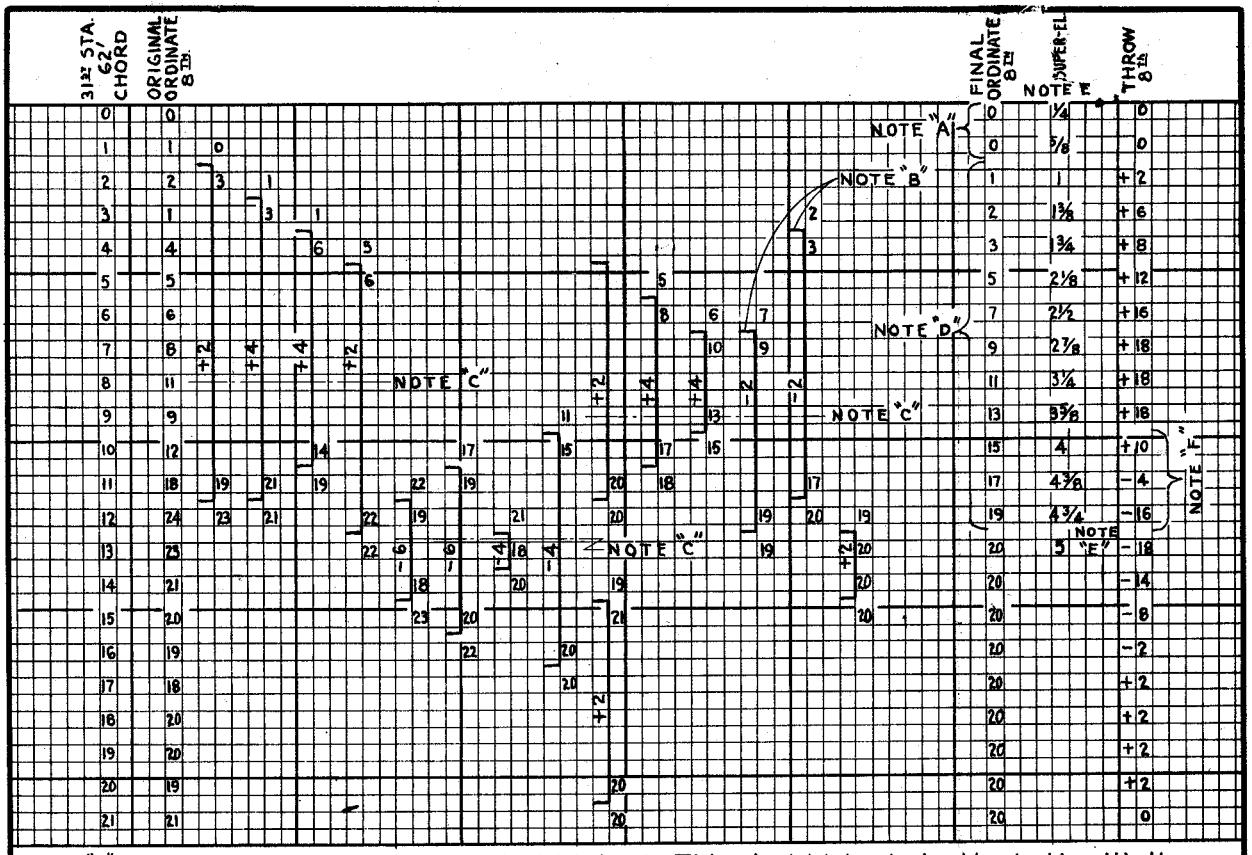
	Req. As Set No.	Frog No.	C.toC. of Tracks	NUMBER OF TIES 7" x 9"									Total Number of Ties	BOARD FEET		
				9'	10'	11'	12'	13'	14'	15'	16'	21'		Ties 16' and Under	Ties Over 16'	Total
TURNOUT †	5	5.289	—	7	5	4	3	5	3	3	3	—	33	2063	—	2063
	6	6	—	7	6	4	3	6	3	4	3	—	36	2263	—	2263
	8	8	—	10	10	6	6	7	5	5	8	—	57	3633	—	3633
	10	10	—	11	13	9	7	8	6	6	9	—	69	4379	—	4379
	15	15	—	17	21	15	11	13	9	9	15	—	110	6983	—	6983
	20	20	—	19	25	19	14	14	12	12	19	—	134	8568	—	8568
CROSSOVER O	612	6	12' 2"	14	12	8	6	4	—	—	—	18	62	2405	1985	4390
	812	8	"	20	20	12	12	6	—	—	—	22	92	3854	2426	6280
	1012	10	"	22	26	18	14	8	—	—	—	24	112	4872	2646	7518
	1512	15	"	34	42	30	22	10	—	—	—	40	178	7613	4410	12023
	2012	20	"	38	50	38	28	8	—	—	—	55	217	8925	6064	14989
	613	6	13'	14	12	8	6	12	—	—	—	12	64	2951	1323	4274
	813	8	"	20	20	12	12	14	—	—	—	18	96	4400	1985	6385
	1013	10	"	22	26	18	14	16	—	—	—	21	117	5418	2315	7733
	1513	15	"	34	42	30	22	22	—	—	—	35	185	8432	3859	12291
	2013	20	14'	38	50	38	28	28	—	—	—	45	227	10290	4961	15251
	614	6	"	14	12	8	6	12	6	#10	—	—	68	4179	—	4179
	814	8	"	20	20	12	12	14	10	#13	—	—	101	6158	—	6158
	1014	10	"	22	26	18	14	16	12	#15	—	—	123	7481	—	7481
	1514	15	"	34	42	30	22	26	16	#25	—	—	195	11849	—	11849
	2014	20	"	38	50	38	28	28	24	#33	—	—	239	14653	—	14653
DOUBLE SLIP CROSSING +	12-6	6	12' 2"	—	—	13	2	5	8	—	—	18	46	1806	1985	3791
	12-8	8	"	—	—	13	8	7	8	—	—	22	58	2321	2426	4747
	12-10	10	"	—	—	17	16	9	8	—	—	24	74	3192	2646	5838
	12-15	15	"	—	—	29	24	9	8	—	—	40	110	4389	4410	8799
	12-20	20	"	—	—	47	22	9	14	—	—	55	147	5744	6064	11808
	13-6	6	13'	—	—	13	2	11	8	—	—	12	46	2215	1323	3538
	13-8	8	"	—	—	13	8	15	8	—	—	18	62	2867	1985	4852
	13-10	10	"	—	—	17	16	17	8	—	—	21	79	3738	2315	6053
	13-15	15	"	—	—	29	24	21	8	—	—	35	117	5208	3859	9067
	13-20	20	"	—	—	47	22	29	14	—	—	45	157	7109	4961	12070
	14-6	6	14'	—	—	13	2	11	14	#10	—	—	50	3444	—	3444
	14-8	8	"	—	—	13	8	15	18	#13	—	—	67	6425	—	4625
	14-10	10	"	—	—	17	16	17	20	#15	—	—	85	5801	—	5801
	14-15	15	"	—	—	29	24	25	24	#25	—	—	127	8626	—	8626
	14-20	20	"	—	—	47	22	29	38	#33	—	—	169	11471	—	11471

† When ordering ties for a turnout lending into a slip, one-half of the number shown for a C OSSOVER of the given number and intertrack distance should be ordered instead of the ties enumerated for turnout. (See also O).

O 7" x9" x 8'6" ties shall be used under split switches, as necessary, in addition to the 9' switch ties specified.

\+ The material for double slip crossings includes all ties under the slip and ties, excluding 8'6" ties where required, to a point midway between point of end frog of the slip and point of frog of slip or turnout adjoining both ends.

\# An 8'6" tie shall be used end to end with each 15' tie. The adjoining ends of ties shall be alternately staggered.



Note "A" The 0 ordinates indicate straight track. This straight track should coincide with the established tangent line in adjacent tangent.

Note "B" The two minus throws indicated improve the alinement and at the same time reduce the amount of work necessary to throw the track. Such opportunities should not be overlooked.

Note "C" Throws indicated in the brackets should be in alinement and not placed indiscriminately in the brackets. This will enable rapid and accurate calculation of throws.

Note "D" The Super Elevation should be sufficient at all points on the run-off and should as far as possible be the correct Super Elevation for the amount of curvature at all points on the run-off.

Note "E" The change in Super Elevation, rate ⅜" per 31', is adjusted slightly at the 1st Station and at Station next to full Elevation in order to avoid too abrupt a change.

Note "F" Method of checking - Check of ordinate Station 11.

+10	throw at	Station 10	affects	Station 11	ordinate −5
− 4	" "	" 11	"	" "	" −4
−16	" "	" 12	"	" "	" +8
				Net	−1

Original ordinate 18 − 1 = 17.

\+ throws indicate away from the center of curve.

\- throws indicate toward the center of curve.

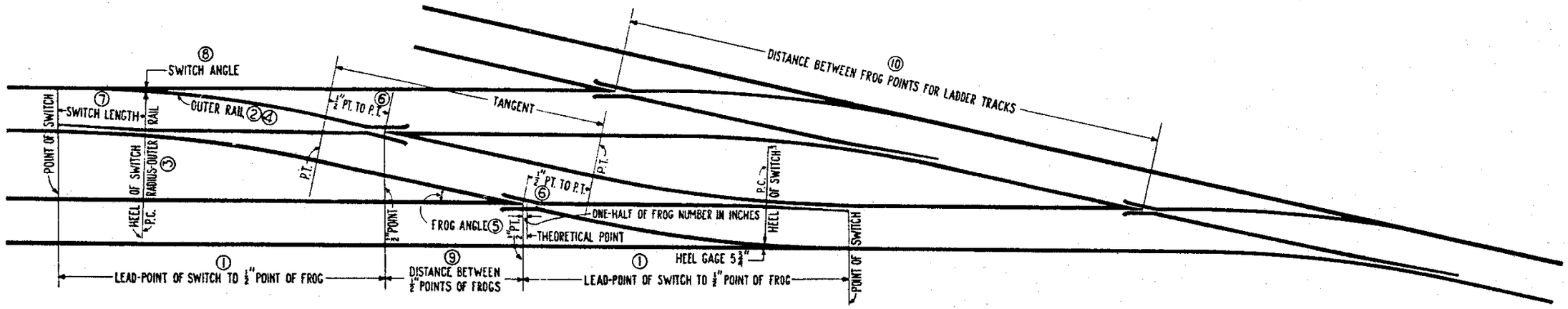
69350-A

THE PENNSYLVANIA RAILROAD

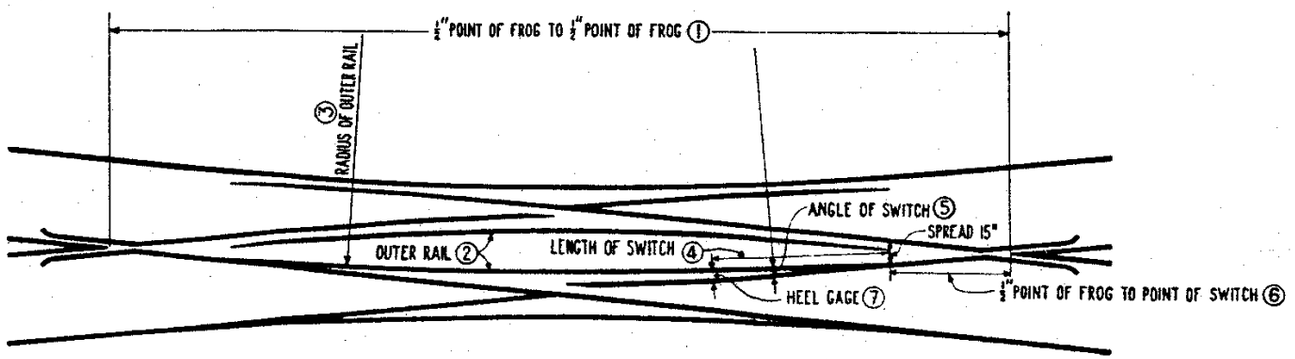
ADJUSTMENT OF PORTION OF CURVE INCLUDING EASEMENT CONNECTING CURVE AND TANGENT STRING LINE METHOD

OFFICE OF CHIEF ENGINEER, PHILA., PA., SEPTEMBER, 1929.

REV. AUG. 1937



TURNOUTS									CROSSOVERS						LADDER TRACKS					
FROG NO.	① LEAD POINT OF SWITCH TO ½" POINT OF FROG	② DEGREE OF CURVE OF OUTER RAIL	③ RADIUS OF OUTER RAIL	④ DISTANCE-HEEL OF SWITCH TO TOE OF RIGID FROG ON CURVED LEAD	FROG ⑤ ANGLE	FROG ⑥ ½" PT TO P.T.	SWITCH ⑦ LENGTH	SWITCH ⑧ ANGLE	⑨ DISTANCE BETWEEN FROG POINTS TRACK CENTERS 12'-2"	13'-0"	14'-0"	16'-0"	17'-0"	19'-0"	⑩ DISTANCE BETWEEN FROG POINTS TRACK CENTERS 12'-2"	13'-0"	14'-0"	17'-0"	20'-0"	FROG NO.
8	69.91'	12°-34'-16.0"	456.69'	44.28'	7°-09'-09.7"	7'-0"	18'	1°-29'-32.1"	20.95'	27.59'	35.56'	51.50'	59.47'	75.41'	97.71'	104.41'	112.44'	136.53'	160.63'	8
10	81.61'	7°-27'-37.4"	768.54'	55.77'	5°-43'-29.3"	7'-0"	18'	1°-29'-32.1"	26.36'	34.67'	44.65'	64.60'	74.58'	94.53'	121.98'	130.33'	140.35'	170.43'	200.50'	10
15	130.04'	3°-06'-18.8"	1845.37'	94.14'	3°-49'-05.9"	6'-0"	30'	0°-53'-43.0"	39.80'	52.28'	67.27'	97.23'	112.22'	142.18'	182.70'	195.22'	210.23'	255.28'	300.33'	15
20	156.03'	1°-39'-53.2"	3441.79'	118.27'	2°-51'-51.1"	7'-10"	30'	0°-53'-43.0"	53.18'	69.84'	89.83'	129.80'	149.79'	189.76'	243.49'	260.16'	280.17'	340.21'	400.25'	20



SLIP CROSSINGS							
FROG NO.	① ½" POINT OF FROG TO ½" POINT OF FROG	② DEGREE OF CURVE OF OUTER RAIL	③ RADIUS OF OUTER RAIL	④ LENGTH OF SWITCH	⑤ ANGLE OF SWITCH	⑥ ½" POINT OF FROG TO POINT OF SWITCH	⑦ HEEL GAGE
8	76.15'	8°-14'-02.0"	696.45'	15'-0"	1°-49'-48.2"	10.33'	6⅜"
10	95.12'	4°-59'-09.0"	1149.54'	18'-6"	1°-31'-31.5"	12.92'	6⅜"
15	142.58'	2°-22'-08.6"	2418.68'	28'-0"	0°-57'-33.4"	19.38'	6⅜"
20	190.06'	0°-56'-58.5"	6033.83'	30'-0"	0°-53'-43.0"	25.83'	6"

NOTE:-
The lines of the diagrams indicate gage lines only.

73000-B

THE PENNSYLVANIA RAILROAD
STANDARD
TABLES OF DIMENSIONS OF TURNOUTS, CROSSOVERS, SLIP CROSSINGS AND LADDER TRACKS FROM TANGENT TRACK
FOR 85, 100 AND 130 LB. RAILS
OFFICE OF CHIEF ENGINEER PHILA., PA., MAY 1927

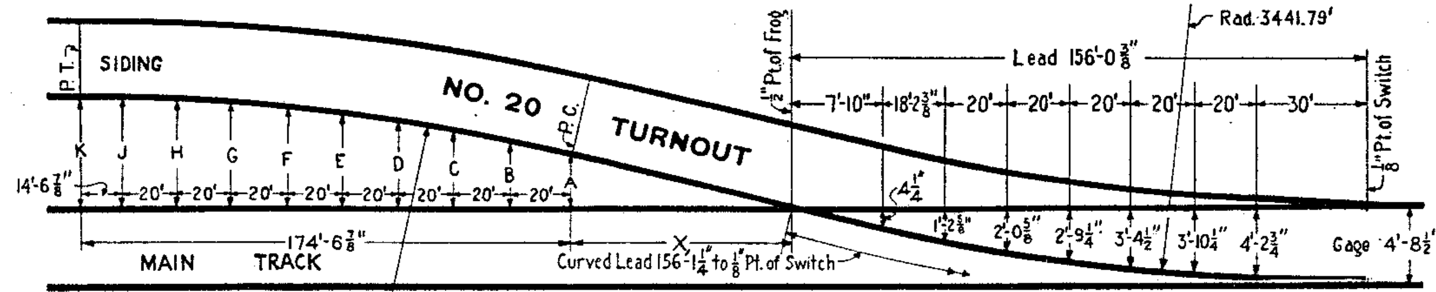
Correct: Engineer of Standards

Approved: Chief Engineer

REV.
APRIL 1938
AUG. 1937

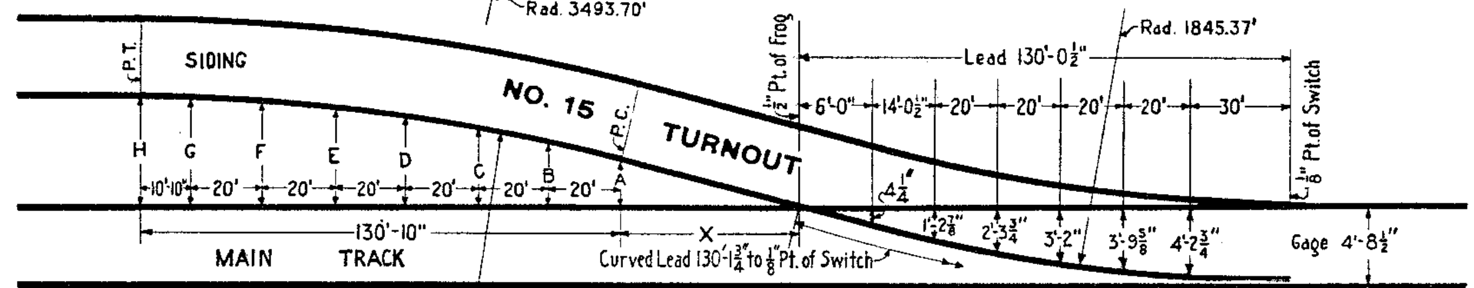
NO. 20 TURNOUT

TRACK CENTERS	X	K	J	H	G	F	E	D	C	B	A
12'-2"	61'-0 1/8"	7'-5 1/2"	7'-5 1/8"	7'-3 1/2"	7'-0 3/8"	6'-8"	6'-2 1/8"	5'-7"	4'-10 3/8"	4'-0 1/2"	3'-1 1/8"
13'-0"	77'-8"	8'-3 1/2"	8'-3 1/8"	8'-1 1/2"	7'-10 3/8"	7'-6"	7'-0 1/8"	6'-5"	5'-8 3/8"	4'-10 1/2"	3'-11 1/8"
14'-0"	97'-7 7/8"	9'-3 1/2"	9'-3 1/8"	9'-1 1/2"	8'-10 3/8"	8'-6"	8'-0 1/8"	7'-5"	6'-8 3/8"	5'-10 1/2"	4'-11 1/8"
15'-0"	117'-7 5/8"	10'-3 1/2"	10'-3 1/8"	10'-1 1/2"	9'-10 3/8"	9'-6"	9'-0 1/8"	8'-5"	7'-8 3/8"	6'-10 1/2"	5'-11 1/8"
16'-0"	137'-7 1/2"	11'-3 1/2"	11'-3 1/8"	11'-1 1/2"	10'-10 3/8"	10'-6"	10'-0 1/8"	9'-5"	8'-8 3/8"	7'-10 1/2"	6'-11 1/8"
17'-0"	157'-7 3/8"	12'-3 1/2"	12'-3 1/8"	12'-1 1/2"	11'-10 3/8"	11'-6"	11'-0 1/8"	10'-5"	9'-8 3/8"	8'-10 1/2"	7'-11 1/8"
18'-0"	177'-7 1/4"	13'-3 1/2"	13'-3 1/8"	13'-1 1/2"	12'-10 3/8"	12'-6"	12'-0 1/8"	11'-5"	10'-8 3/8"	9'-10 1/2"	8'-11 1/8"
19'-0"	197'-7"	14'-3 1/2"	14'-3 1/8"	14'-1 1/2"	13'-10 3/8"	13'-6"	13'-0 1/8"	12'-5"	11'-8 3/8"	10'-10 1/2"	9'-11 1/8"
20'-0"	217'-6 7/8"	15'-3 1/2"	15'-3 1/8"	15'-1 1/2"	14'-10 3/8"	14'-6"	14'-0 1/8"	13'-5"	12'-8 3/8"	11'-10 1/2"	10'-11 1/8"



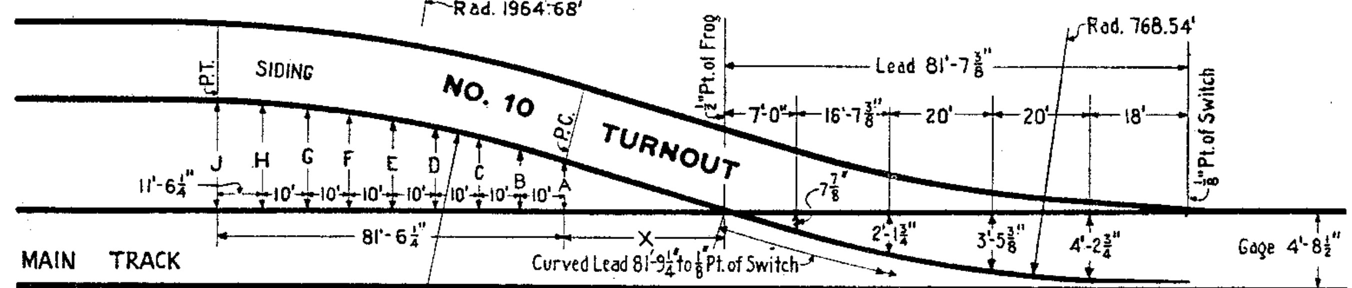
NO. 15 TURNOUT

TRACK CENTERS	X	H	G	F	E	D	C	B	A
12'-2"	45'-9 3/8"	7'-5 1/2"	7'-5 1/8"	7'-2 5/8"	6'-10 1/2"	6'-2 1/8"	5'-4 1/4"	4'-4"	3'-1 1/8"
13'-0"	58'-3 1/4"	8'-3 1/2"	8'-3 1/8"	8'-0 5/8"	7'-8 1/2"	7'-0 1/8"	6'-2 1/4"	5'-2"	3'-11 1/8"
14'-0"	73'-3"	9'-3 1/2"	9'-3 1/8"	9'-0 5/8"	8'-8 1/2"	8'-0 1/8"	7'-2 1/4"	6'-2"	4'-11 1/8"
15'-0"	88'-2 7/8"	10'-3 1/2"	10'-3 1/8"	10'-0 5/8"	9'-8 1/2"	9'-0 1/8"	8'-2 1/4"	7'-2"	5'-11 1/8"
16'-0"	103'-2 5/8"	11'-3 1/2"	11'-3 1/8"	11'-0 5/8"	10'-8 1/2"	10'-0 1/8"	9'-2 1/4"	8'-2"	6'-11 1/8"
17'-0"	118'-2 3/8"	12'-3 1/2"	12'-3 1/8"	12'-0 5/8"	11'-8 1/2"	11'-0 1/8"	10'-2 1/4"	9'-2"	7'-11 1/8"
18'-0"	133'-2 1/4"	13'-3 1/2"	13'-3 1/8"	13'-0 5/8"	12'-8 1/2"	12'-0 1/8"	11'-2 1/4"	10'-2"	8'-11 1/8"
19'-0"	148'-2"	14'-3 1/2"	14'-3 1/8"	14'-0 5/8"	13'-8 1/2"	13'-0 1/8"	12'-2 1/4"	11'-2"	9'-11 1/8"
20'-0"	163'-1 7/8"	15'-3 1/2"	15'-3 1/8"	15'-0 5/8"	14'-8 1/2"	14'-0 1/8"	13'-2 1/4"	12'-2"	10'-11 1/8"



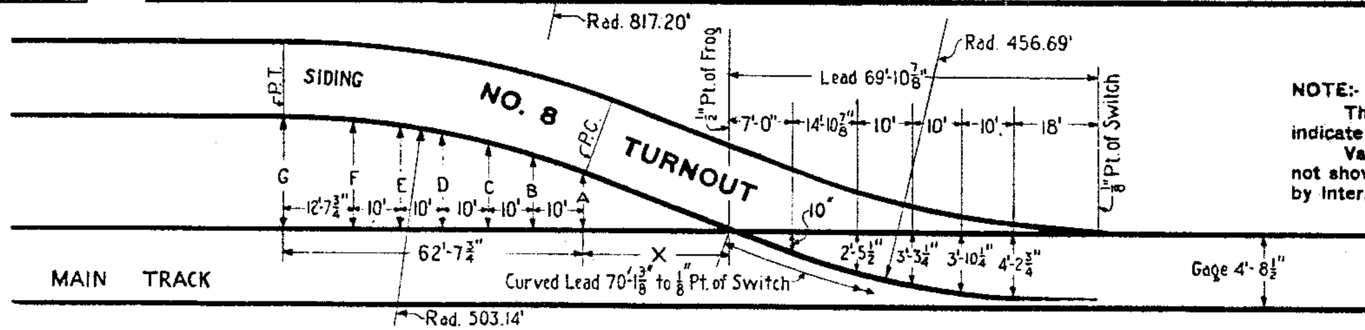
NO. 10 TURNOUT

TRACK CENTERS	X	J	H	G	F	E	D	C	B	A
12'-2"	33'-3 7/8"	7'-5 1/2"	7'-4 1/2"	7'-2 1/8"	6'-10 1/4"	6'-4 7/8"	5'-10"	5'-1 5/8"	4'-3 7/8"	3'-4 5/8"
13'-0"	41'-7 5/8"	8'-3 1/2"	8'-2 1/2"	8'-0 1/8"	7'-8 1/4"	7'-2 7/8"	6'-8"	5'-11 5/8"	5'-1 7/8"	4'-2 5/8"
14'-0"	51'-7 3/8"	9'-3 1/2"	9'-2 1/2"	9'-0 1/8"	8'-8 1/4"	8'-2 7/8"	7'-8"	6'-11 5/8"	6'-1 7/8"	5'-2 5/8"
15'-0"	61'-7"	10'-3 1/2"	10'-2 1/2"	10'-0 1/8"	9'-8 1/4"	9'-2 7/8"	8'-8"	7'-11 5/8"	7'-1 7/8"	6'-2 5/8"
16'-0"	71'-6 3/4"	11'-3 1/2"	11'-2 1/2"	11'-0 1/8"	10'-8 1/4"	10'-2 7/8"	9'-8"	8'-11 5/8"	8'-1 7/8"	7'-2 5/8"
17'-0"	81'-6 1/2"	12'-3 1/2"	12'-2 1/2"	12'-0 1/8"	11'-8 1/4"	11'-2 7/8"	10'-8"	9'-11 5/8"	9'-1 7/8"	8'-2 5/8"
18'-0"	91'-6 1/8"	13'-3 1/2"	13'-2 1/2"	13'-0 1/8"	12'-8 1/4"	12'-2 7/8"	11'-8"	10'-11 5/8"	10'-1 7/8"	9'-2 5/8"
19'-0"	101'-5 7/8"	14'-3 1/2"	14'-2 1/2"	14'-0 1/8"	13'-8 1/4"	13'-2 7/8"	12'-8"	12'-11 5/8"	11'-1 7/8"	10'-2 5/8"
20'-0"	111'-5 1/2"	15'-3 1/2"	15'-2 1/2"	15'-0 1/8"	14'-8 1/4"	14'-2 7/8"	13'-8"	13'-11 5/8"	12'-1 7/8"	11'-2 5/8"



NO. 8 TURNOUT

TRACK CENTERS	X	G	F	E	D	C	B	A
12'-2"	27'-10 3/4"	7'-5 1/2"	7'-3 5/8"	6'-11 3/8"	6'-4 3/4"	5'-7 3/4"	4'-8 3/8"	3'-6 1/2"
13'-0"	34'-6 1/2"	8'-3 1/2"	8'-1 5/8"	7'-9 3/8"	7'-2 3/4"	6'-5 3/4"	5'-6 3/8"	4'-4 1/2"
14'-0"	42'-6 1/8"	9'-3 1/2"	9'-1 5/8"	8'-9 3/8"	8'-2 3/4"	7'-5 3/4"	6'-6 3/8"	5'-4 1/2"
15'-0"	50'-5 3/4"	10'-3 1/2"	10'-1 5/8"	9'-9 3/8"	9'-2 3/4"	8'-5 3/4"	7'-6 3/8"	6'-4 1/2"
16'-0"	58'-5 3/8"	11'-3 1/2"	11'-1 5/8"	10'-9 3/8"	10'-2 3/4"	9'-5 3/4"	8'-6 3/8"	7'-4 1/2"
17'-0"	66'-5"	12'-3 1/2"	12'-1 5/8"	11'-9 3/8"	11'-2 3/4"	10'-5 3/4"	9'-6 3/8"	8'-4 1/2"
18'-0"	74'-4 5/8"	13'-3 1/2"	13'-1 5/8"	12'-9 3/8"	12'-2 3/4"	11'-5 3/4"	10'-6 3/8"	9'-4 1/2"
19'-0"	82'-4 1/4"	14'-3 1/2"	14'-1 5/8"	13'-9 3/8"	13'-2 3/4"	12'-5 3/4"	11'-6 3/8"	10'-4 1/2"
20'-0"	90'-3 7/8"	15'-3 1/2"	15'-1 5/8"	14'-9 3/8"	14'-2 3/4"	13'-5 3/4"	12'-6 3/8"	11'-4 1/2"



NOTE:- The lines of the diagrams indicate gage lines only. Values for track centers not shown may be determined by interpolation.

73007-C

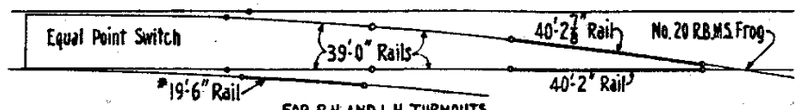
THE PENNSYLVANIA RAILROAD
STANDARD
TABLES OF OFFSETS OF NOS. 8, 10, 15 AND 20 TURNOUTS
FROM TANGENT TRACK
FOR 85, 100 AND 130 LB. RAILS

OFFICE OF CHIEF ENGINEER PHILA., PA., MAY, 1927

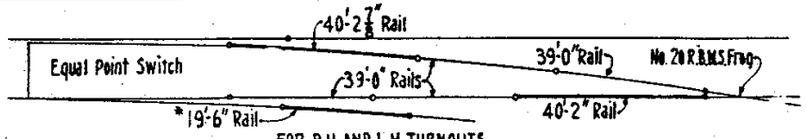
Correct — Engineer of Standards

Approved — Chief Engineer

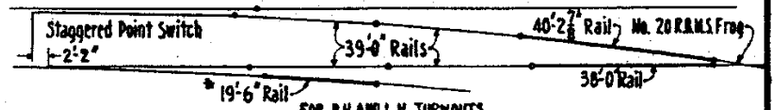
REV. THIS PLAN REPLACES "A" JAN. 1953



FOR R.H. AND L.H. TURNOUTS
WITH 30' EQUAL POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

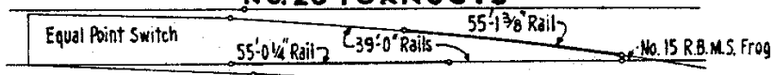


FOR R.H. AND L.H. TURNOUTS
WITH 30' EQUAL POINT SWITCHES AND DESIGN S STOCK RAILS
AND RIGID FROGS

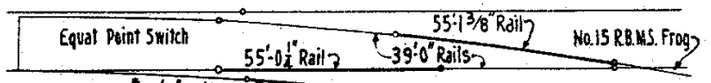


FOR R.H. AND L.H. TURNOUTS
WITH 30' STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

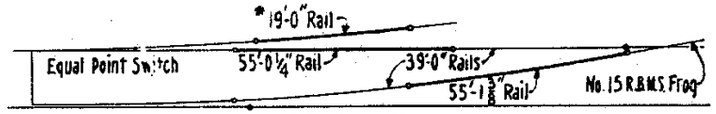
NO. 20 TURNOUTS



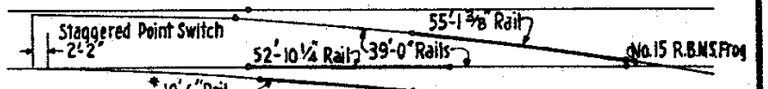
FOR R.H. TURNOUTS
WITH 30' EQUAL POINT SWITCHES AND DESIGN S STOCK RAILS
AND RIGID FROGS



FOR R.H. AND L.H. TURNOUTS
WITH 30' EQUAL POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

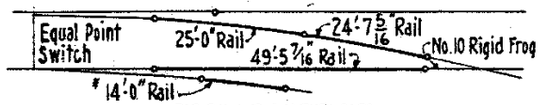


FOR L.H. TURNOUT
WITH 30' EQUAL POINT SWITCHES AND DESIGN S STOCK RAILS
AND RIGID FROGS

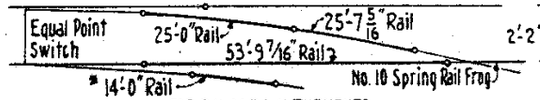


FOR R.H. AND L.H. TURNOUTS
WITH 30' STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

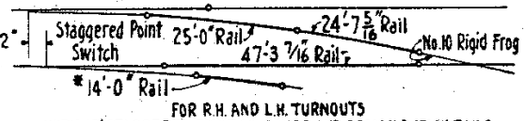
NO. 15 TURNOUTS



FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS

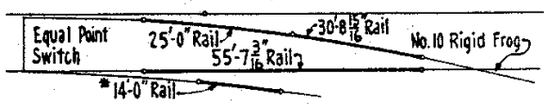


FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND SPRING RAIL FROGS

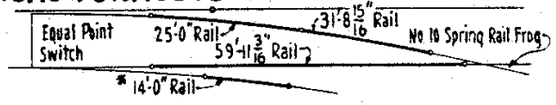


FOR R.H. AND L.H. TURNOUTS
WITH 18' STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

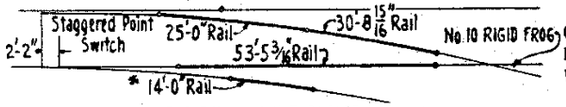
†NO. 10 TURNOUTS WITH SHORT LEADS



FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS

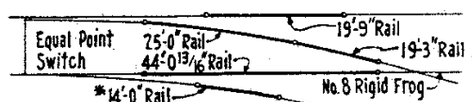


FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND SPRING RAIL FROGS

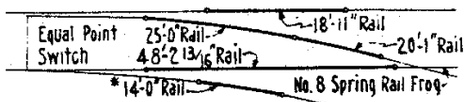


FOR R.H. AND L.H. TURNOUTS
WITH 18' STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

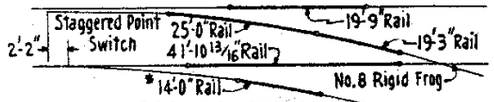
NO. 10 TURNOUTS WITH STANDARD LEADS



FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS



FOR R.H. AND L.H. TURNOUTS
WITH 18' EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND SPRING RAIL FROGS



FOR R.H. AND L.H. TURNOUTS
WITH 18' STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

NO. 8 TURNOUTS

†These turnouts shall be used only to meet special limiting conditions.

*This rail is necessary for locating insulating joints but any variation in length that will provide a stagger between joints of not more than 5'-0" will be permitted. The length of rails between heel of switch and toe of frog shall be as specified.

BILL OF MATERIAL OF LEAD RAILS FOR ONE TURNOUT EXCLUDING 39'-0" RAILS

NO. 8 TURNOUTS			NO. 10 TURNOUTS			NO. 15 TURNOUTS		NO. 20 TURNOUTS	
R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS SPRING RAIL FROGS	L.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS SPRING RAIL FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS
			WITH STANDARD LEADS						
Rail 25'-0"	Rail 25'-0"	Rail 25'-0"	Rail 25'-0"	Rail 25'-0"	Rail 25'-0"	Rail 55'-1 3/8"	Rail 55'-1 3/8"	Rail 40'-2 7/8"	Rail 40'-2 7/8"
" 14'-0"	" 14'-0"	" 14'-0"	" 14'-0"	" 14'-0"	" 14'-0"	" 55'-0 1/4"	" 52'-10 1/4"	" 40'-2"	" 38'-0"
" 19'-3"	" 20'-1"	" 19'-3"	" 30'-8 15/16"	" 31'-8 15/16"	" 30'-8 15/16"	" 19'-6"	" 19'-6"	" 19'-6"	" 19'-6"
" 19'-9"	" 18'-11"	" 19'-9"	" 55'-7 3/16"	" 59'-11 3/16"	" 53'-5 3/16"				
" 44'-0 13/16"	" 48'-2 13/16"	" 41'-10 13/16"				R.H. TURNOUTS EQUAL PT. SWITCHES DESIGN S STOCK RAILS RIGID FROGS	L.H. TURNOUTS EQUAL PT. SWITCHES DESIGN S STOCK RAILS RIGID FROGS		
			†WITH SHORT LEADS			Rail 55'-1 3/8"	Rail 55'-1 3/8"		
			Rail 25'-0"	Rail 25'-0"	Rail 25'-0"	" 55'-0 1/4"	" 55'-0 1/4"		
			" 14'-0"	" 14'-0"	" 14'-0"	" 19'-6"	" 19'-0"		
			" 24'-7 5/16"	" 25'-7 5/16"	" 24'-7 5/16"				
			" 49'-5 7/16"	" 53'-9 7/16"	" 47'-3 7/16"				

The Lead Rails covered by this plan are indicated by heavy solid lines and shall be ordered as separate items on the requisition, specifying quantity and length of rails required, weight and section of rail and number of this plan. 39'-0" Rails are not furnished where indicated as they shall be provided locally.

The Lead Rails specified on this plan are for Standard –

No. 8 Turnouts according to Plan 73000-( ).
No. 10 " " " " "
No. 15 " " " " "
No. 20 " " " " "

with Design L or S Stock Rails for 18 Ft. and 30 Ft. Switches, according to Plan 73060-( ) and with joints in turnout run beyond heel of switch staggered not more than 5'-0".

Lead Rails shall meet the requirements of No. 1 Rails as prescribed by The Pennsylvania Railroad Specifications for O.H. Steel Rails, C.E. 35-( ), excluding "A" Rails.

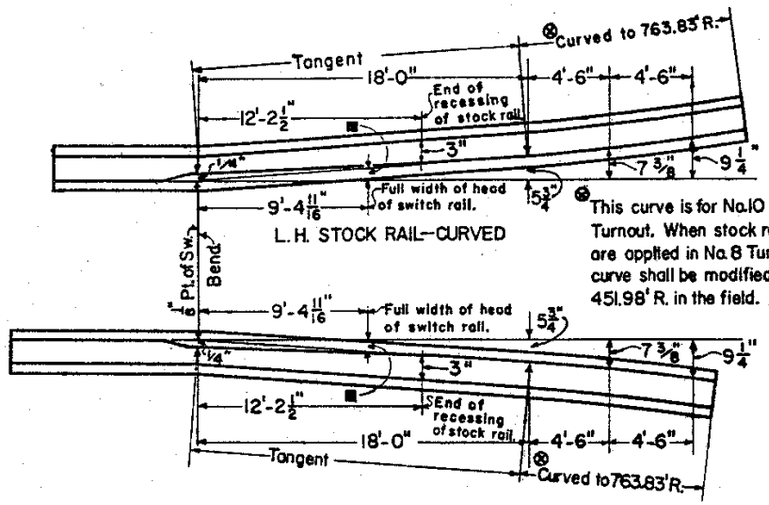
Lead Rails shall be drilled $2\frac{23}{32}$"-6"-7" and shall be furnished straight.

† No. 10 Turnout with Short Leads shall be used only to meet special limiting conditions; upon approval of the Chief Engineer.

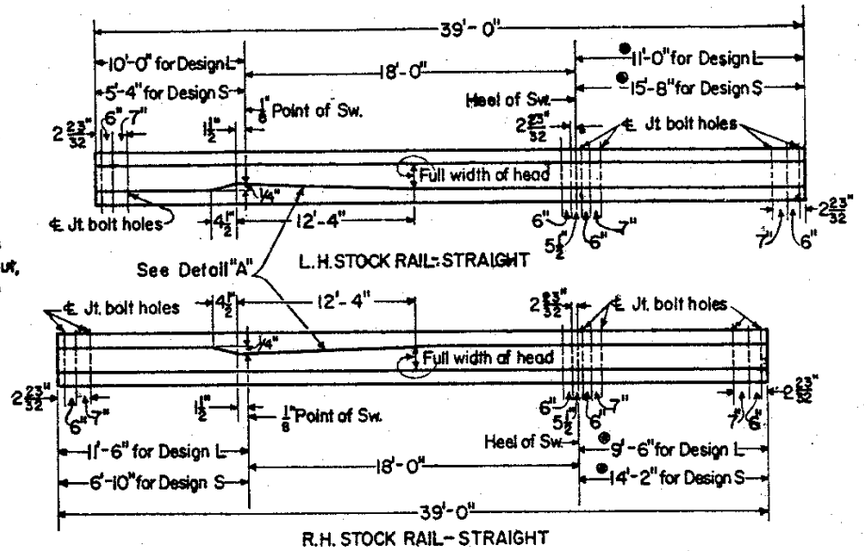
73049-B

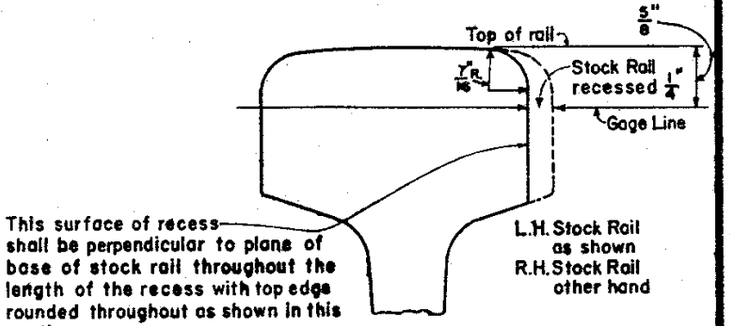
THE PENNSYLVANIA RAILROAD
STANDARD
LEAD RAILS
FOR TURNOUTS OF 130 LB. P.S. RAIL DRILLED $2\frac{23}{32}$"-6"-7"
OFFICE OF CHIEF ENGINEER, PHILA., PA. - MAY 1957

Chief Engineer



This curve is for No.10 Turnout. When stock rails are applied in No.8 Turnout, curve shall be modified to 451.98' R. in the field.





This surface of recess shall be perpendicular to plane of base of stock rail throughout the length of the recess with top edge rounded throughout as shown in this section.

SECTION THROUGH STOCK RAIL AT ⅛" PT. OF SWITCH
DETAIL A

STOCK RAILS FOR 18 FT. SPLIT SWITCHES, 130 LB. P.S., 3 HOLE DRILLING,—39'-0" LONG

Details of curved stock rails are same as for straight stock rails of same hand except curved stock rails shall be furnished bent and curved to the alinement specified above and below.

Joint Bolt Holes shall be 1 3/16" Dia. Center line of Joint Bolt Holes shall be 2¾" above base of rail.

Any variation in rail length, within limits prescribed by rail specification, shall occur in this dimension.

■ Spread of 3" between theoretical gage lines.

NOTE:-

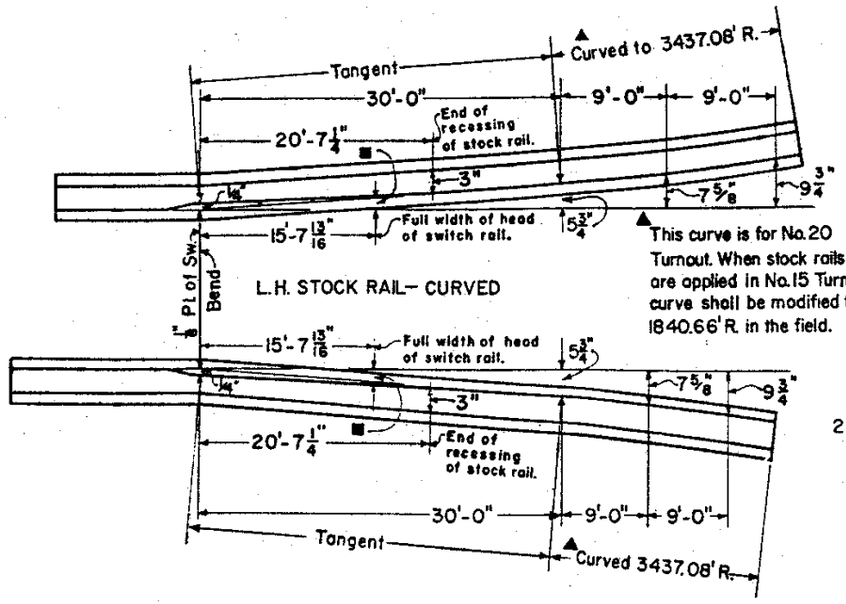
Requisitions for stock rails shall specify weight and type of rail, hand, whether straight or curved, design, the length of switch with which they are to be used, and the number of this plan.

Wherever practicable, two Design L or one Design L and one Design S stock rails shall be used. Two Design S stock rails shall be used only to meet special limiting conditions.

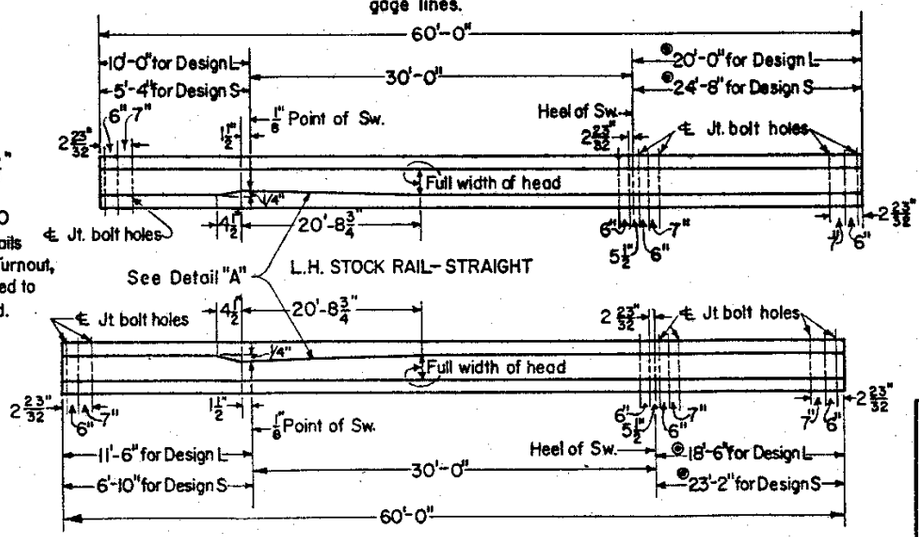
Stock Rails shall meet the requirements of No.1 Rails as prescribed by the Pennsylvania Railroad Specifications for O.H. Steel Rails, excluding "A" Rails, C.E. 35-( ). No rails which were cut when cold by the use of a high speed friction saw shall be used.

Rail Ends shall be beveled as indicated on Plan 71099-( ).

One straight and one curved stock rail are used with each standard switch.



This curve is for No.20 Turnout. When stock rails are applied in No.15 Turnout, curve shall be modified to 1840.66' R. in the field.



STOCK RAILS FOR 30 FT. SPLIT SWITCHES, 130 LB. P.S., 3 HOLE DRILLING,—60'-0" LONG

73060-A

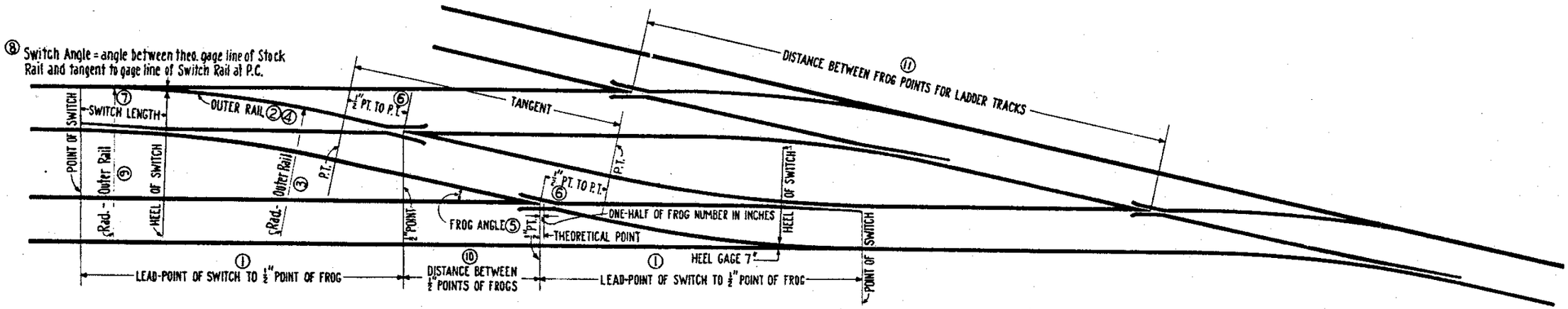
THE PENNSYLVANIA RAILROAD
STANDARD

STOCK RAILS
RECESSED 1/4"-FOR 18 FT. AND 30 FT. SPLIT SWITCHES,
130 LB. P.S. DRILLED 2 23/32"-6"-7"

OFFICE OF CHIEF ENGINEER, PHILA., PA., JUNE, 1957

Chief Engineer

REV.
THIS PLAN
REPLACES
"A" DEC. 1949
"B" AUG. 1953



TURNOUTS

FROG NO.	① LEAD POINT OF SWITCH TO ½" POINT OF FROG	② DEGREE OF CURVE OF OUTER RAIL	③ RADIUS OF OUTER RAIL	④ DISTANCE-HEEL OF SWITCH TO TOE OF FROG ON CURVED LEAD	FROG ⑤ ANGLE	FROG ⑥ ½" PT. TO P.T.	SWITCH ⑦ LENGTH	SWITCH ⑧ ANGLE	SWITCH LOCATION OF P.C.	SWITCH DEGREE OF CURVE OF OUTER RAIL	SWITCH ⑨ RADIUS OF OUTER RAIL
8	67.11'	12°14'-38"	468.85'	40.31'	7°09'-09.7"	7'-0"	20'	1°26'-00"	8'-0¼"	6°37'-31"	865.30'
10	75.76'	7°32'-24"	760.44'	46.43'	5°43'-29.3"	9'-6"	20'	1°26'-00"	BACK OF PT. OF SW.	6°37'-31"	865.30'
15	116.33'	2°51'-07"	2009.22'	78.03'	3°49'-05.9"	6'-6"	30'	0°41'-00"	AT PT. OF SW.	2°51'-07"	2009.22'
20	160.13'	1°40'-15"	3429.17'	106.71'	2°51'-51.1"	10'-8 13/16"	45'	0°22'-00"	AT PT. OF SW.	1°40'-15"	3429.17'

CROSSOVERS

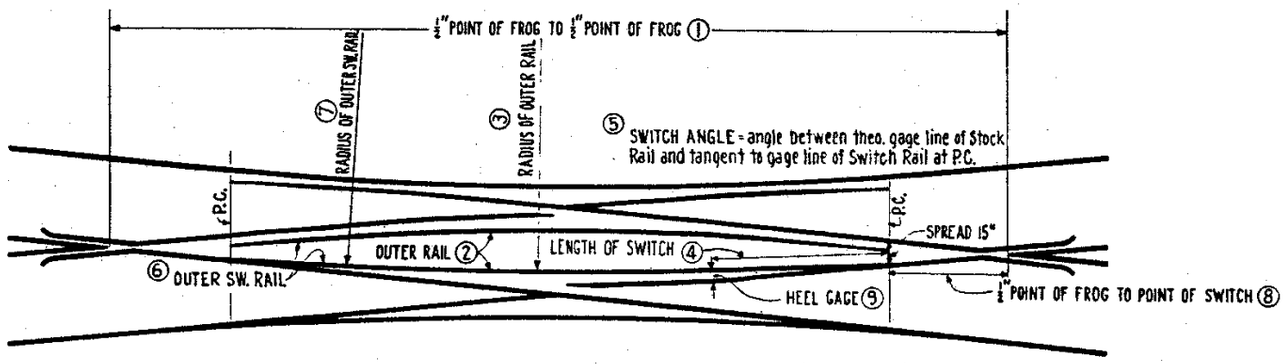
DISTANCE BETWEEN FROG POINTS ⑩ — TRACK CENTERS

12'-2"	13'-0"	14'-0"	16'-0"	17'-0"	19'-0"
20.95'	27.59'	35.56'	51.50'	59.47'	75.41'
26.36'	34.67'	44.65'	64.60'	74.58'	94.53'
39.80'	52.28'	67.27'	97.23'	112.22'	142.18'
53.18'	69.84'	89.83'	129.80'	149.79'	189.76'

LADDER TRACKS

DISTANCE BETWEEN FROG POINTS ⑪ — TRACK CENTERS

12'-2"	13'-0"	14'-0"	17'-0"	20'-0"	FROG NO.
97.71'	104.41'	112.44'	136.53'	160.63'	8
121.98'	130.33'	140.35'	170.43'	200.50'	10
182.70'	195.22'	210.23'	255.28'	300.33'	15
243.49'	260.16'	280.17'	340.21'	400.25'	20



SLIP CROSSINGS

FROG NO.	① ½" POINT OF FROG TO ½" POINT OF FROG	② DEGREE OF CURVE OF OUTER RAIL	③ RADIUS OF OUTER RAIL	④ LENGTH OF SWITCH	⑤ ANGLE OF SWITCH	⑥ DEGREE OF CURVE OF OUTER SW. RAIL	⑦ RADIUS OF OUTER SW. RAIL	⑧ ½" POINT OF FROG TO POINT OF SWITCH	⑨ HEEL GAGE
8	76.15'	8°27'-06"	678.53'	17'	1°14'-00"	8°27'-06"	678.53'	10.33'	6 15/16"
10	95.12'	4°41'-19"	1222.34'	20'	1°10'-00"	5°02'-52"	1135.46'	12.92'	7"
15	142.58'	1°41'-23"	3390.78'	30'	0°41'-00"	2°51'-07"	2009.22'	19.38'	7"
20	190.06'	1°20'-48"	4253.51'	45'	0°30'-00"	1°20'-48"	4253.51'	25.83'	7 9/16"

The lines of the diagrams indicate gage lines only.

73001-C

THE PENNSYLVANIA RAILROAD
STANDARD
TABLES OF DIMENSIONS OF TURNOUTS, CROSSOVERS, SLIP CROSSINGS AND LADDER TRACKS FROM TANGENT TRACK
FOR 131, 140 LB. R.E. - 152, 155 LB. P.S. RAILS

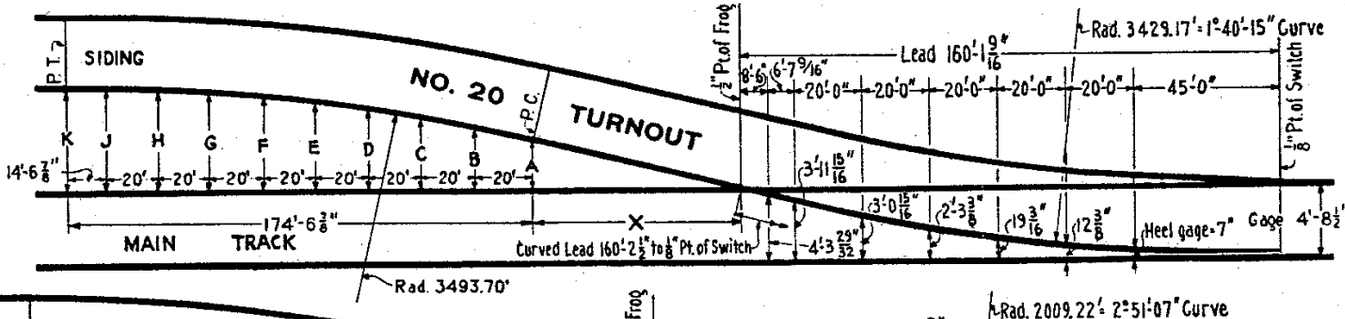
OFFICE OF CHIEF ENGINEER, PHILA., PA. - MAY - 1957

Chief Engineer

REV.
THIS PLAN
REPLACES
"A" DEC. 1949

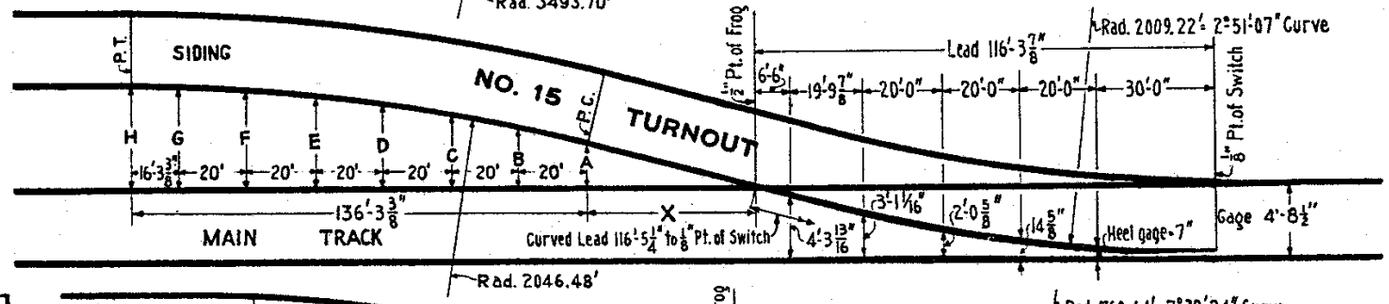
NO. 20 TURNOUT

TRACK CENTERS	X	K	J	H	G	F	E	D	C	B	A
12'-2"	61'-0 1/8"	7'-5 1/2"	7'-5 1/8"	7'-3 1/2"	7'-0 3/8"	6'-8"	6'-2 5/8"	5'-7"	4'-10 5/8"	4'-0 1/2"	3'-1 1/8"
13'-0"	77'-8"	8'-3 1/2"	8'-3 1/8"	8'-1 1/2"	7'-10 3/8"	7'-6"	7'-0 1/8"	6'-5"	5'-8 3/8"	4'-10 1/2"	3'-11 1/8"
14'-0"	97'-7 7/8"	9'-3 1/2"	9'-3 1/8"	9'-1 1/2"	8'-10 3/8"	8'-6"	8'-0 1/8"	7'-5"	6'-8 3/8"	5'-10 1/2"	4'-11 1/8"
15'-0"	117'-7 7/8"	10'-3 1/2"	10'-3 1/8"	10'-1 1/2"	9'-10 3/8"	9'-6"	9'-0 1/8"	8'-5"	7'-8 3/8"	6'-10 1/2"	5'-11 1/8"
16'-0"	137'-7 1/2"	11'-3 1/2"	11'-3 1/8"	11'-1 1/2"	10'-10 3/8"	10'-6"	10'-0 1/8"	9'-5"	8'-8 3/8"	7'-10 1/2"	6'-11 1/8"
17'-0"	157'-7 3/8"	12'-3 1/2"	12'-3 1/8"	12'-1 1/2"	11'-10 3/8"	11'-6"	11'-0 1/8"	10'-5"	9'-8 3/8"	8'-10 1/2"	7'-11 1/8"
18'-0"	177'-7 1/4"	13'-3 1/2"	13'-3 1/8"	13'-1 1/2"	12'-10 3/8"	12'-6"	12'-0 1/8"	11'-5"	10'-8 3/8"	9'-10 1/2"	8'-11 1/8"
19'-0"	197'-7"	14'-3 1/2"	14'-3 1/8"	14'-1 1/2"	13'-10 3/8"	13'-6"	13'-0 1/8"	12'-5"	11'-8 3/8"	10'-10 1/2"	9'-11 1/8"
20'-0"	217'-6 7/8"	15'-3 1/2"	15'-3 1/8"	15'-1 1/2"	14'-10 3/8"	14'-6"	14'-0 1/8"	13'-5"	12'-8 3/8"	11'-10 1/2"	10'-11 1/8"



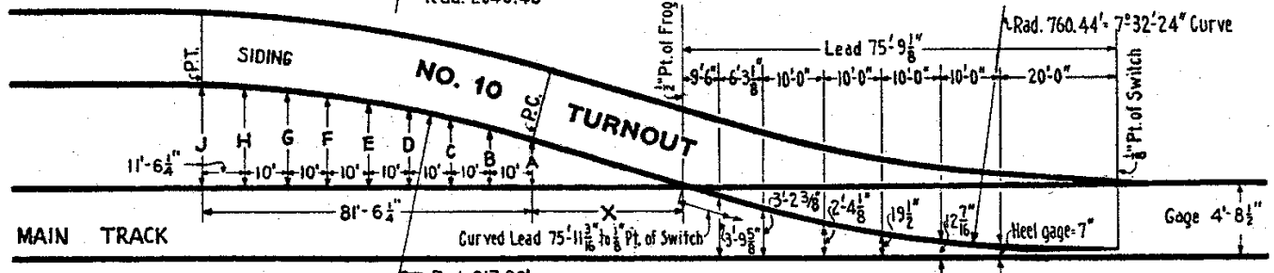
NO. 15 TURNOUT

TRACK CENTERS	X	H	G	F	E	D	C	B	A
12'-2"	43'-0 11/16"	7'-5 1/2"	7'-4 3/4"	7'-1 5/16"	6'-8 3/16"	6'-0 7/16"	5'-2 5/16"	4'-1 13/16"	2'-11"
13'-0"	55'-6 5/16"	8'-3 1/2"	8'-2 3/4"	7'-11 5/16"	7'-6 3/16"	6'-10 7/16"	6'-0 5/16"	4'-11 13/16"	3'-9"
14'-0"	70'-6 5/16"	9'-3 1/2"	9'-2 3/4"	8'-11 5/16"	8'-6 3/16"	7'-10 7/16"	7'-0 5/16"	5'-11 13/16"	4'-9"
15'-0"	85'-6 1/16"	10'-3 1/2"	10'-2 3/4"	9'-11 5/16"	9'-6 3/16"	8'-10 7/16"	8'-0 5/16"	6'-11 13/16"	5'-9"
16'-0"	100'-5 15/16"	11'-3 1/2"	11'-2 3/4"	10'-11 5/16"	10'-6 3/16"	9'-10 7/16"	9'-0 5/16"	7'-11 13/16"	6'-9"
17'-0"	115'-5 3/4"	12'-3 1/2"	12'-2 3/4"	11'-11 5/16"	11'-6 3/16"	10'-10 7/16"	10'-0 5/16"	8'-11 13/16"	7'-9"
18'-0"	130'-5 9/16"	13'-3 1/2"	13'-2 3/4"	12'-11 5/16"	12'-6 3/16"	11'-10 7/16"	11'-0 5/16"	9'-11 13/16"	8'-9"
19'-0"	145'-5 5/16"	14'-3 1/2"	14'-2 3/4"	13'-11 5/16"	13'-6 3/16"	12'-10 7/16"	12'-0 5/16"	10'-11 13/16"	9'-9"
20'-0"	160'-5 1/16"	15'-3 1/2"	15'-2 3/4"	14'-11 5/16"	14'-6 3/16"	13'-10 7/16"	13'-0 5/16"	11'-11 13/16"	10'-9"



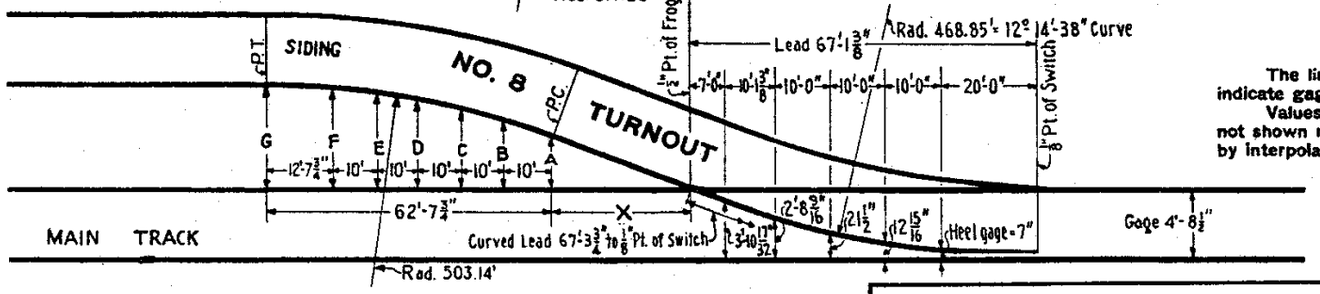
NO. 10 TURNOUT

TRACK CENTERS	X	J	H	G	F	E	D	C	B	A
12'-2"	33'-3 3/8"	7'-5 1/2"	7'-4 1/2"	7'-2 1/8"	6'-10 1/4"	6'-4 7/8"	5'-10"	5'-1 5/8"	4'-3 7/8"	3'-4 5/8"
13'-0"	41'-7 3/4"	8'-3 1/2"	8'-2 1/2"	8'-0 1/8"	7'-8 1/4"	7'-2 7/8"	6'-8"	5'-11 5/8"	5'-1 7/8"	4'-2 5/8"
14'-0"	51'-7 7/8"	9'-3 1/2"	9'-2 1/2"	9'-0 1/8"	8'-8 1/4"	8'-2 7/8"	7'-8"	6'-11 5/8"	6'-1 7/8"	5'-2 5/8"
15'-0"	61'-7"	10'-3 1/2"	10'-2 1/2"	10'-0 1/8"	9'-8 1/4"	9'-2 7/8"	8'-8"	7'-11 5/8"	7'-1 7/8"	6'-2 5/8"
16'-0"	71'-6 3/4"	11'-3 1/2"	11'-2 1/2"	11'-0 1/8"	10'-8 1/4"	10'-2 7/8"	9'-8"	8'-11 5/8"	8'-1 7/8"	7'-2 5/8"
17'-0"	81'-6 1/4"	12'-3 1/2"	12'-2 1/2"	12'-0 1/8"	11'-8 1/4"	11'-2 7/8"	10'-8"	9'-11 5/8"	9'-1 7/8"	8'-2 5/8"
18'-0"	91'-6 1/8"	13'-3 1/2"	13'-2 1/2"	13'-0 1/8"	12'-8 1/4"	12'-2 7/8"	11'-8"	10'-11 5/8"	10'-1 7/8"	9'-2 5/8"
19'-0"	101'-5 7/8"	14'-3 1/2"	14'-2 1/2"	14'-0 1/8"	13'-8 1/4"	13'-2 7/8"	12'-8"	12'-11 5/8"	11'-1 7/8"	10'-2 5/8"
20'-0"	111'-5 1/2"	15'-3 1/2"	15'-2 1/2"	15'-0 1/8"	14'-8 1/4"	14'-2 7/8"	13'-8"	13'-11 5/8"	12'-1 7/8"	11'-2 5/8"



NO. 8 TURNOUT

TRACK CENTERS	X	G	F	E	D	C	B	A
12'-2"	27'-10 3/4"	7'-5 1/2"	7'-3 5/8"	6'-11 1/8"	6'-4 3/4"	5'-7 3/4"	4'-8 3/8"	3'-6 1/2"
13'-0"	34'-6 1/2"	8'-3 1/2"	8'-1 5/8"	7'-9 1/8"	7'-2 3/4"	6'-5 3/4"	5'-6 3/8"	4'-4 1/2"
14'-0"	42'-6 1/4"	9'-3 1/2"	9'-1 5/8"	8'-9 1/8"	8'-2 3/4"	7'-5 3/4"	6'-6 3/8"	5'-4 1/2"
15'-0"	50'-5 3/4"	10'-3 1/2"	10'-1 5/8"	9'-9 1/8"	9'-2 3/4"	8'-5 3/4"	7'-6 3/8"	6'-4 1/2"
16'-0"	58'-5 3/8"	11'-3 1/2"	11'-1 5/8"	10'-9 1/8"	10'-2 3/4"	9'-5 3/4"	8'-6 3/8"	7'-4 1/2"
17'-0"	66'-5"	12'-3 1/2"	12'-1 5/8"	11'-9 1/8"	11'-2 3/4"	10'-5 3/4"	9'-6 3/8"	8'-4 1/2"
18'-0"	74'-4 5/8"	13'-3 1/2"	13'-1 5/8"	12'-9 1/8"	12'-2 3/4"	11'-5 3/4"	10'-6 3/8"	9'-4 1/2"
19'-0"	82'-4 1/4"	14'-3 1/2"	14'-1 5/8"	13'-9 1/8"	13'-2 3/4"	12'-5 3/4"	11'-6 3/8"	10'-4 1/2"
20'-0"	90'-3 7/8"	15'-3 1/2"	15'-1 5/8"	14'-9 1/8"	14'-2 3/4"	13'-5 3/4"	12'-6 3/8"	11'-4 1/2"



The lines of the diagrams indicate gage lines only.
Values for track centers not shown may be determined by interpolation.

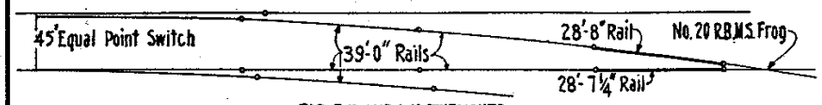
73008-B

THE PENNSYLVANIA RAILROAD
STANDARD
TABLES OF OFFSETS OF
NOS. 8-10-15 AND 20 TURNOUTS FROM TANGENT TRACK
FOR 131, 140 LB. R.E. - 152, 155 LB. P.S. RAILS

OFFICE OF CHIEF ENGINEER, PHILA., PA. - MAY 1957

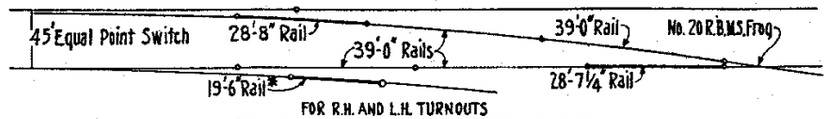
C. J. Hennig
Chief Engineer

REV.
THIS PLAN
REPLACES
"A" OCT. 1951

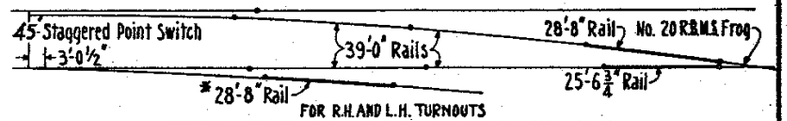


FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

No. 20 R.B.M.S. Frogs in accordance with Plan 74143-().

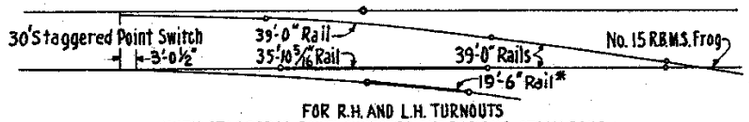


FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN S STOCK RAILS
AND RIGID FROGS



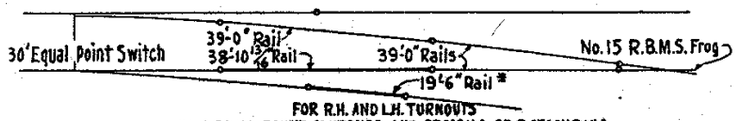
FOR R.H. AND L.H. TURNOUTS
WITH STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

NO. 20 TURNOUTS



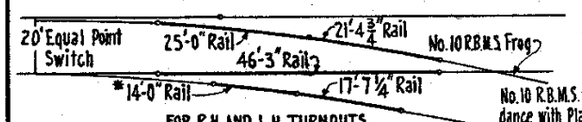
FOR R.H. AND L.H. TURNOUTS
WITH STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

No. 15 R.B.M.S Frogs in accordance with Plan 74142-().



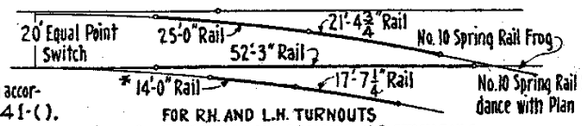
FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS

NO. 15 TURNOUTS



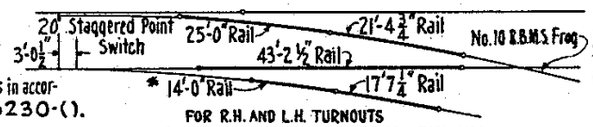
FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS

No. 10 R.B.M.S. Frogs in accordance with Plan 74141-().



FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND SPRING RAIL FROGS

No. 10 Spring Rail Frogs in accordance with Plan 66230-().

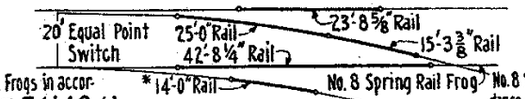


FOR R.H. AND L.H. TURNOUTS
WITH STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

NO. 10 TURNOUTS

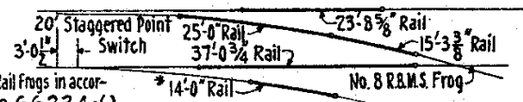
FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND RIGID FROGS

No. 8 R.B.M.S. Frogs in accordance with Plan 74140-().



FOR R.H. AND L.H. TURNOUTS
WITH EQUAL POINT SWITCHES AND DESIGN L OR S STOCK RAILS
AND SPRING RAIL FROGS

No. 8 Spring Rail Frogs in accordance with Plan 66234-().



FOR R.H. AND L.H. TURNOUTS
WITH STAGGERED POINT SWITCHES AND DESIGN L STOCK RAILS
AND RIGID FROGS

NO. 8 TURNOUTS

The Lead Rails covered by this plan are indicated by heavy solid lines and shall be ordered as separate items on the requisition, specifying quantity and length of rails required, weight and section of rail and number of this plan. 39'-0" Rails are not furnished where indicated as they shall be provided locally.

The Lead Rails specified on this plan are for Standard-
No. 8 Turnouts according to Plan 73001-().
No. 10 " " " " "
No. 15 " " " " "
No. 20 " " " " "
with Design L or S Stock Rails for 20 Ft., 30 Ft. and 45 Ft. Switches, according to Plan 73061-() and with joints in turnout run beyond heel of switch staggered not more than 5'-0".

Lead Rails shall meet the requirements of No. 1 Rails as prescribed by The Pennsylvania Railroad Specifications for O.H. Steel Rails, C.E. 35-(), excluding "A" Rails.

Lead Rails shall be drilled $2\frac{23}{32}$"-6"-7" and shall be furnished straight.

*This rail is necessary for locating insulating joints but any variation in length that will provide a stagger between joints of not more than 5'-0" will be permitted. The length of rails between heel of switch and toe of Frog shall be as specified.

BILL OF MATERIAL OF LEAD RAILS FOR ONE TURNOUT EXCLUDING 39'-0" RAILS

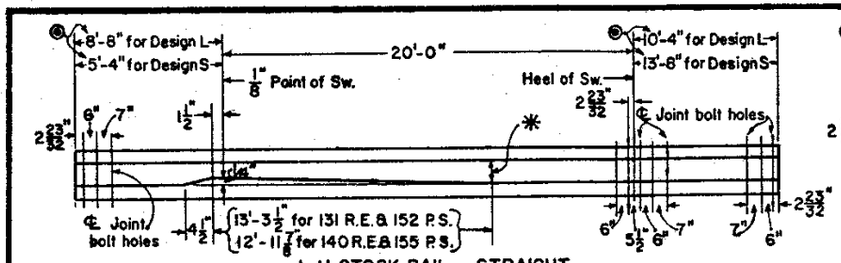
NO. 8 TURNOUTS			NO. 10 TURNOUTS			NO. 15 TURNOUTS		NO. 20 TURNOUTS		
R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS SPRING RAIL FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS SPRING RAIL FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DES. L OR S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DESIGN L STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS EQUAL PT. SWITCHES DESIGN S STOCK RAILS RIGID FROGS	R.H. & L.H. TURNOUTS STAGGERED PT. SWITCHES DESIGN L STOCK RAIL RIGID FROGS
1 Rail 25'-0"	1 Rail 25'-0"	1 Rail 25'-0"	1 Rail 25'-0"	1 Rail 25'-0"	1 Rail 25'-0"	1 Rail 38'-10 13/16"	1 Rail 35'-10 5/16"	1 Rail 28'-8"	1 Rail 28'-8"	2 Rails 28'-8"
1 " 14'-0"	1 " 14'-0"	1 " 14'-0"	1 " 14'-0"	1 " 14'-0"	1 " 14'-0"	1 " 19'-6"	1 " 19'-6"	1 " 28'-7¼"	1 " 28'-7¼"	1 Rail 25'-6¾"
1 " 23'-8 5/8"	1 " 23'-8 5/8"	1 " 23'-8 5/8"	1 " 21'-4¾"	1 " 21'-4¾"	1 " 21'-4¾"				1 " 19'-6"	
1 " 15'-3 3/8"	1 " 15'-3 3/8"	1 " 15'-3 3/8"	1 " 17'-7¼"	1 " 17'-7¼"	1 " 17'-7¼"					
1 " 40'-1¼"	1 " 42'-8¼"	1 " 37'-0¾"	1 " 46'-3"	1 " 52'-3"	1 " 43'-2½"					

64

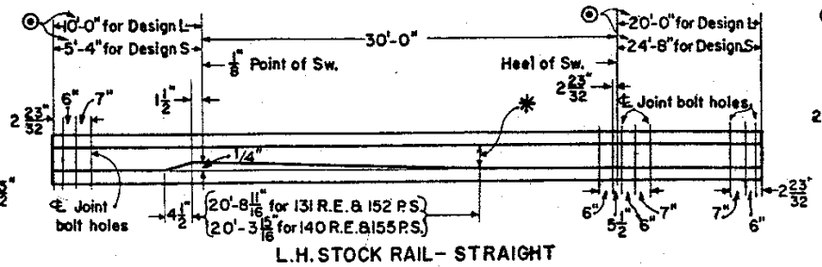
73050-B

THE PENNSYLVANIA RAILROAD
STANDARD
LEAD RAILS
FOR 131-140 LB. R.E. AND 152-155 LB. P.S. TURNOUTS
OFFICE OF CHIEF ENGINEER, PHILA., PA. - MAY 1957

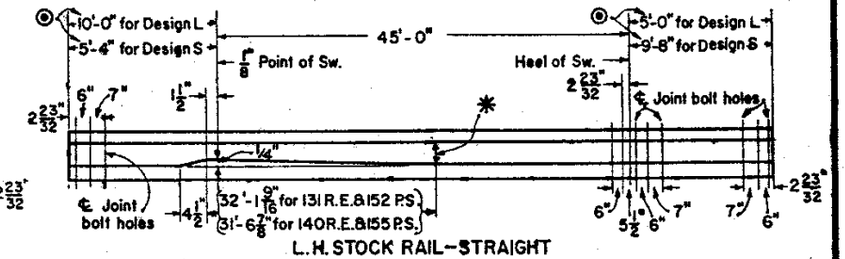
C.J. Henning
Chief Engineer



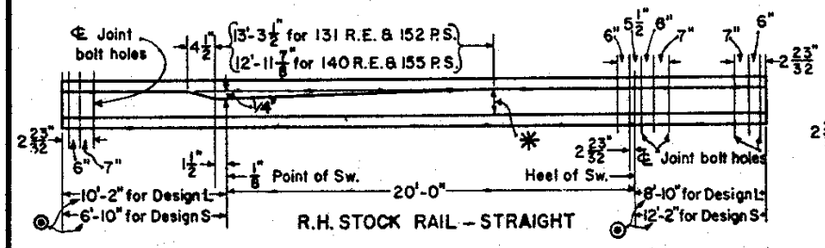
L.H. STOCK RAIL – STRAIGHT



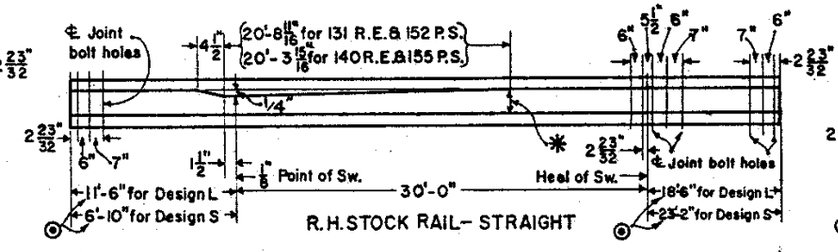
L.H. STOCK RAIL – STRAIGHT



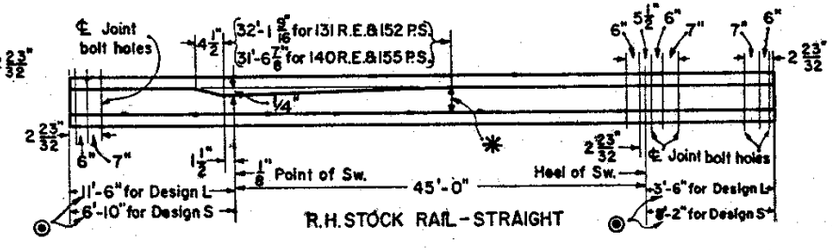
L.H. STOCK RAIL – STRAIGHT



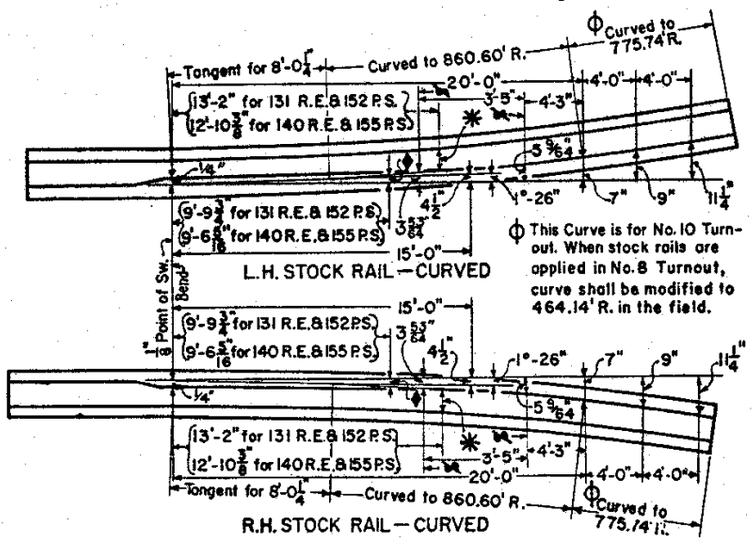
R.H. STOCK RAIL – STRAIGHT



R.H. STOCK RAIL – STRAIGHT

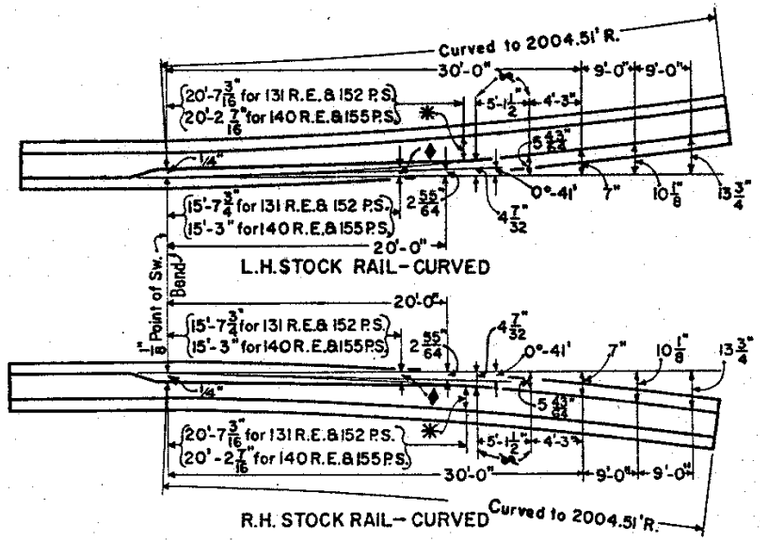


R.H. STOCK RAIL – STRAIGHT



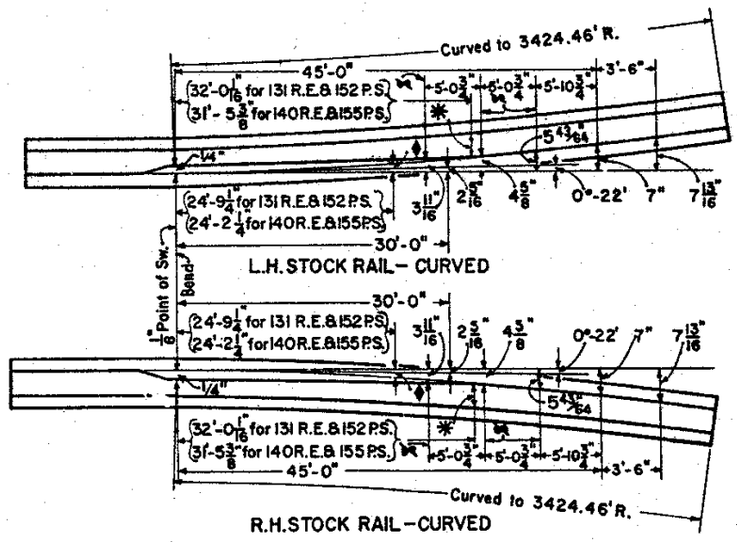
L.H. STOCK RAIL – CURVED

R.H. STOCK RAIL – CURVED



L.H. STOCK RAIL – CURVED

R.H. STOCK RAIL – CURVED



L.H. STOCK RAIL – CURVED

R.H. STOCK RAIL – CURVED

STOCK RAILS FOR 20 FT. SWITCHES – 131 & 140 R.E., 152 & 155 P.S., 39'-0" LONG

STOCK RAILS FOR 30 FT. SWITCHES – 131 & 140 R.E., 152 & 155 P.S., 60'-0" LONG

STOCK RAILS FOR 45 FT. SWITCHES – 131 & 140 R.E., 152 & 155 P.S., 60'-0" LONG (FOR NO. 20 TURNOUTS)

NOTE:–

Requisitions for stock rails shall specify weight and type of rail, hand, whether straight or curved, design, the length of switch with which they are to be used and the number of this plan. (One straight and one curved stock rail are used with each standard switch).

Wherever practicable, two Design L or one Design L and one Design S stock rails shall be used. Two Design S stock rails shall be used only to meet special limiting conditions.

Details of curved stock rails are same as for straight stock rails of same hand except curved stock rails shall be furnished bent and curved to the alinement specified on this plan.

Size and distance of joint bolt holes from rail base shall conform to Standard Plans of the respective rail sections.

The ends of the stock rails shall be beveled as shown on Standard Plan 71099-( ).

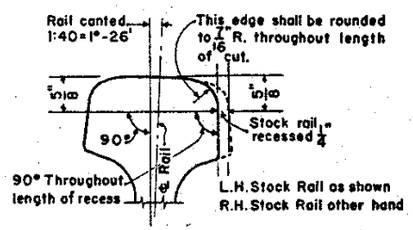
Stock rails shall meet the requirements of No. 1 Rails as prescribed by the Pennsylvania Railroad Specifications for O.H. Steel Rails, C.E. 35-( ), excluding "A" Rails. No rails which were cut when cold by the use of a high speed friction saw shall be used.

⊙ Any variation in rail length within limits prescribed by rail specifications, shall occur in this dimension.

✳ Full width of head of rail at gage line – ($2\frac{31}{32}$" for 131 R.E. & 152 P.S., and $2\frac{7}{8}$" for 140 R.E. & 155 P.S.).

♦ Spread between theoretical gage lines – ($2\frac{31}{32}$" for 131 R.E. & 152 P.S., and $2\frac{7}{8}$" for 140 R.E. & 155 P.S.).

Center line of stop on switch rail; (spread between theoretical gage lines shown).



SECTION THROUGH STOCK RAIL AT 1/8 POINT OF SWITCH

73061-A

THE PENNSYLVANIA RAILROAD

STANDARD

STOCK RAILS

RECESSED 1/4" – FOR 20 FT., 30 FT., AND 45 FT. SPLIT SWITCHES, 131 AND 140 LB. R.E., 152 AND 155 LB. P.S. DRILLED $2\frac{23}{32}$"–6"–7"

OFFICE OF CHIEF ENGINEER, PHILA., PA., JUNE 1957

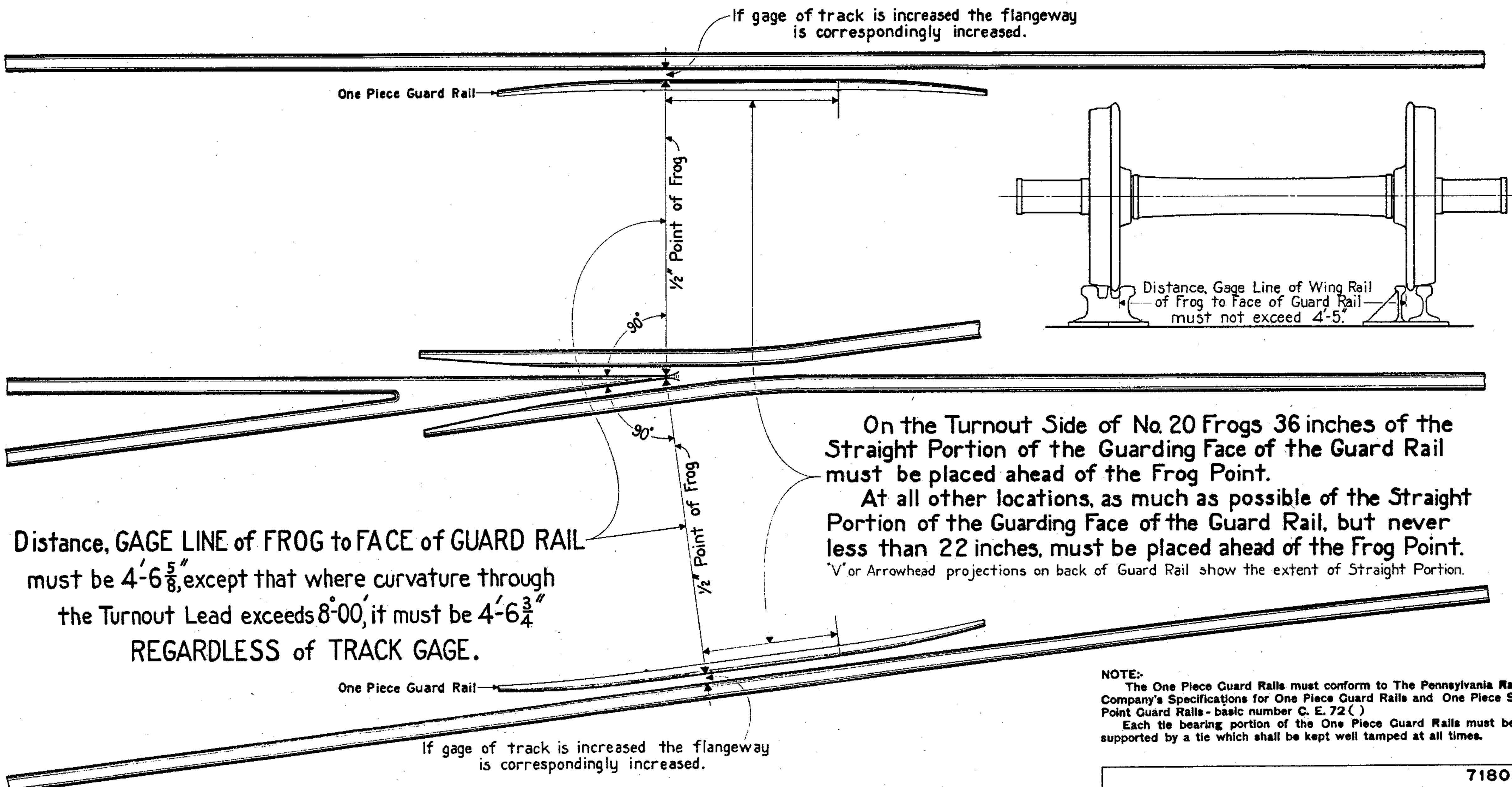
P.J. Hennessy
Chief Engineer

APPENDIX XI

THE USE OF VARIOUS TYPES OF FROGS AND SWITCHES DENOTED BY LETTER X

				130-lb. and under				131-lb. and over			
HEAVY TRAFFIC (High Speed)	Frogs		Number	20	15	10	8	20	15	10	8
			Manganese	X	X	X	X	X	X	X	X
	Switches	45'	Equal Point					X			
		30'	Equal Point	X	X				X		
		20'	Equal Point							X	X
		18'	Equal Point			X	X				
LIGHT TRAFFIC (Under 50 M.P.H.)	Frogs		Manganese	X	X	X	X	X	X	X	X
	Switches	45'	Equal Point					X			
			Staggered Point					X			
		30'	Equal Point	X	X				X		
			Staggered Point	X	X				X		
		20'	Equal Point							X	X
			Staggered Point							X	X
		18'	Equal Point			X	X				
			Staggered Point			X	X				
SIDE TRACKS AND YARDS	Frogs		Manganese			X	X			X	X
			Bolted Rigid			X	X			X	X
	Switches	20'	Equal Point							X	X
			Staggered Point							X	X
		18'	Equal Point			X	X				
			Staggered Point			X	X				

REV.
JULY 1928.
APR. 1932


If gage of track is increased the flangeway is correspondingly increased.
One Piece Guard Rail
½" Point of Frog
90°
90°
½" Point of Frog
Distance, Gage Line of Wing Rail of Frog to Face of Guard Rail must not exceed 4'-5."
On the Turnout Side of No. 20 Frogs 36 inches of the Straight Portion of the Guarding Face of the Guard Rail must be placed ahead of the Frog Point.
At all other locations, as much as possible of the Straight Portion of the Guarding Face of the Guard Rail, but never less than 22 inches, must be placed ahead of the Frog Point.
"V" or Arrowhead projections on back of Guard Rail show the extent of Straight Portion.
Distance, GAGE LINE of FROG to FACE of GUARD RAIL must be 4'-6⅝", except that where curvature through the Turnout Lead exceeds 8°-00', it must be 4'-6¾" REGARDLESS of TRACK GAGE.
One Piece Guard Rail
If gage of track is increased the flangeway is correspondingly increased.

NOTE:-
The One Piece Guard Rails must conform to The Pennsylvania Railroad Company's Specifications for One Piece Guard Rails and One Piece Switch Point Guard Rails - basic number C. E. 72( )
Each tie bearing portion of the One Piece Guard Rails must be fully supported by a tie which shall be kept well tamped at all times.

71800-C

THE PENNSYLVANIA RAILROAD
STANDARD
DIMENSIONS FOR INSTALLATION AND MAINTENANCE OF ONE PIECE GUARD RAILS

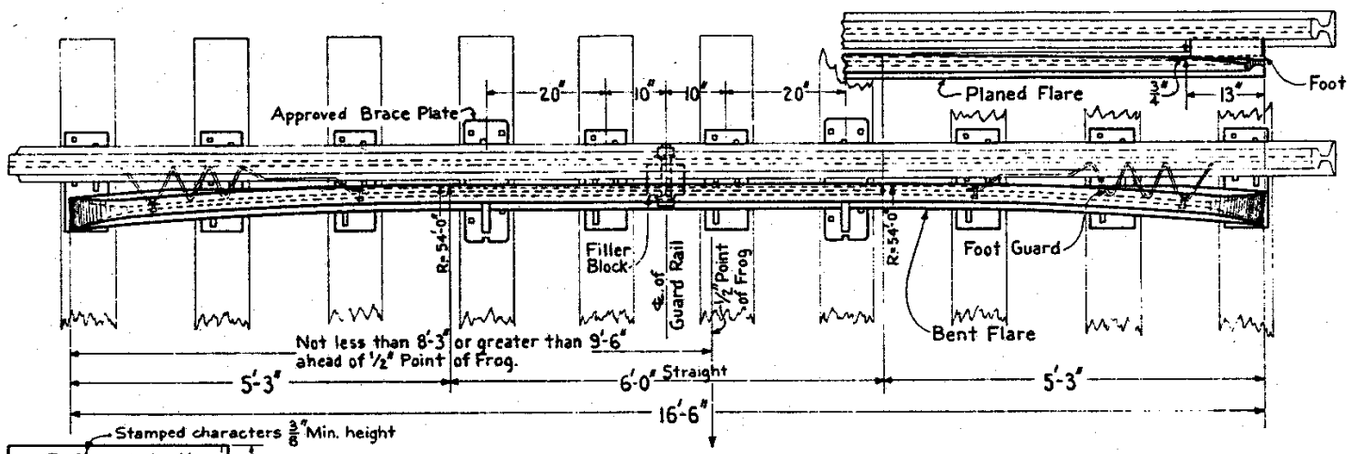
OFFICE OF CHIEF ENGINEER, PHILA., PA., JANUARY 1928

Correct — Engineer of Standards

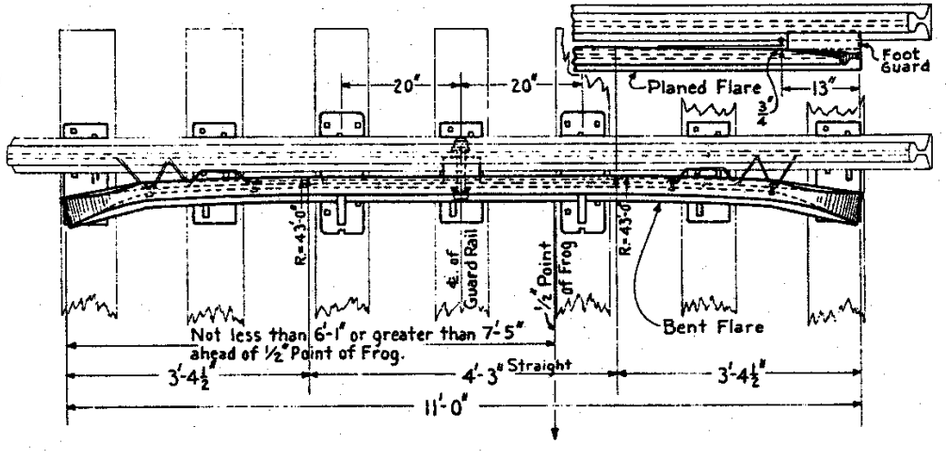
Approved — Chief Engineer

R.E.S.
R.H.B.

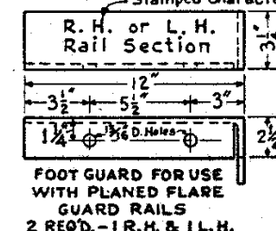
REV.
JULY 1937
JUNE 1953



16 FT.-6 IN. TEE GUARD RAIL WITH 1 FILLER BLOCK
FOR USE WITH MEDIUM TRAFFIC TURNOUT SIDE,
AND HEAVY TRAFFIC STRAIGHT SIDE



11 FT.-0 IN. TEE GUARD RAIL WITH 1 FILLER BLOCK
FOR USE WITH MEDIUM TRAFFIC TURNOUT OR STRAIGHT SIDE,
ALSO FOR USE WITH HEAVY TRAFFIC STRAIGHT SIDE



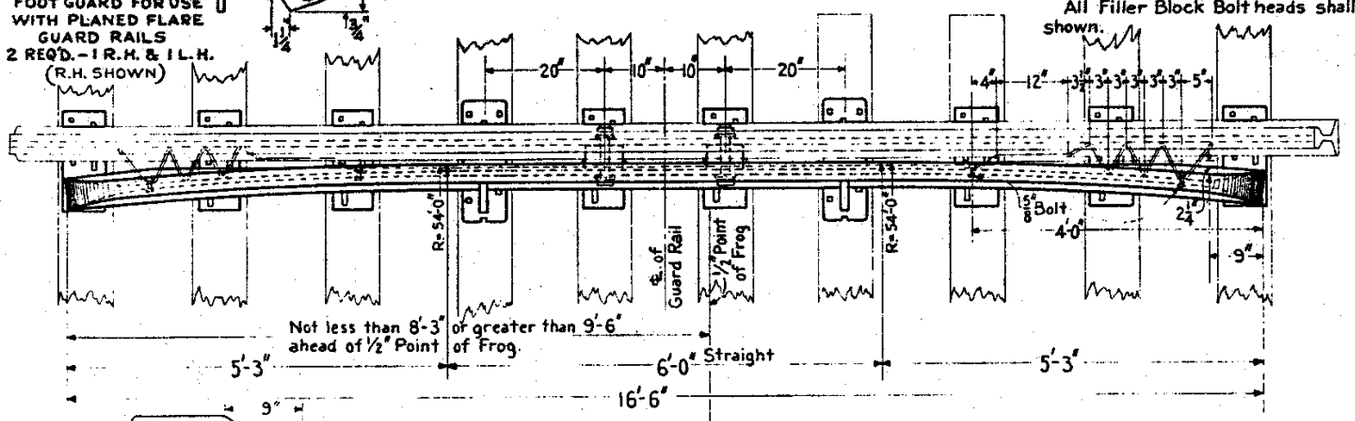
FOOT GUARD FOR USE WITH PLANED FLARE GUARD RAILS
2 REQ'D. - 1 R.H. & 1 L.H.
(R.H. SHOWN)

NOTE:

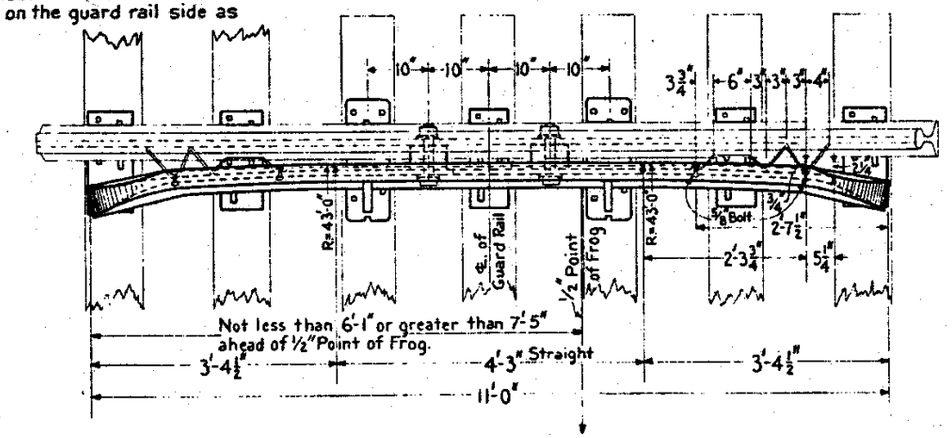
Guard Rails may be furnished with either planed or bent flares, both ends being alike.

The 1 1/2" dia. Holes in Running Rail to take Filler Block Bolts shall be drilled when guard rail is applied.

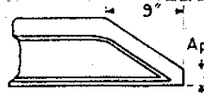
All Filler Block Bolt heads shall be on the guard rail side as shown.



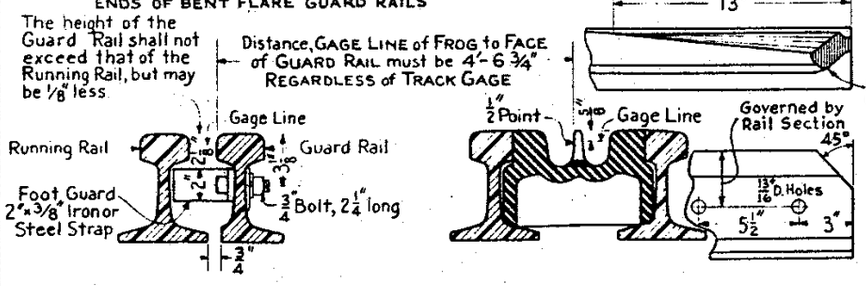
16 FT.-6 IN. TEE GUARD RAIL WITH 2 FILLER BLOCKS
FOR USE WITH HEAVY TRAFFIC TURNOUT SIDE



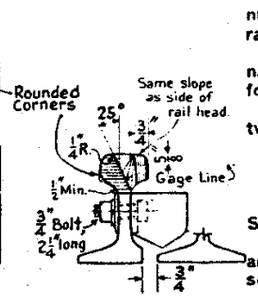
11 FT.-0 IN. TEE GUARD RAIL WITH 2 FILLER BLOCKS
FOR USE WITH HEAVY TRAFFIC TURNOUT SIDE



ENDS OF BENT FLARE GUARD RAILS



DETAIL OF BASE PLANING AND ATTACHMENT OF FOOT GUARDS FOR BENT FLARE GUARD RAILS ALSO POSITION OF ALL TEE GUARD RAILS AT 1/2" POINT OF FROG



DETAIL OF HEAD AND BASE PLANING AND ATTACHMENT OF FOOT GUARDS FOR PLANED FLARE GUARD RAILS

NOTE:-

Requisition for Tee Guard Rail complete must specify the plan number, length and section of the Guard Rail (section, same as running rail), Gage of Track and whether with one or two Filler Blocks.

Requisition for repair parts must specify the plan number and the name (as designated on plan) of the part and quantity required, giving the following additional information for each of the four parts listed below:-

1. Rail Part of Guard Rail - length, section, and whether for one or two Filler Blocks and amount of wear on head of Running Rail.
2. Brace Plate - Rail Section with which used and Gage of Track.
3. Filler Block - Rail Section with which used and dim. A, plan 71806-( ).
4. Filler Block Bolts - Length.

All rail parts must conform to The Pennsylvania Railroad Specifications for O.H. Steel Rails, C.E. 35-( ).

For details of Brace Plates, Filler Blocks, Guard Rail Tie Plate, Bolts and Nuts, Headlock, and Curved Back and Helical Spring Washers, see plan 71806-( ).

End of Guard Rail must always rest over a tie.

FOR USE WITH 4'-8½" AND 4'-9" GAGES OF TRACK

71805-C

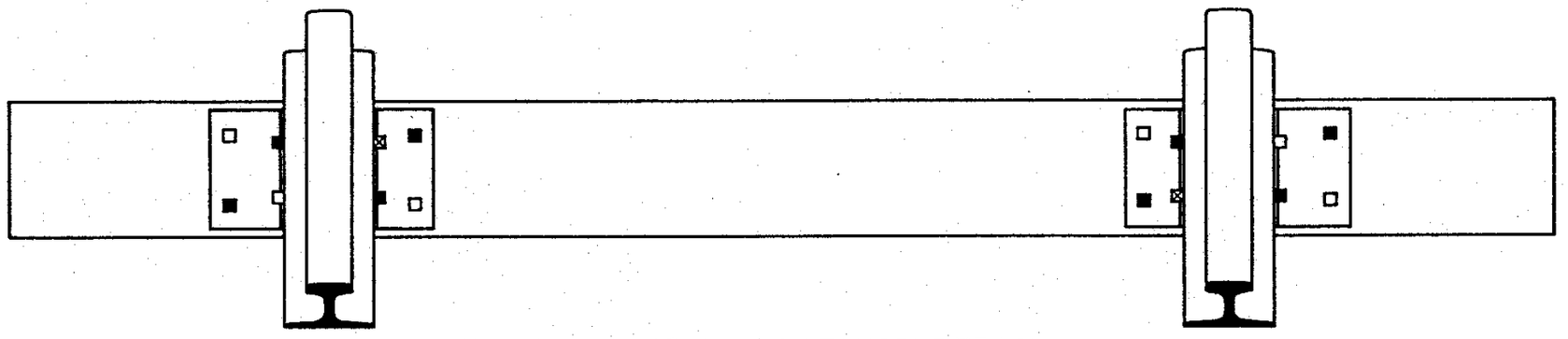
THE PENNSYLVANIA RAILROAD
STANDARD
TEE GUARD RAILS
11'-0" AND 16'-6" LONG
FOR USE IN YARDS AND SIDINGS

OFFICE OF CHIEF ENGINEER, PHILA., PA., JUNE 1931.

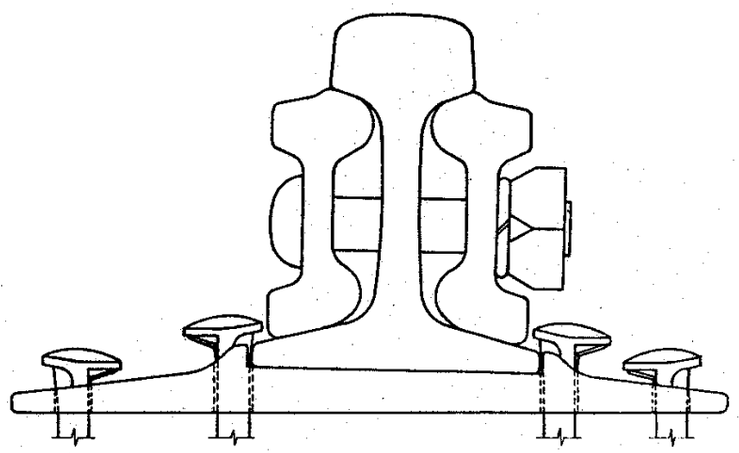
Engineer of Standards

Chief Engr.

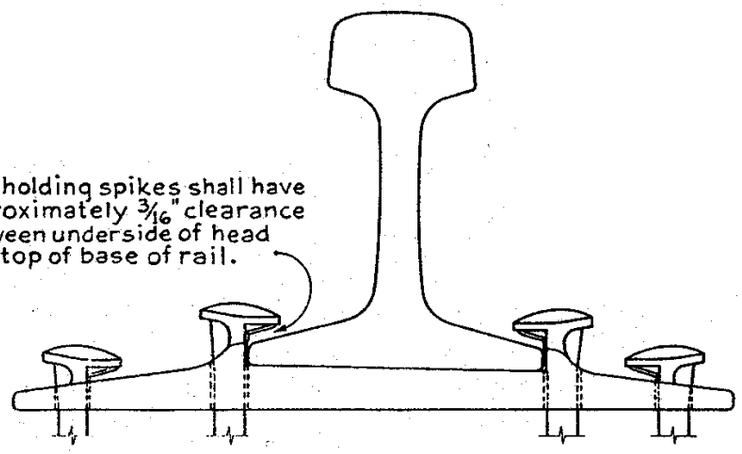
REV.
THIS PLAN
REPLACES
A^ JULY 1956



■ INDICATES SPIKING ON TANGENT TRACK.
⊠ " ADDITIONAL SPIKES ON CURVED TRACK AS SPECIFIED.
□ " HOLES TO BE USED ONLY WHEN OTHER HOLES CANNOT BE SPIKED EFFECTIVELY.



SPIKE APPLICATION WITHIN JOINT BAR LIMITS
NOTE REVERSE POSITION OF HEADS OF RAIL HOLDING SPIKES



SPIKE APPLICATION OF RAIL AND PLATE HOLDING SPIKES
TANGENT AND CURVED TRACK

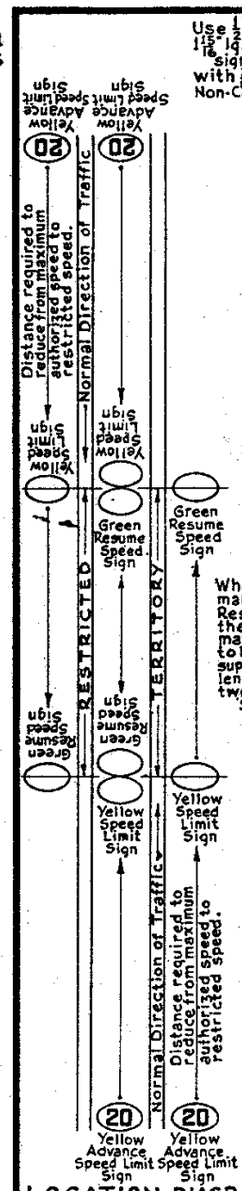
Spiking shall be in accordance with The Pennsylvania Railroad Specifications for Construction and Maintenance of Track, C.E.78-().
Spiking on bridges and trestles shall be the same as for Standard Ballasted Track.

72050-B

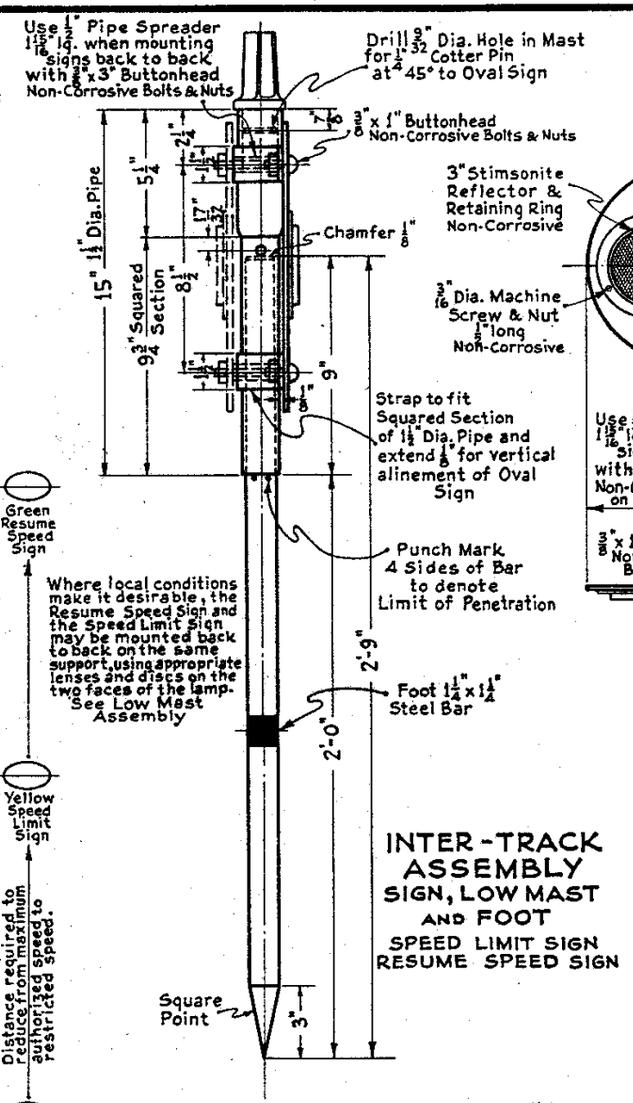
THE PENNSYLVANIA RAILROAD
STANDARD
SPIKING ARRANGEMENT FOR TIE PLATES
OFFICE OF CHIEF ENGINEER, PHILA., PA.-JULY 1957

Chief Engineer

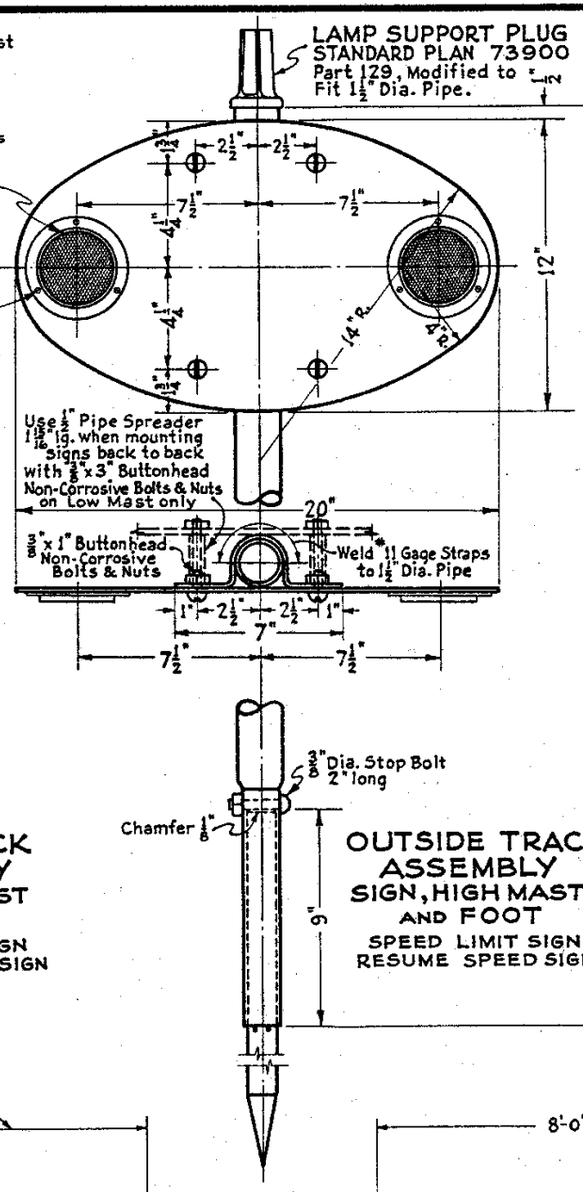
REV.
OCT. 1951
APR. 1955



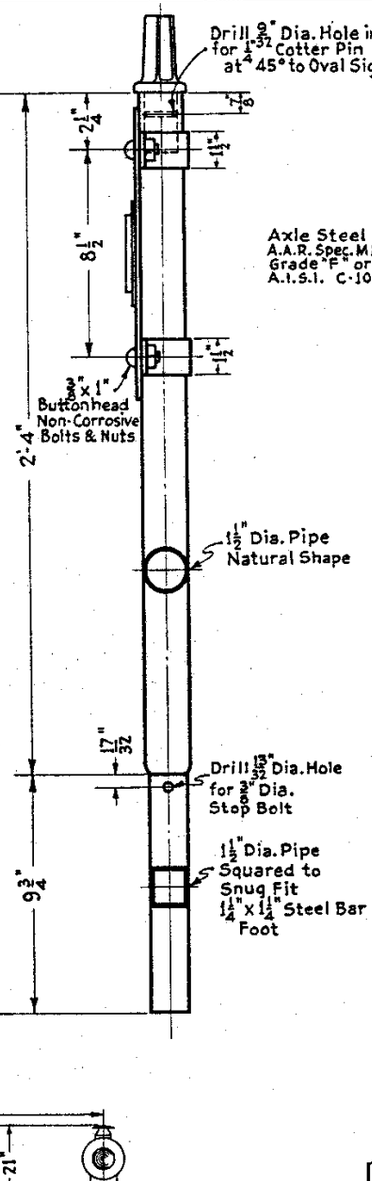
LOCATION DIAGRAM
FOR
SPEED LIMIT SIGNS

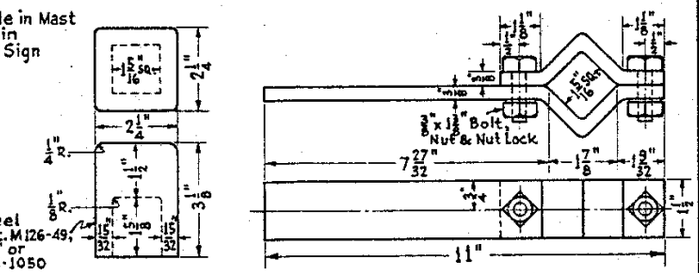


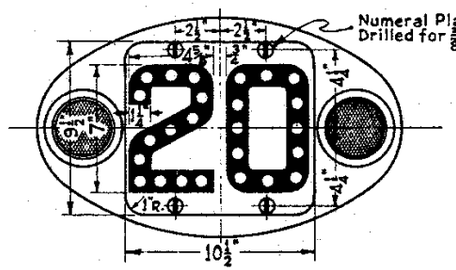
INTER-TRACK
ASSEMBLY
SIGN, LOW MAST
AND FOOT
SPEED LIMIT SIGN
RESUME SPEED SIGN



OUTSIDE TRACK
ASSEMBLY
SIGN, HIGH MAST
AND FOOT
SPEED LIMIT SIGN
RESUME SPEED SIGN







ADVANCE SPEED LIMIT SIGN

Advance Speed Limit sign with numeral plate indicating restricted speed shall be placed a sufficient distance in advance of restricted territory to permit a train to reduce from maximum authorized speed to the restricted speed. See C.E. 78(), Table 901-3.

Speed Limit sign shall be placed to mark the entrance to the restricted territory.

Resume Speed sign shall be placed to mark the end of restricted territory. When entire train has passed this point, speed may be resumed.

Advance Speed Limit sign shall have background of Flat Top Yellow Scotchlite and two 3" yellow Stimsonite reflectors. Superimposed on the yellow background shall be a numeral plate showing speed permitted over restricted territory. Numeral plates shall be furnished in multiples of 10 miles per hour.

Speed Limit sign shall have background of Flat Top Yellow Scotchlite and two 3" yellow Stimsonite reflectors.

Resume Speed sign shall have background of Flat Top Green Scotchlite and two 3" green Stimsonite reflectors.

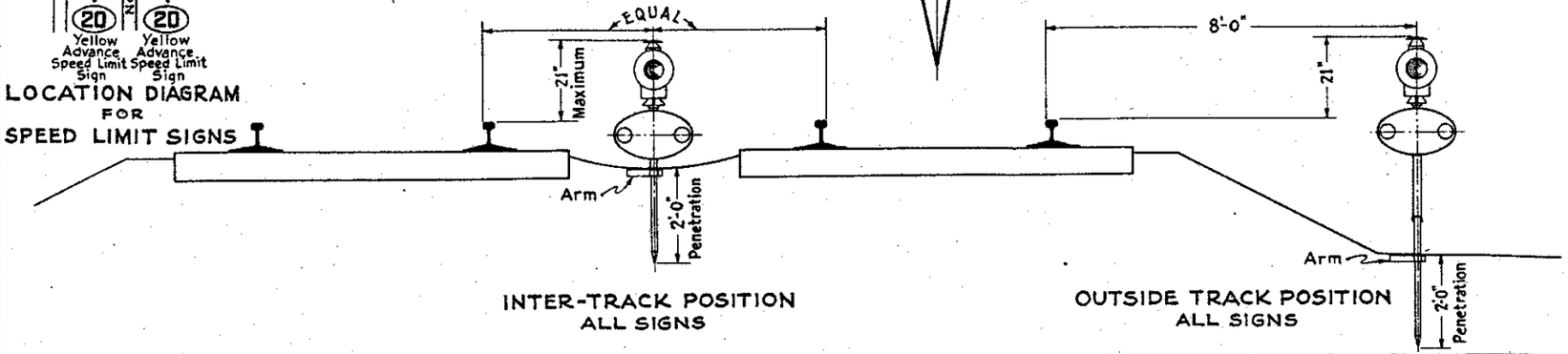
Numeral plate shall have black numerals and ⅞" yellow Stimsonite reflector buttons with yellow enamel background. The back plate shall be *18 gage ingot iron with embossed numerals permanently attached.
Alternate design of numeral plate shall have background of Flat Top Yellow Scotchlite and black numerals and shall be single sheet *18 gage ingot iron.

Oval sign and straps shall be *11 gage ingot iron. Mast shall be 1½" dia. W.I. pipe.

A standard switch lamp shall be mounted on top of each sign. Lamps shall have lenses and discs removed, except one and the apertures closed. Lamps for Advance Speed Limit sign and Speed Limit Sign shall have yellow lens and disc. Lamp for Resume Speed sign shall have green lens and white disc.

Metal surfaces shall be well sanded to remove corrosion, oil and dirt, shall be cleaned with substitute turpentine and dried thoroughly.

Mast, straps and both sides of signs shall have one coat brown zinc chromate primer, 47-2077, dried thoroughly, then one coat black enamel, 47-3315.



INTER-TRACK POSITION
ALL SIGNS

OUTSIDE TRACK POSITION
ALL SIGNS

78405-C

THE PENNSYLVANIA RAILROAD
STANDARD
SPEED LIMIT SIGNS
FOR TEMPORARY SPEED RESTRICTIONS
OFFICE OF CHIEF ENGINEER, PHILA., PA. - AUGUST 15, 1951

J. B. Bennett
Chief Engineer

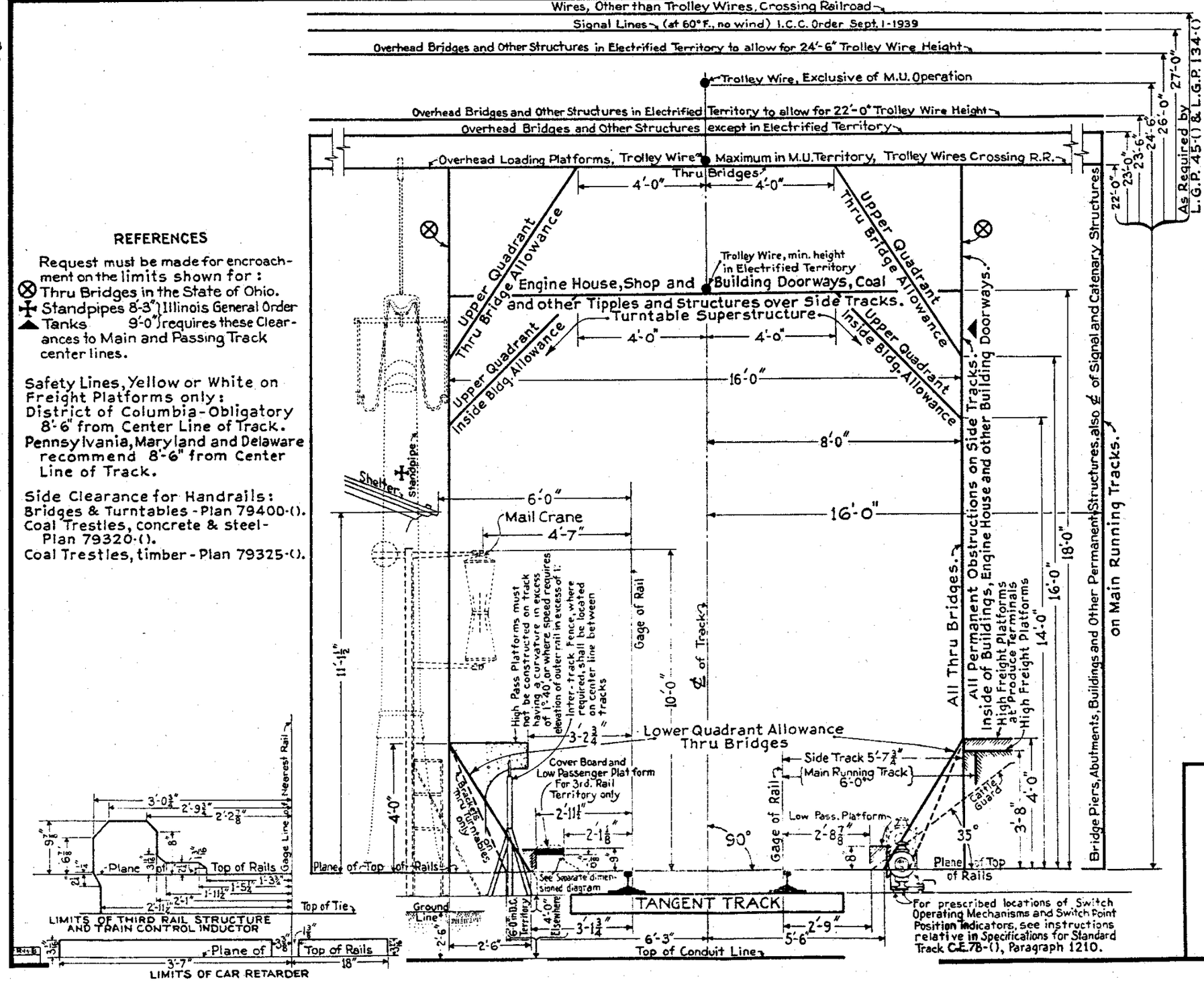
REV.
THIS PLAN
REPLACES
"A" NOV. 1948
"B" NOV. 1955

REFERENCES

Request must be made for encroachment on the limits shown for:
⊗ Thru Bridges in the State of Ohio.
✝ Standpipes 8'-3" } Illinois General Order
▲ Tanks 9'-0" } requires these Clearances to Main and Passing Track center lines.

Safety Lines, Yellow or White on Freight Platforms only:
District of Columbia - Obligatory 8'-6" from Center Line of Track.
Pennsylvania, Maryland and Delaware recommend 8'-6" from Center Line of Track.

Side Clearance for Handrails:
Bridges & Turntables - Plan 79400-().
Coal Trestles, concrete & steel - Plan 79320-().
Coal Trestles, timber - Plan 79325-().



Structures must not be located nearer to the track than the minimum clearance limits prescribed by this plan and these distances should be exceeded where possible.

Minimum Clearances:

For Tangent Track - Shall be as shown on this plan.

For Curved Track:

Above Top of Rail - Are same as shown for tangent track measured vertically from top of high rail, except passenger and freight platforms, the height of which shall be measured from top of nearest rail.

Side Clearances (Measured Radially)

Outside - On the outside of curved track, side clearances shall be measured horizontally from the gage of nearest rail and be increased by 1 inch per degree of curvature over that shown for tangent track.

Inside - On the inside of curved track, side clearances shall be measured horizontally from the gage of nearest rail and be increased by 1 inch per degree of curvature over that shown for tangent track, to which must also be added 3½ times the amount of super-elevation of the high rail above the low rail.

Consideration should always be given to the probability of increased distance between track centers, and widening ditches, and the structures located accordingly.

For standard distances, C. to C. of tracks and spacing of tracks where intertrack Clearance Limiting Objects are located, see Spec. for Standard Track C.E. 78-(), Paragraphs 937 to 941, incl.

Where physical conditions impose insurmountable restrictions, closer than those specified; the matter must be submitted to the Chief Engineer for any modification, also to local or state authorities if necessary.

Clearance Requirements set forth on this plan shall apply only to new construction or reconstruction. Structures and Tracks constructed prior to July, 1953 may be maintained and extended at the existing clearances.

70050-C

THE PENNSYLVANIA RAILROAD
STANDARD
MINIMUM ROADWAY CLEARANCES
OFFICE OF CHIEF ENGINEER PHILA., PA., NOV. 1956

R. J. Henry
Chief Engineer