# THE PENNSYLVANIA RAILROAD COMPANY

WEST JERSEY & SEASHORE RAILROAD COMPANY

## SPECIFICATIONS

FOR THE

## CONSTRUCTION AND MAINTENANCE

OF

## STANDARD RAILROAD

REVISED SEPTEMBER 1st, 1909

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## ROADBED.

1. The roadbed shall be graded to the established sub-grade and shall conform to the cross-section shown on the standard plans, with a regular and uniform surface sloping toward the outer edges. Any inequality developing in the roadbed shall be corrected before track laying is commenced.

2. The roadbed, exclusive of ditches, shall be covered uniformly with sub-ballast, of an approved material, to a sufficient depth to provide proper drainage. In cuts or on fills where the material does not allow free percolation of water, two feet of clean gravel, engine ashes, broken stone or slag should be provided for sub-ballast. The sub-ballast must be compacted and leveled to an elevation which will permit of the depth of top ballast at crown of roadbed shown on standard plans.

3. Effective drainage is most essential, and side ditches should be made in accordance with the standard plans. The section may be enlarged where greater waterway or steeper grade in ditch

is necessary, or where a standard ditch cannot be economically maintained. Where necessary, lateral or cross-drains should be established.

All embankments along water-ways subject to erosion by action of high water or ice, should be protected with rip-rap.

4. Slopes of cuts subject to "slips" and slides should be protected with sod, rip-rap or paving.

Growth of vegetation should be encouraged on banks, and slope gutters should be constructed where necessary.

## DITCHES.

5. Ditches must be kept free from cinders or other material likely to wash into and choke the drains.

6. The flow of water in ditches must not be obstructed by crossties or other material of any kind.

7. Drains must be kept open at all times for the free discharge of water.

8. Berm ditches shall be provided when necessary to protect the slopes of cuts, and should be located at least five feet (5′) from top of cut; if necessary to prevent erosion they should be protected by stone, cribbing or in other suitable manner.

9. In cleaning ditches material must not be piled on slopes of cuts, or deposited on ballast border.

## BRIDGES AND CULVERTS.

10. All bridges and culverts shall be constructed and maintained in accordance with approved plans.

11. Guard timbers and guard rails shall be placed and maintained on bridges and trestles in accordance with standard plans.

12. Careful inspection of the foundations and superstructures of all bridges shall be made by the Division Engineer and the Master Carpenter at prescribed intervals, and written reports made of their condition.

13. Master Carpenters, Supervisors and Track Foremen must be thoroughly familiar with the condition of all bridges and culverts on their divisions. They should particularly examine bridge foundations that are under water and report any defects.

14. The iron work of all bridges should be maintained in good condition. The Master Carpenter shall keep an accurate record of the date each bridge is painted, the kind of paint and number of coats. The date of last painting shall be on each bridge.

15. The Supervisor shall see that bridges and bridge seats are kept clean.

16. Care should be taken that dry grass and other inflammable material is kept away from bridge structures.

17. The channels of streams on either side of track should be examined frequently and cleaned of all brush and debris that may interfere with the free flow of water.

18. The water-ways between abutments of culverts where excessive scouring occurs should be paved.

18a. It is the duty of the Track Foreman to know that the bridge warnings are in proper condition at all times. Repairs that he can make with his own force should be attended to at once, and if the repairs are such as to require the attention of the carpenters, he should at once communicate the fact by wire to his Supervisor.

## BALLAST.

19. All ballast used shall conform to standard specifications, and the kinds to be used will be designated.

20. Ballast should be leveled between all ties to a plane one-half inch ($\frac{1}{2}''$) below top of ties, and borders should conform to standard plans.

21. The inter-tie space at joint ties and at ties against which anti-creeping devices abut must be kept filled with ballast at all times.

22. Stone ballast should be kept clean to a depth sufficient to properly drain the track.

23. Before raising track, stone ballast must be cleaned if necessary for drainage.

24. Ballast larger than standard may be used at track troughs.

## CROSSTIES.

25. Crossties must be in accordance with standard specifications.

Revision of May, 1913

26. They shall be placed upon the ballast square to the line of the rail. On account of variation in length of ties, the outside ends on four-track and on double track roads, and the right hand ends, going north or west on single track roads, must be lined parallel with the rail.

27. Ties should be placed with heart face down.

28. The largest and best ties shall be selected for use at joints, and the joint ties spaced to have not exceeding eleven inches (11″) between bearing surfaces.

29. Intermediate ties shall be evenly spaced and in main running tracks the distance between bearing surfaces of two adjacent ties shall not be greater than eighteen inches (18″).

Revision of December, 1913

30. For yards, storage sidings and commercial sidings, fourteen (14) ties shall be used to each thirty-three feet (33′) of track. If necessary the number of ties may be increased on curves.

For Main Tracks, on branches with light traffic and in running sidetracks, sixteen (16) ties shall be used to each thirty-three feet (33′) of track.

For main running tracks, on branches with medium freight and passenger traffic,

Revision of December 1913

eighteen (18) ties shall be used to each thirty-three feet (33′) of track.

For main running tracks of heavy freight and fast passenger traffic, twenty (20) ties shall be used to each thirty-three feet (33′) of track.

31. Badly hewn or twisted ties must not be notched, but must be adzed to give the rail or tieplate an even bearing.

32. Various classes of crossties should be used as follows:

Ties of first and second class dimensions in all running tracks where the traffic demands.

Ties of third class dimensions, and culls, in all other tracks.

33. In tie renewals, the ties unfit for further service shall be removed from track by the method known as "spotting," and not more than one-half the number under each rail should be renewed during one season. Renewals in "face" are not permitted, except through road crossings, station platforms and half-through solid floor bridges. Renewals of switch ties should also be made by the "spotting" method.

Revised June, 1918

34. It is the duty of the Supervisor to be fully informed as to the tie requirements on each section, to inspect the ties in track and to select each year the ties that are to be renewed. Ties must not be broken or disfigured when inspecting.

All spikes and plates must be removed from old ties before they are disposed of.

35. Old ties must not be burned on sodded banks, close to hedges, nor where injury will be done to telegraph lines, to masonry or passing trains.

36. When spacing ties care should be taken not to damage them by striking them with spiking hammer, pick or sharp tools.

37. When re-spiking ties, standard tie plugs must be used.

38. Ties distributed in advance of the time of use must be neatly piled, care being taken not to place them on sodded banks.

39. Ties should be piled in accordance with specifications, and, if possible, should have not less than six (6) months' summer seasoning before being used. In every case the oldest tie should be used first.

## TIE-PLATES.

Revision of April, 1916

40. Tie plates are to be used on all curves of two degrees or over in running tracks and six degrees or over in sidings; also on all switch ties, and ties on turntables, ash pits, bridges and trestles; at water stations and track troughs, and through all road crossings and station platforms.

On tangents and curves of less than two degrees in running tracks or six degrees in sidings,

Revision of April, 1916.

when the annual tonnage is less than the figures shown in the table below, tie plates are not to be used; when the annual tonnage equals or exceeds the amount shown, tie plates must be used.

ANNUAL TONNAGE REQUIRING TIE PLATES.
(Expressed in Millions of Tons.)

| Untreated Ties. | Mill. Tons. | Treated Ties. | Mill. Tons. | Treated Ties. | Mill. Tons. |
|---|---|---|---|---|---|
| White Oak | 8.5 | Red Oak | 5.1 | Red Gum | 2.6 |
| Black Locust | 11.7 | Honey Locust | 5.1 | Soft Maple | 2.6 |
| " Walnut | 6.3 | Hickory | 5.1 | Butternut | 2.6 |
| " Cherry | 6.4 | Hard Maple | 5.1 | Elm | 2.6 |
| Chestnut | 3.6 | Hackberry | 5.1 | Shortleaved Pine | 2.6 |
| Sassafras | 5.5 | Ash | 5.1 | Longleaved Pine | 4.5 |
| Red Mulberry | 6.4 | Beech | 3.6 | | |
| Longleaved Pine | 7.6 | Sycamore | 3.6 | | |
| Bald Cypress | 4.2 | Black Gum | 3.6 | | |

41. Tie plates should be applied according to standard plans and care taken that the shoulder will have full bearing against base of rail.

## RAILS.

42. Rails must be so laid that each joint will be opposite the middle of the opposite rail of same track on tangents; on curves a maximum variation of eighteen inches (18″) will be allowed. This rule may be varied in laying rail through switch connections, where joints must be staggered not less than three feet (3′). If avoidable, joints should not be placed through switches, guard rails, or road crossings.

43. Rails, must not be thrown from cars, nor unloaded from cars in motion, except when an approved unloading device is used.

44. Rails distributed for use must be placed base down, parallel with the track, with uniform bearing surface on roadbed.

45. Before being laid, crooked rails shall be carefully straightened.

46. Rails must be laid one at a time and, to insure perfect adjustment, the rail ends should be brought squarely together against proper shims, and carefully bolted before spiking.

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

48. Before rail renewals are made, the track should be placed in good surface and line.

49. No more rail shall be laid at one time than will have ties re-spaced and track properly lined, surfaced, gauged and back-filled with ballast within the following six (6) days. Rails must be fully spiked and bolted and the joint ties spaced the same day as laid. In relaying rail the ties must be adzed to give the rail a proper bearing.

50. The use of switch points in laying rail is prohibited.

51. No rail of less than twelve (12) feet in length shall be used in main track.

52. It is essential that the creeping of rails be prevented. Where this occurs, each, individual rail should be thoroughly anchored and a sufficient number of anti-rail creeping devices of approved

design used for this purpose. They shall be attached to the rail opposite the joints, and if more are required they shall be applied to both rails at the same intermediate ties.

September, 1918

Anti-creepers shall not be used on track of less than 5/10 per cent. grade, or on any track where the movement does not exceed 500 cars per day, without the approval of the Engineer M. W.

The number of anti-creepers attached to each rail shall not exceed six, except with the approval of the Engineer M. W.

Anti-creepers must be kept clear of ballast and ice so that they will not be loosened when the rail contracts.

When removed all serviceable parts must be saved and new parts ordered to replace those unfit for service.

52a. Track Foremen and Watchmen must examine rail frequently and carefully for signs of damage or defect, such as splitting of head (which is indicated by a black streak along top surface), splitting of base (which is evidenced by rust streaks at juncture of web and upper side of base, and results in what is known as "half-moon breaks"), nicked or dented base or head from broken wheel, or other damage from derailed equipment, burned spots on head from slipping of driving wheels, etc.; and such rails (damaged or with signs of defects) if, in the judgment of the Foreman they are unsafe for traffic, must be removed as soon as discovered, or, if not immediately dangerous they must be reported promptly to the Supervisor and removed from track whenever in his judgment the injury or defect is of such a nature or extent as to impair the strength of the rail.

## JOINTS.

53. Splices must be applied with their full quota of bolts, nuts and nut locks; where rails are less than 70 pounds per yard in weight, the nuts must be placed on the outside.

54. The temperature of rails must be taken with a P. R. R. standard Fahrenheit thermometer.

The openings between the ends of thirty-three foot (33′) rails shall vary with the temperature as follows:—

| Temperature Fahrenheit. | Openings between rails for 33′ rail. |
|---|---|
| From 10° below to 14° above zero ..... | $\frac{5}{16}$ inch. |
| From 14° above to 38° above zero ..... | $\frac{1}{4}$ inch. |
| From 38° above to 62° above zero ..... | $\frac{3}{16}$ inch. |
| From 62° above to 86° above zero ..... | $\frac{1}{8}$ inch. |
| From 86° above to 110° above zero ..... | $\frac{1}{16}$ inch. |

Above 110°, rail to be laid close without bumping.

55. Standard steel shims must be used for spacing rails. During hot weather spacing between rail ends must be carefully watched, and, when necessary, rails driven back, or a piece or pieces of rail cut out to avoid buckling of track.

56. In tunnels, when temperature is above 70 degrees, lay rails with close joints without bumping them together; and, when temperature is below 70 degrees, make an opening of one-sixteenth of an inch ($\frac{1}{16}$″) for each 24 degree variation for thirty-three foot (33′) rails.

57. Particular attention must be given to proper maintenance of insulating and compromise joints.

58. The space between rails at insulating joints should be one-half inch ($\frac{1}{2}$"), using end posts as shown on standard plan.

59. Slot holes of splices, both inside and outside, should be fully spiked, except on bridges, trestles and viaducts, where ballast is not used.

60. Compromise splices must be used when joining rails of different sections, to bring them to proper surface and gauge.

## SPIKES.

61. The rails must be full spiked to each tie. The spikes must be driven vertically, and not slanted under the rail or bent against the rail when driving. Where tie plates are not used, the inside spikes must be driven near the east or south edge of the tie and the outside ones near the west or north edge, but not closer to the edge of tie than two inches. Care must be used in spiking to avoid striking the rail.

62. The number of spikes used per tie shall be as follows:

(a) On tangents without tie plates, one rail-holding spike inside and one outside at each rail.

(b) On tangents with tie plates, one rail-holding spike inside and one outside at each rail.

(c) On curves where tie plates are used, ordinarily one rail-holding spike inside and one outside, and one plate-holding spike inside, at each rail, except as noted below.

NOTE.—When necessary on account of high speed or heavy traffic, two rail-holding and two plate-holding spikes are to be used at each rail.

63. Care must be taken to keep spikes driven home

## LINE, SURFACE AND GAUGE.

64. The track shall be lined and surfaced prior to back filling with ballast so that newly laid rails will not be bent by the passage of trains.

65. On tangents and on curves up to and including 10 degrees, the track shall be laid to standard gauge (4 feet $8\frac{1}{2}$ inches).

66. On curves over 10 degrees the track may be laid to a gauge not to exceed 4 feet 9 inches.

Revision of July, 1917

66a. The gauge of track shall be tested periodically and when found to be more than one-eighth ($\frac{1}{8}$″) tight or more than one-fourth ($\frac{1}{4}$″) wide on tangents, or one-half inch ($\frac{1}{2}$″) wide on curves, the track shall be regauged.

67. Track gauges and levels in possession of Track Foremen must be tested and verified at frequent intervals by the Supervisor.

68. In surfacing track, the low rail on curves and the line rail on tangents should first be brought to proper surface, and the other rail brought up with track level. Care must be taken to maintain proper elevation on curves.

Revision of Jan., 1918

69. The Supervisor shall instruct the Track Foremen as to the proper elevation of the outer rail on every curve in running tracks. Sidings should be laid and maintained without elevation.

70. The correct elevation may be calculated as follows:

Let E represent elevation in inches.
" D " degree of curve.
" V " speed in miles per hour
Then $E=0.00066\ DV^2$ and is the middle

ordinate of a chord whose length in. feet is $1\frac{6}{10}$ times the speed in miles per hour. The elevation must not exceed $7\frac{1}{2}$ inches.

71. The rate of increase or decrease in the elevation at the approach or run-off of curves should not exceed one-half inch ($\frac{1}{2}''$) for each thirty-three foot (33′) rail length.

72. When surfacing tracks the track level must be used to insure accurate work.

73. Track must not be raised above the established grade, and lifts shall be regulated to avoid bending the splice bars or straining the joints.

74. On lines carrying high speed traffic, the track should be raised by making slight lifts not to exceed two inches (2″).

75. The use of track jacks on the inside of rail is prohibited, except under proper flag protection. Wherever possible, raising bars should be used in preference to track jacks.

76. Special care should be taken to insure thorough tamping of all ties from the ends to fifteen inches (15″) inside centre of rail.

Revision of May, 1918

76a. When necessary to use shims in surfacing track they shall consist of boards the full width of the tie, not less than two feet in length, bored for the spikes, and fastened to the tie with not less than six 60-penny nails. Shimming in excess of two inches will not be permitted.

77. Alignment of track should be established by the transit, and the alignment of curves maintained by string method.

78. When renewing or re-spacing crossties, raising track or cleaning ballast, sufficient back filling must be done to hold track in proper line and surface and prevent creeping. The raising of a main track should be made against the current of traffic, and both rails lifted at the same time. Particular attention must be given to the above work when done during warm weather to avoid buckling of rails.

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**TRACK OBSTRUCTION.**

78a. In no instance must main track be allowed to remain over night in other than standard condition, except under full protection and also notification of the Superintendent by wire.

Attention is particularly directed to the fact that any track should be regarded as unsafe for passage of trains at full speed when obstructed:

(a) Rail Renewals:

When the spikes are withdrawn from the rail on one side of the track from more than every other tie on straight line, every third tie on curves up to three degrees, every fifth tie on curves over three degrees or where the distance between the inside and outside spikes of adjoining ties exceeds 3′ 8″.

(b) Tie Renewals:

When two or more adjoining ties are removed; or the space between surface bearings on adjoining ties in track is more than three feet two

Revision of July, 1917

inches; or without at least four adjoining ties on each side of the tie or ties removed being in place and fully spiked and tamped. The new tie must be placed without delay.

(c) Gauging–Tangent Track:

When the spikes are removed from more than one tie under one rail; or the inside spikes are removed from more than three adjoining ties. The distance between gauging squads must be at least one rail length.

Curves—Any gauging is an obstruction.

(d) Joints:

When one or both of a pair of joint bars are broken entirely through; or when one or both joint bars are removed; or when there are less than two bolts at a joint; or when one rail end is unbolted.

(e) Lining:

When lining is being done other than that of simply maintaining ordinary alignment.

(f) Raising Track:

When the super-elevation on curves varies more than one-half inch in a rail length from that designated; when the level of opposite rails on tangents varies more than, one-half inch; when the run-off exceeds one inch in thirty-three feet; when the line and surface has not been completed and the track filled in so that it will prove safe and stable.

## SWITCHES, FROGS AND GUARD RAILS.

79. Switches, frogs and guard rails must be placed in track in conformity with standard plans.

Revision of August, 1918

Hard centre frogs may be used:

(a) Through interlocking plants where diverting movements are made at high speed.

(b) Through interlocking plants where the traffic on the diverting side of the frog is over 50% of the main line traffic.

(c) In main line connections where the traffic on diverting side of the track is over 50% of the main line.

Spring rail frogs shall be used for main line slow speed cross-overs and turnouts not included above.

Sliding or fit spring or hard centre frogs removed from main track shall be used for yard tracks.

80. If avoidable, turnouts and cross-overs should not be located on curves, nor placed to face the traffic in present or possible future multiple track roads,

81. Special attention should be given to cleaning and lubricating switch plates and movable parts of frogs and switches.

82. Switch stands should be so located that, when switches are set for main track, connecting rods will be in tension; and, where possible, they should be on right-hand side of switches in the direction of the facing point movement. Care should be taken to keep lamps in proper adjustment.

## SIDINGS.

83. No siding shall be constructed with curve of a radius less than one hundred and seventy five feet (175′).

84. Sidings, other than passing sidings, where parallel and adjacent to main tracks, should be constructed with the centre of siding not less than sixteen (16) feet from centre of main track, as shown on standard plan. This distance should be eighteen (18) feet where practicable.

85. The unconnected ends of sidings adjacent to main tracks must be curved away from main tracks as shown on standard plan.

86. Throw-off switches or other approved derails must be used on all siding connections to main running tracks to prevent cars on sidings being run or blown out onto main track and to prevent cars being so placed as to obstruct or endanger main track movements. All throw-off switches or derails must be installed in accordance with standard plan.

87. Foremen must inspect private sidings at frequent intervals and promptly report to the Supervisor any defects noted.

## FENCES, ROAD CROSSINGS AND SIGNS.

88. Road crossings shall be constructed in accordance with standard plans.

89. Track signs, properly painted, must be placed according to instructions and where they may be readily seen.

90. All sign posts must be kept plumb and maintained in proper condition.

91. Overhead bridge warnings shall be erected in accordance with standard plan and maintained in proper condition.

92. Cattle guards of approved design shall be provided where required.

93. Fences owned by the Railroad Company shall be kept in good repair.

94. It is important that no buildings, structures or material be placed at or near grade crossings where they will obstruct the view of approaching trains.

## SIGNALS, INTERLOCKING AND TRACK CIRCUITS.

95. Track Foremen will exercise proper care in their work to avoid disturbing appliances connected with the signals.

96. Track Foremen must see that all broken bond wires are repaired promptly, and the rails and splices in bonded track kept clear from contact with ballast or dirt.

97. Track Foremen will see that insulating joints are kept in good order, the bolts tight, and ties well tamped, and that the insulation is renewed when required. When work is to be done on bonded track which will interfere with circuits, or any work which will interfere with interlocking or signal appliances, Signal Repairmen must first be notified.

98. While working on bonded track, such care must be exercised in the handling of material and tools as to avoid making a metallic circuit between the rails.

99. Hand cars and trucks which are not insulated shall not be used on bonded track.

## FIRE PROTECTION.

100. All fires on or in the vicinity of the right-of-way must be promptly extinguished, or closely watched and controlled to prevent damage being done to fences, buildings or crops. All employes should render every assistance possible in extinguishing fires on or adjacent to the property of the Railroad Company.

## SNOW AND ICE.

101. At the approach of winter ballast should be cleaned from the space between the ties under the rail at frogs, switches and guard rails, in order to facilitate the removal of snow and ice.

102. Switch connections, platforms at stations, subways, overhead foot bridges, road and street crossings, track at water stations and track troughs, and interlocking pipes and wires must be kept clear of snow and ice. On portions of the road where heavy snows are frequent, this work should be followed by flanging tracks for a shovel-width on the inside of each rail, and the opening of water-ways in ditches.

## POLICING.

103. Track Foremen must not allow any person to erect telegraph or other poles, place signs or advertisements, string wires or ropes, or otherwise occupy the Company's property, without proper authority. Any attempted encroachment must be reported at once to the Supervisor, giving full particulars.

104. Station platforms, fences, tool houses, subways, overhead foot bridges and grounds at stations and yards must be kept clean and in good order. Defective platforms which might cause injury to persons, must be temporarily repaired and promptly reported to the Supervisor.

105. Open culverts, ditches or drains near stations, or where shifting is done, must be protected to prevent passengers or others from falling into them.

106. All Company buildings should be inspected regularly as to their sanitary conditions. Special attention should be given to the condition of cellars and attics.

107. All classes of scrap material must be collected, sorted and stored at proper points, and reported for disposal. Material stored upon right of way or station grounds for emergency or future use should be neatly piled.

108. Grass, weeds and brush must be cut at least once a year, and the cuttings destroyed. Thistles and other noxious weeds should be cut frequently to prevent flowering.

109. Trees near telegraph lines should be kept trimmed to prevent interference with the wires or with the view of signals.

110. Sodded surfaces should be cleaned in the spring and cinder removed with stiff brooms. Seed should be sown where necessary and slopes well compacted.

## PATROLLING OF TRACKS.

111. Track Foremen must make frequent and careful inspections of their sub-divisions.

112. Track Foremen will see that watchmen are properly detailed to patrol the track, watch

bridges or perform other duties pertaining to the safety of the track and structures. Track Foremen will frequently visit these men at such intervals, day or night, as may be necessary, to see that their duties are faithfully performed.

113. Trees, rocks, etc., if in danger of falling on the track, must be removed.

## GENERAL.

114. Proper judgment and caution must be exercised by all employes to prevent the extravagant use of material entrusted to their care, and economy must be practiced at all times.

Issued by order of General Manager.

JOSEPH T. RICHARDS,
*Chief Engineer* of *Maintenance of Way.*

L. R. ZOLLINGER,
*Engineer* of *Maintenance of Way.*

PHILADELPHIA, September 1st, 1909.