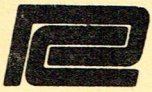
PENN CENTRAL TRANSPORTATION COMPANY

MANUAL FOR CONSTRUCTION AND MAINTENANCE OF TRACK

M. W. 4

S. E. Booth



PENN CENTRAL
TRANSPORTATION COMPANY

MANUAL

FOR CONSTRUCTION

AND MAINTENANCE OF

TRACK

M.W. 4

PART I

TRACK MAINTENANCE LIMITS

FEBRUARY 1, 1974

Contents Of Part I

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Subpart A - General

§213.1 Scope of part.

(a) This part prescribes minimum requirements and limits for control of the condition of tracks, owned or leased, that are maintained by the Penn Central Transportation Company.

(b) These requirements and limits apply where one of the described track conditions is found to exist at a single location. Where a combination of two or more of these conditions is found to exist at the same location, even though none are individually beyond the prescribed limits, judgment must be used to determine the extent to which such combinations may be permitted to exist, and action to be taken.

§213.3 Application.

(a) Except as provided in paragraph (b) of this section, this part applies to all tracks maintained by the Penn Central Transportation Company.

(b) This part does not apply to tracks:

(1) Located inside industrial installations which are not used by the railroad as part of its operating facilities; or

(2) Used exclusively for rapid transit, commuter, or other short-haul passenger service in a metropolitan or suburban area.

§213.5 Responsibility.

(a) When it is known by track supervision, or track supervision has responsible notice, that a track does not comply with the requirements of this part, the following action must be taken:

(1) Reduce the operating speed to within a range for which the track does comply; or

(2) Repair or improve the track; or

(3) Place the track out of service.

§213.6 Protection.

(a) Protection shall be provided for any track that is considered not satisfactory for the passage of trains at the maximum speed permitted, including placing an appropriate temporary speed restriction and notification of the Block Station and/or Train Dispatcher.

(b) Portions of tracks on which temporary speed restrictions have been placed are to be marked by placing Approach Speed, Speed Limit, and Resume Speed signs to the right of each track for both directions of traffic, as follows:

(1) The general arrangement, details of construction and assembly, height and distance from the track, of signs shall be as shown on Plan 78404-( ).

(2) The relative positions for placement of signs are shown on diagram appended to this part.

(3) Signs are to be placed so as to give the greatest practical unobstructed view, considering alinement and other local physical conditions. Reflecting surfaces of signs must be kept clean to preserve their reflecting ability.

(4) Speed Limit and Resume Speed signs are to be placed with the Speed Limit sign at the point where the actual restriction begins and the Resume Speed sign at the point where it ends.

(5) Approach Speed signs with numerals indicating the restricted speed are to be placed far enough ahead of the Speed Limit signs, in the direction from which trains are approaching, to permit trains to reduce from normal speed to the speed permitted by the restriction or to stop, but not less than the distances shown in the following table for passenger trains and freight trains on level or ascending grades. For descending grades the distances in the table should be increased by the amounts shown in paragraph (b)(6) of this section.

Distances From Approach Speed Signs
To Speed Limit Signs And Stop Signs

Speed - M.P.H. Reduced		Distance between signs - feet (Level or ascending grades)	
From	To	Passenger	Freight
100	90	1,600.	
"	80	3,000.	
"	70	4,300.	
"	60	5,400.	
"	50	6,300.	
"	40	7,000.	
"	30	7,600.	
"	20	8,000.	
"	10	8,300.	
"	Stop	8,800.	
90	80	1,400.	
"	70	2,600.	
"	60	3,700.	
"	50	4,600.	
"	40	5,400.	
"	30	6,000.	
"	20	6,400.	
"	10	6,600.	
"	Stop	7,100.	
80	70	1,300.	
"	60	2,300.	
"	50	3,200.	
"	40	4,000.	
"	30	4,500.	
"	20	5,000.	
"	10	5,200.	
"	Stop	5,700.	
70	60	1,100.	3,200.
"	50	2,000.	6,000.
"	40	2,700.	8,200.
"	30	3,300.	10,000.
"	20	3,700.	11,200.
"	10	4,000.	12,000.
"	Stop	4,500.	12,500.

Speed - M.P.H. Reduced		Distance between signs - feet (Level or ascending grades)	
From	To	Passenger	Freight
60	50	1,000.	3,200.
"	40	1,700.	5,800.
"	30	2,300.	7,900.
"	20	2,700.	9,400.
"	10	3,000.	10,300.
"	Stop	3,500.	10,800.
50	40	800.	2,700.
"	30	1,400.	4,700.
"	20	1,800.	6,200.
"	10	2,200.	7,100.
"	Stop	2,700.	7,600.
40	30	600.	2,100.
"	20	1,100.	3,500.
"	10	1,500.	4,500.
"	Stop	2,000.	5,000.
30	20	500.	1,500.
"	10	900.	2,400.
"	Stop	1,400.	2,900.
20	10	400.	900.
"	Stop	900.	1,400.
10	Stop	500.	700.

(6) To determine the distance between Approach Speed signs and Speed Limit or Stop signs for descending grades, the appropriate distance from the table above should be increased, as follows:

Grades	Increase	Grades	Increase
Level to 0.10%	= None	1.34% to 1.50%	= 60%
0.11% to 0.36%	= 10%	1.51% to 1.64%	= 70%
0.37% to 0.66%	= 20%	1.65% to 1.78%	= 80%
0.67% to 0.92%	= 30%	1.79% to 1.90%	= 90%
0.93% to 1.14%	= 40%	1.91% to 2.00%	= 100%
1.15% to 1.33%	= 50%	2.01% to 2.10%	= 110%

§213.7 Designation of persons to supervise certain maintenance and renewals, and inspect track.

(a) Competent persons shall be designated to supervise maintenance, restorations, and renewals of track under traffic conditions.

(1) Each person designated must have at least:

(i) One (1) year of supervisory experience in railroad track maintenance; or

(ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance, prescribed by the railroad; or

(iii) A combination of supervisory experience in track maintenance and training from a college level educational program related to track maintenance.

(2) Each person designated must have demonstrated to the railroad that he:

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations.

(3) Persons designated to supervise maintenance, restorations, and renewals of track have authority to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part.

(b) Competent persons shall be designated to inspect track for defects.

(1) Each person designated must have at least:

(i) One (1) year of experience in railroad track inspection; or

(ii) A combination of experience in track inspection and training from a course in track inspection, prescribed by the railroad; or

(iii) A combination of experience in track inspection and training from a college level educational program related to track inspection.

(2) Each person designated must have demonstrated to the railroad that he:

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations.

(3) Persons designated to inspect track for defects have authority to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a person designated under paragraph (a) of this section.

(c) With respect to designations under paragraphs (a) and (b) of this section, written records must be maintained of:

(1) Each designation in effect;

(2) The basis for each designation; and

(3) Track inspections made by designated persons as required by §213.241.

These records must be kept available for inspection or copying by the Federal Railroad Administrator during regular business hours.

(d) A person designated under paragraphs (a) or (b) of this section shall be given a standard qualification card and carry the card on his person while on duty.

§213.9 Classes of track: Operating speed limits.

(a) Maximum allowable operating speeds for designated classes of track are:

Over track that meets all of the requirements prescribed in this part for:	The maximum allowable operating speed in miles per hour is: Freight trains	Passenger trains
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	70	90
Class 6 track	70	100

(b) If a segment of track does not meet all of the requirements for its intended class, it is reclassified to the next lowest class of track for which it does meet all of the requirements of this part. However, if it does not at least meet the requirements for class 1 track, no operations may be conducted over that segment except as provided in §213.11.

(c) Maximum operating speed must not exceed 100 m.p.h., unless special authority has been granted by the Chief Engineer M.W., who will arrange for approval of the Federal Railroad Administrator for speeds in excess of 110 m.p.h.

§213.11 Restoration or renewal of track under traffic conditions.

If, during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work and operations on the track must be under the continuous supervision of a person designated under §213.7(a).

§213.13 Measuring track not under load.

When track, not under load, is measured to determine compliance with the requirements of this part and rail movement under load is apparent, that apparent amount of rail movement must be added to the measurements taken.

§213.15 Civil penalty.

(a) If any requirement prescribed in this part is violated, the railroad may be subject to a civil penalty by the Federal Railroad Administrator of at least $250 but not more than $2,500.

(b) For the purpose of this section, each day a violation persists is treated as a separate offense.

Subpart B - Roadbed

§213.31 Scope.

This subpart prescribes requirements for roadbed and areas immediately adjacent to roadbed.

§213.33 Drainage.

Each drainage facility under or immediately adjacent to the roadbed must be kept sufficiently free of obstructions to accommodate expected water flow for the area concerned.

§213.37 Vegetation.

Vegetation on railroad property which is on or immediately adjacent to roadbed must be controlled so that it does not:

(a) Become a fire hazard to track-carrying structures;

(b) Obstruct visibility of railroad signs and signals;

(c) Interfere with railroad employees performing normal trackside duties;

(d) Prevent proper functioning of signal and communication lines;

(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Subpart C - Track Geometry

§213.51 Scope.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation and speed limits on curves.

§213.53 Gage.

(a) Gage is measured between the heads of rails at right angles to the rails in a plane five-eighths of an inch (5/8") below the top of the rail head.

(b) The gage of track must not be less than 4-ft. 8-in., on either tangents or curves, regardless of the class of track.

(c) The gage of track must not be more than that prescribed in the following table:

Class of track	Maximum speed (mph) F - P	Tangent track	Curved track
1	10-15	4' 9-3/4"	4' 9-3/4"
2	25-30	4' 9-1/2"	4' 9-3/4"
3	40-60	4' 9-1/2"	4' 9-3/4"
4	60-80	4' 9-1/4"	4' 9-1/2"
5	70-90	4' 9"	4' 9-1/2"
6	70-100	4' 8-3/4"	4' 9"

§213.55 Alinement.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	Maximum speed (mph) F - P	Tangent track The deviation of the mid-offset from 62-foot line[1] may not be more than:	Curved track The deviation of the mid-ordinate from 62-foot chord[2] may not be more than:
1	10-15	5"	5"
2	25-30	3"	3"
3	40-60	1-3/4"	1-3/4"
4	60-80	1-1/2"	1-1/2"
5	70-90	3/4"	5/8"
6	70-100	1/2"	3/8"

[1] The ends of the line must be at points on the gage side of the line rail, five-eighths of an inch (5/8") below the top of the rail head. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment of track.

[2] The ends of the chord must be at points on the gage side of the outer rail, five-eighths of an inch (5/8") below the top of the rail head.

§213.57 Curves: Elevation and speed limits.

(a) The outer rail of a curve may not be lower than the inner rail, except as provided in §213.63 and through turnouts, crossovers and track crossings in elevated curved tracks.

(b) Curves shall be surfaced to not more than four inches (4") elevation, except at designated locations where special authority has been granted by the Chief Engineer M.W. for higher elevation, including the following territories:

Between:

Boston, Mass., and New York, N.Y.
(Shore Line)

New York, N.Y., and Washington, D.C.

Philadelphia, Pa., and Harrisburg, Pa.

New York, N.Y., and Albany, N.Y.

Woodlawn, N.Y., and New Rochelle, N.Y.

Mott Haven, N.Y., and Pauling, N.Y.

Where such authority for higher elevation has been granted, the elevation must not exceed a maximum of six (6) inches.

(c) The maximum allowable operating speed for each curve must not produce an underbalance in excess of one and one-half inches (1-1/2"), except in the territories listed in paragraph (b) of this section, unless special authority has been granted by the Chief Engineer M.W. for increased underbalance. Where authority for increased underbalance has been granted the amount of underbalance must not exceed three (3) inches.

(d) The following table gives maximum allowable speeds for passenger and freight trains for various degrees of curvature and various amounts of elevation. The speeds shown in this table are based on the operation of trains at one and one-half inches (1-1/2") of underbalance and must not be exceeded, except in the territories listed in paragraph (b) of this section, unless special authority has been granted by the Chief Engineer M.W.

Maximum Allowable Operating Speeds On Curves

Degree of curve	Elevation in Inches (1-1/2" Underbalance)												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Speed in Miles per Hour												
0°-10'	100												
0°-20'	80	93	100										
0°-30'	65	76	85	93	100								
0°-40'	57	65	73	80	87	93	98	100					
0°-50'	51	59	65	72	77	83	88	93	97	100			
1°-00'	46	53	60	65	71	76	80	85	89	93	96	100	
1°-15'	41	48	53	59	63	68	72	76	79	83	86	89	93
1°-30'	38	44	49	53	58	62	65	69	72	76	79	82	85
1°-45'	35	40	45	49	53	57	61	64	67	70	73	76	78
2°-00'	33	38	42	46	50	53	57	60	63	65	68	71	73
2°-15'	31	36	40	44	47	50	53	56	59	62	64	67	69
2°-30'	29	34	38	41	45	48	51	53	56	59	61	63	65
2°-45'	28	32	36	39	43	46	48	51	53	56	58	60	62
3°-00'	27	31	35	38	41	44	46	49	51	53	56	58	59
3°-15'	26	30	33	36	39	42	44	47	49	51	53	55	57
3°-30'	25	29	32	35	38	40	43	45	47	49	51	53	55
3°-45'	24	28	31	34	37	39	41	44	46	48	50	52	53
4°-00'	23	27	30	33	35	38	40	42	44	46	48	50	52
4°-30'	22	25	28	31	33	36	38	40	42	44	45	47	49
5°-00'	21	24	27	29	32	34	36	38	40	41	43	45	46
5°-30'	20	23	25	28	30	32	34	36	38	39	41	43	44
6°-00'	19	22	24	27	29	31	33	35	36	38	39	41	42
6°-30'	18	21	23	26	28	30	31	33	35	36	38	39	41
7°-00'	17	20	23	25	27	29	30	32	34	35	36	38	39
7°-30'	17	20	22	24	26	28	29	31	32	34	35	37	38
8°-00'	16	19	21	23	25	27	28	30	31	33	34	35	37
8°-30'	16	18	20	22	24	26	27	29	30	32	33	34	35
9°-00'	15	18	20	22	24	25	27	28	30	31	32	33	35
9°-30'	15	17	19	21	23	25	26	27	29	30	31	32	34
10°-00'	15	17	19	21	22	24	25	27	28	29	30	31	33
10°-30'	14	16	18	20	22	23	25	26	27	29	30	31	32
11°-00'	14	16	18	20	21	23	24	25	27	28	29	30	31
12°-00'	13	15	17	19	20	22	23	24	26	27	28	29	30

(e) Maximum allowable speeds for various degrees of curvature and various amounts of elevation for passenger trains consisting entirely of designated types of equipment are shown in the following table. This table is based on the operation of trains at three inches (3") of underbalance and may be used only where special authority has been granted by the Chief Engineer M.W., including territories listed in paragraph (b) of this section.

Maximum Allowable Operating Speeds On Curves At 3 Inches Of Underbalance

Degree of curve	Elevation in Inches (3" Underbalance)												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Speed in Miles per Hour												
0°-25'	100												
0°-30'	93	100											
0°-40'	80	87	93	98	100								
0°-50'	72	77	83	88	93	97	100						
1°-00'	65	71	76	80	85	89	93	96	100				
1°-15'	59	63	68	72	76	79	83	86	89	93	96	99	100
1°-30'	53	58	62	65	69	72	76	79	82	85	87	90	93
1°-45'	49	53	57	61	64	67	70	73	76	78	81	83	86
2°-00'	46	50	53	57	60	63	65	68	71	73	76	78	80
2°-15'	44	47	50	53	56	59	62	64	67	69	71	73	76
2°-30'	41	45	48	51	53	56	59	61	63	65	68	70	72
2°-45'	39	43	46	48	51	53	56	58	60	62	64	66	68
3°-00'	38	41	44	46	49	51	53	56	58	60	62	64	65
3°-15'	36	39	42	44	47	49	51	53	55	57	59	61	63
3°-30'	35	38	40	43	45	47	49	51	53	55	57	59	61
3°-45'	34	37	39	41	44	46	48	50	52	53	55	57	59
4°-00'	33	35	38	40	42	44	46	48	50	52	53	55	57
4°-30'	31	33	36	38	40	42	44	45	47	49	50	52	53
5°-00'	29	32	34	36	38	40	41	43	45	46	48	49	51
5°-30'	28	30	32	34	36	38	39	41	43	44	46	47	48
6°-00'	27	29	31	33	35	36	38	39	41	42	44	45	46
6°-30'	26	28	30	31	33	35	36	38	39	41	42	43	45
7°-00'	25	27	29	30	32	34	35	36	38	39	40	42	43
7°-30'	24	26	28	29	31	32	34	35	37	38	39	40	41
8°-00'	23	25	27	28	30	31	33	34	35	37	38	39	40
8°-30'	22	24	26	27	29	30	32	33	34	35	37	38	39
9°-00'	22	24	25	27	28	30	31	32	33	35	36	37	38
9°-30'	21	23	25	26	27	29	30	31	32	34	35	36	37
10°-00'	21	22	24	25	27	28	29	30	31	33	34	35	36
10°-30'	20	22	24	25	26	27	29	30	31	32	33	34	35
11°-00'	20	21	23	24	25	27	28	29	30	31	32	33	34
12°-00'	19	20	22	23	24	26	27	28	29	30	31	32	33

§213.59 Elevation of curved track; runoff.

(a) If a curve or segment of a compound curve is elevated, the full elevation must be provided between points of full curvature, throughout the curve, unless physical conditions do not permit. If the elevation does not extend throughout the curve or segment of a compound curve, the minimum elevation must be used in determining the maximum allowable operating speed.

(b) Elevation runoff must be at a uniform rate, within the limits of track surface deviation prescribed in §213.63, and it must extend at least the full length of the spiral. If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, a maximum of one (1) inch elevation may be run off on tangent track.

§213.61 Curve data for classes 4 through 6 track.

A record shall be maintained of each curve in classes 4 through 6 track. The record must contain the following information:

(a) Location;
(b) Degree of curvature;
(c) Designated elevation;
(d) Designated length of elevation runoff; and
(e) Maximum allowable operating speed.

§213.63 Track surface.

The surface of track shall be maintained within the limits prescribed in the following table:

Track Surface Condition	Class of track - Maximum speeds					
	1 F- 10 P- 15	2 F- 25 P- 30	3 F- 40 P- 60	4 F- 60 P- 80	5 F- 70 P- 90	6 F- 70 P-100
The runoff in any 31 feet of track at the end of a raise may not be more than	3-1/2"	3"	2"	1-1/2"	1"	1/2"
The deviation from uniform profile on either rail at the mid-ordinate of a 62-foot chord may not be more than	3"	2-3/4"	2-1/4"	2"	1-1/4"	1/2"
Deviation from designated elevation on spirals may not be more than	1-3/4"	1-1/2"	1-1/4"	1"	3/4"	1/2"
Variation in cross level on spirals in any 31 feet may not be more than	2"	1-3/4"	1-1/4"	1"	3/4"	1/2"
Uniform deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than	3"	2"	1-3/4"	1-1/4"	1"	1/2"
The difference in cross level between any two points less than 62-feet apart on tangents and curves between spirals amy not be more than	3"	2"	1-3/4"	1-1/4"	1"	5/8"

Subpart D - Track Structure

§213.101 Scope.

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical condition of rails.

§213.103 Ballast; general.

Unless it is otherwise structurally supported, all track must be supported by material which will:

(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

(b) Provide restraint for the track in lateral, longitudinal and vertical directions;

(c) Provide drainage for the track structure; and

(d) Facilitate maintenance of track cross level, surface, and alinement.

§213.105 Ballast; disturbed track.

If track is raised or otherwise disturbed so as to lift the ties off of the tie beds, the track must be inspected by a person designated under §213.7(a) or (b), before a train is allowed to pass over that track, so that it is known to be in safe condition for the speed permitted.

§213.109 Crossties.

(a) Crossties may be made of any material to which rails can be securely fastened. The material must be capable of holding the rails to proper gage, and of transmitting train wheel loads from the rails to the ballast and roadbed.

(b) A timber crosstie is considered to be defective when it is:

(1) Broken through between the field ends of tie plates, or at any point if tie plates are not used;

(2) Split or otherwise impaired to the extent it will not hold spikes, or will allow the ballast to work through;

(3) So deteriorated that the tie plate or base of rail can move laterally more than one-half inch (1/2") relative to the crosstie;

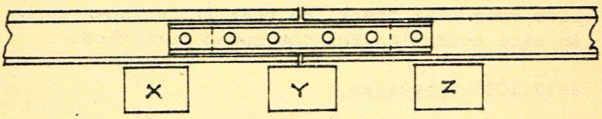
(4) Cut by the tie plate through more than 40 percent of its thickness; or

(5) Not spiked as required by §213.127.

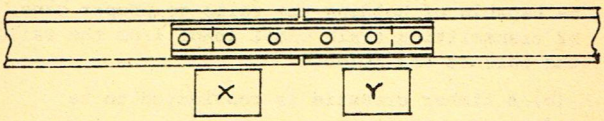
(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties, as set forth in the following table:

Class of track	Maximum allowable speed (mph) F - P	Minimum number of nondefective ties per 39 feet of track	Maximum distance between nondefective ties (center to center)	Maximum number of successive defective ties (normal spacing)
1	10-15	5	100"	3
2	25-30	8	70"	2
3	40-60	8	70"	2
4	60-80	12	48"	1
5	70-90	12	48"	1
6	70-100	14	48"	1

(d) If timber ties are used, the minimum number of nondefective ties under a rail joint and their relative positions under the joint are described in the following chart. The letters in the chart correspond to letters underneath the ties for each type of joint shown.



Supported Joint



Suspended Joint

Class of track	Maximum allowable speed (mph) F - P	Minimum number of nondefective ties under a joint	Required position of nondefective ties	
			Supported joint	Suspended joint
1	10-15	1	X, Y, or Z	X or Y
2	25-30	1	Y	X or Y
3	40-60	1	Y	X or Y
4	60-80	2	X&Y or Y&Z	X and Y
5	70-90	2	X&Y or Y&Z	X and Y
6	70-100	2	X&Y or Y&Z	X and Y

(e) Except in an emergency or for a temporary installation of not more than 6 months duration, crossties may not be interlaced to take the place of switch ties.

§213.113 Defective rails.

(a) When it is known by track supervision, through inspection or otherwise, that a rail in a track contains any of the defects listed in the following table, a person designated under §213.7 (a) or (b) shall determine whether or not the track may remain in service. Operation over that rail is not permitted until:

(1) The defective rail is replaced; or

(2) The remedial action prescribed in the table is initiated:

Defect	Defect size	Remedial action	
	Percent of rail head cross section From To	If defective rail is not replaced take the following remedial action	Max. speed (mph)
Detected transverse defect[2] in non-control cooled rail	0 - 19	Limit speed to	10
	20 - 99	Limit speed to	10
Transverse fissure[3] Compound fissure[3]	100 & Over	Visually supervise[1] each operation over defective rail	--
Detected transverse defect[2] in control cooled rail Detail fracture Engine burn fracture Defective weld	0 - 19	Apply joint bars[4] to defect within 20 days. Until joint bars are applied limit speed to	30
		After applying bars limit speed to	50
	20 - 99	Apply joint bars[4] to defect within 10 days. Until joint bars are applied limit speed to	10
		After applying bars limit speed to	50
	100 & Over	Apply joint bars[5] to defect. Until bars are applied visually supervise[1] each operation over defective rail	--
		After applying bars limit speed to	50

Defect	Defect size: Length in inches — More than	Defect size: Length in inches — Not over	Remedial action: If defective rail is not replaced take the following remedial action	Remedial action: Max. speed (mph)
Horizontal split head; Vertical split head	0	2	Limit speed to ..... and inspect rail in 90 days.	50
	2	4	Limit speed to ..... and inspect rail in 30 days.	30
	4	---	Limit speed to	10
	(Break out in rail head)		Visually supervise[1] each operation over defective rail	--
Split web; Piped rail; Head web separation	0	1/2	Limit speed to ..... and inspect rail in 90 days.	50
	1/2	3	Limit speed to ..... and inspect rail in 30 days.	30
	3	---	Limit speed to	10
	(Break out in rail head)		Visually supervise[1] each operation over defective rail	--
Bolt hole crack	0	1/2	Limit speed to ..... and inspect rail in 90 days.	50
	1/2	1-1/2	Limit speed to ..... and inspect rail in 30 days.	30
	1-1/2	---	Limit speed to	10
	(Break out in rail head)		Visually supervise[1] each operation over defective rail	--
Broken base	0	6	Apply joint bars[5] to defect, and limit speed to	30
	6	---	Replace rail	--
Ordinary break	.....	.....	Apply joint bars[5] to break. Until bars are applied visually supervise[1] each operation over broken rail	--
			After applying bars limit speed to	50
Damaged rail	.....	.....	Apply joint bars[4] to defect within 20 days. Until joint bars are applied limit speed to	30
			After applying bars limit speed to	50

Notes:

[1] - By person designated under §213.7 (a) or (b).

[2] - Includes detected crosswise defects which cannot be verified until after rail is removed from track and the fracture faces examined.

[3] - Can only be identified by examination of the fracture faces after rail is removed from track.

[4] - With rail not drilled at middle bolt hole locations.

[5] - With at least two (2) bolts on each side of defect, except in class 1 conventional jointed track, where one (1) bolt on each side of defect is required. Where 6-hole joint bars are used, rail must not be drilled at middle bolt hole locations.

(b) If a rail in classes 3 through 6 track, or class 2 track on which passenger trains operate, evidences any of the conditions listed in the following table, the remedial action prescribed in the table must be taken:

Condition	Remedial action	
	If a person designated under §213.7 determines that condition requires rail to be replaced	If a person designated under §213.7 determines that condition does not require rail to be replaced
Shelly spots Head checks Engine burn (but not fracture) Mill defect	Limit speed to 20 m.p.h., and schedule rail for replacement.	Inspect rail for internal defects at intervals of not more than every 12 months.
Flaking Slivered Corrugated (wavy) Corroded	Limit speed to 20 m.p.h., and schedule rail for replacement.	Inspect rail at intervals of not more than every 6 months.

(c) As used in this section:

(1) "Transverse Fissure" means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

(2) "Compound Fissure" means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

(3) "Horizontal Split Head" means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch (1/4") or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.

(4) "Vertical Split Head" means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.

(5) "Split Web" means a lengthwise crack along the side of the web and extending into or through it.

(6) "Piped Rail" means a vertical split in a rail, usually in the web, due to failure of the sides of the shrinkage cavity in the ingot to unite in rolling.

(7) "Broken Base" means any break in the base of a rail.

(8) "Detail Fracture" means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.

(9) "Engine Burn Fracture" means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissure with which they should not be confused or classified.

(10) "Ordinary Break" means a partial or complete break in which there is no sign of fissure, and in which none of the other defects described in this paragraph are found.

(11) "Damaged Rail" means any rail broken or made unfit for track by abuse or accidents such as wrecks, derailments, broken or flat wheels, or similar causes.

(12) "Shelly Spots" means a condition where a thin (usually three-eighths inch (3/8") in depth or less) shell-like piece of surface metal becomes separated from the parent metal in the rail head, generally at the gage corner. It may be evidenced by a black spot appearing on the rail head over the zone of separation or a piece of metal breaking out completely, leaving a shallow cavity in the rail head. In the case of a small shell there may be no surface evidence, the existence of the shell being apparent only after the rail is broken or sectioned.

(13) "Head Checks" mean hair line cracks which appear in the gage corner of the rail head, at any angle with the length of the rail. When not readily visible the presence of the checks may often be detected by the raspy feeling of their sharp edges.

(14) "Flaking" means small shallow flakes of surface metal generally not more than one-quarter inch (1/4") in length or width break out of the gage corner of the rail head.

(15) "Transverse Defect" means a progressive fracture in the head of a rail which has a transverse separation. This classification is used when internal or cracked-out crosswise defects are found which can only be identified by field or laboratory examination after the rail is removed from track. Detected or unidentified transverse fissures, compound fissures, and detail fractures from shelling are included in this classification.

(16) "Head-Web Separation" means a progressive fracture, longitudinally separating the head from the web of the rail in the head fillet area, and extending into or through the web.

§213.115 Rail end mismatch.

Any mismatch of rails at joints may not be more than that prescribed in the following table:

Class of track	Maximum allowable speed (mph) F - P	Mismatch of rails at joints may not be more than:	
		On the tread of the rail ends (inch)	On the gage side of the rail ends (inch)
1	10-15	1/4	1/4
2	25-30	1/4	3/16
3	40-60	3/16	3/16
4	60-80	1/8	1/8
5	70-90	1/8	1/8
6	70-100	1/8	1/8

§213.117 Rail end batter.

(a) Rail end batter is the depth of depression at one-half inch (1/2") from the end of the rail. It is measured by placing an 18-inch straightedge on the tread of the rail end, without bridging the joint, and measuring the distance between the bottom of the straightedge and the top of the rail end.

(b) Rail end batter may not be more than that prescribed by the following table:

Class of track	Maximum allowable speed (mph) F - P	Rail end batter may not be more than: (inch)
1	10-15	1/2
2	25-30	3/8
3	40-60	3/8
4	60-80	1/4
5	70-90	1/8
6	70-100	1/8

§213.119 Continuous welded rail (CWR).

(a) Continuous welded rail is designated by the initials "CWR" in these instructions. Track laid with CWR is referred to as "CWR track".

(b) When being laid, CWR must be installed at, or adjusted for, a rail temperature of 85 degrees Fahrenheit (85°F.) or higher.

(c) After CWR has been installed, it should not be raised or otherwise disturbed at rail temperatures higher than its installation or adjusted installation rail temperature, except as provided in §213.120.

§213.120 Maintaining CWR track.

(a) Where CWR track is to be worked by operations such as those described in paragraphs (a)(1) and (a)(2) of this section, the work must be performed when the rail temperature is equal to, or lower than, the installation or latest adjusted rail temperature:

(1) All out-of-face track raising, heavy tie renewals (with or without raising), extensive lining, or disturbing the ballast section;

(2) Selective operations such as smoothing and/or lining, where more than five (5) consecutive ties are loosened from their tie beds, or where more than five (5) consecutive or intermittent ties are loosened from their tie beds in any 39-foot length of track.

(b) The following kinds of maintenance operations do not constitute disturbing the track structure for the purposes of these instructions:

(1) Cleaning ballast in the ballast shoulders or in the intertrack spaces, using Speno, Brownhoist, or comparable types of ballast cleaning equipment, provided that a full ballast section is restored immediately behind the ballast cleaning operation.

(2) Spot tie renewals where there are at least four (4) adjacent ties on each side of the tie to be replaced that are properly spiked and tamped, with rail anchors in prescribed positions, and the tie cribs and shoulders properly filled with ballast. The new ties must be promptly tamped, and the ballast properly dressed.

(3) Smoothing (spot surfacing) and lining where not more than five (5) consecutive ties are lifted from their tie beds, and not more than five (5) ties are lifted in any 39-foot length of track.

(c) Before disturbing CWR track, as described in paragraph (a) of this section, the rail temperature at the time of installation, or latest adjustment, must be compared with the currently measured rail temperature, as follows:

(1) The records kept by the Supervisor of Track shall first be checked by the Supervisor, or his delegated representative, to determine the rail temperature at the time when the rail was laid, or the most recent adjusted temperature;

(2) The Supervisor of Track, or his delegated representative, shall then measure the actual rail temperature, using a standard rail thermometer placed on the base of the rail and sheltered from the direct rays of the sun.

(3) The actual rail temperature, just measured, shall be compared with the rail temperature in the record to determine whether or not the CWR track may be worked without making further temperature adjustments to the rail.

(d) If the measured actual rail temperature is found to be no higher than the installation or the latest adjusted rail temperature of record, work as described in paragraph (a) of this section may be progressed observing the following requirements:

(1) When raising CWR track, the height of raise should be kept to the minimum necessary to obtain a good surface, but should not exceed a general raise of 1-1/2 inches, unless protected by a slow order. If a higher raise is needed to meet a required profile, additional raises should be made with enough elapsed time between raises for the track to become sufficiently settled by the passage of trains to assure stability at normal speed, or the speed permitted under the slow order;

(2) Both rails should be raised simultaneously in CWR track, and the cross level maintained at all times. Raising track without immediately and fully tamping all ties should be avoided;

(3) When renewing ties, not more than three (3) successive ties nor more than eight (8) ties per 39-foot length of track are to be renewed in any one (1) pass. If more ties than the above need to be renewed, additional passes must be made with a minimum of one (1) day's traffic over the track after each pass, and speed restricted to 30 m.p.h., until the track has been surfaced. The first train to pass over the track after surfacing shall be restricted to 30 m.p.h;

(4) Before track is returned to normal service, all ties installed shall be rail spiked, tamped, rail anchors reapplied, and standard ballast section restored.

(5) At least the first train, allowed to operate over newly worked track, must be restricted to 30 m.p.h. Track is to be reinspected and, if satisfactory, full speed may then be restored. If there is any doubt concerning the condition of the track for normal speed, the 30 m.p.h. slow order must remain in effect until a sufficient amount of tonnage has passed over the track to settle it properly.

(6) In order to prevent heavy braking action by trains on newly worked track, the 30 m.p.h. slow order will include all track worked that day and in addition all track worked on the previous day.

(e) If measured rail temperature is higher than installation or latest adjusted rail temperature, CWR may be adjusted before or during maintenance operations, using the following procedures:

(1) Remove buffer rails or disconnect and line the ends of CWR strings out of the tie plates to clear adjoining rail ends;

(2) Remove all rail anchors between disconnected ends;

(3) After the track has been raised, tamped and lined, rail closures should be made, adjusting the length of buffer rails or CWR as needed;

(4) All rail anchors must be reapplied in accordance with paragraph (g) of this section before the track is returned to service;

(5) In the event work is performed through only part of a CWR string, the entire string is to be freed, and the unworked portion of the string is to be loosened in its tie plates by operating a heavy self propelled unit of M.W. equipment over the unworked portion, or tapping the tie plates with a hammer before making closure and anchoring;

(6) The rail temperature of each CWR string that is adjusted is to be measured and recorded, using a standard rail thermometer. The thermometer should be laid on the base of the rail, shielded from the direct rays of the sun and left there long enough to determine the rail temperature accurately. This will be the new rail temperature of record.

(f) A full ballast section, as shown on Standard Plan 70003-( ), shall be provided and maintained. Where necessary, a sufficient amount of new ballast should be distributed on the track, in advance of raising, to permit ballast regulating equipment to dress the ballast to a proper cross section before the track is placed in service.

(g) CWR is to be anchored in both directions by box anchoring ties, as follows:

(1) Every tie (full boxing):

For 200 feet at each bolted end of CWR strings;

For 200 feet adjacent to each side of track crossings;

For 200 feet adjacent to each end of open floor bridges;

For 200 feet adjacent to each side of public and private road crossings;

Through turnouts laid with CWR to the extent practicable, and for 200 feet adjacent to switch ties at each end of turnouts through which CWR extends;

Through CWR strings less than 400 feet in length and all buffer rails.

(2) Every other tie:

Through the remainder of each CWR string where full boxing is not specified above;

Across open floor decks on timber and steel structures where blocking has been placed between bridge ties.

(3) Omit rail anchors entirely:

In the vehicular roadway area of paved or panelled public and private road crossings.

(h) If train operation necessitates that CWR track be worked in a manner contrary to the provisions above, the track shall be protected by a 10 m.p.h. slow order until these provisions have been complied with.

§213.121 Rail joints.

(a) Each rail joint, insulated joint, and compromise joint must be of the proper design and dimensions for the rail on which it is applied.

(b) If a joint bar on classes 3 through 6 track is cracked, broken, or because of wear allows vertical movement of either rail when all bolts are tight, it must be replaced.

(c) If a joint bar is cracked or broken between the middle two bolt holes, it must be replaced.

(d) If, between the middle two bolt holes, both joint bars are found to be cracked or one joint bar is found to be broken entirely through, the track must be protected by an appropriate speed restriction until defective bars are replaced.

(e) If both joint bars are found to be broken entirely through between the middle two bolt holes, trains may be operated only under the visual supervision of a person designated under §213.7 (a) or (b).

(f) In conventional jointed track, each rail must be bolted with at least two (2) bolts at each joint in classes 2 through 6 track, and at least one (1) bolt in class 1 track.

(g) In CWR track, each rail must be bolted with at least two (2) bolts at each bolted joint used to connect CWR strings, or CWR to conventional rail.

(h) Each joint bar must be held in position by track bolts, or fasteners, tightened sufficiently to provide firm support for abutting rail ends, and to allow longitudinal movement of rails in the joint to accommodate expansion and contraction due to temperature variations. When out-of-face, no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations are considered to be CWR track, and must meet all the requirements for CWR track in this part.

(i) Where either of the following conditions is found to exist, the track must be protected by an appropriate speed restriction until the condition is corrected:

(1) Less than two (2) bolts in a joint.

(2) One (1) rail end unbolted.

(j) No rail or joint bar having a torch cut or burned bolt hole may be used in track. When new holes are necessary, they must be drilled and not punched, slotted, or burned with a torch.

§213.123 Tie plates.

(a) There must be tie plates on at least eight (8) of any ten (10) consecutive ties, where timber crossties are used in classes 3 through 6 track.

(b) Tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail.

§213.125 Rail anchoring.

(a) Longitudinal rail movement must be effectively controlled. No reduction in the number of anchors in track may be made without approval of the Chief Engineer M.W.

(b) Anchors must be applied at both ends, and on the same side of the tie.

(c) Rail anchoring of CWR must comply with the requirements of §213.120(g) of this part. Anchors previously applied to CWR in accordance with former standards need not be changed until the track is worked out-of-face.

§213.127 Track spikes.

(a) When cut steel track spikes are used in track constructed with wood crossties, each rail, unless otherwise ordered by the Chief Engineer M.W., shall be fastened to every tie by the following number of spikes:

Tracks	Rail holding spikes	Plate holding spikes
(1) 5,000,000. or less gross tons of traffic per year:		
Tangents and curves under 1 degree	2	0
Curves 1 degree and over ..	2	1
(2) Over 5,000,000. gross tons of traffic per year:		
Tangents and curves under 1 degree	2	1
Curves 1 degree and over ..	2	2

(b) The location of spikes shall be in accordance with Plan 72051-A.

(c) A tie that does not meet the requirements of paragraph (a)(1) of this section is considered to be a defective tie for the purposes of §213.109(b).

(d) Track is not considered satisfactory for passage of trains at normal speed if, with rail-holding spikes in place for both rails in all other ties, spikes for either or both rails are removed from more than every third (3rd) tie on tangent track and curves up to 5 degrees, or from more than every fifth (5th) tie on curves over 5 degrees.

§213.129 Track shims.

(a) If track does not meet the geometric limits in Subpart C of this part, and the working of ballast is not possible due to weather or other natural conditions, track shims may be installed to correct the deficiencies.

(b) If shims are used, they must be removed, the track resurfaced, and the ties tamped to a solid bearing as soon as weather or other natural conditions permit.

(c) When shims are used, they must be inserted directly on top of the tie, beneath the rail and tie plate.

(d) Tie plates must not be removed from the ties as a means of adjusting the surface or cross level of track.

(e) Track shims must be at least the size of the tie plate, and be spiked directly to the tie with spikes which penetrate the tie at least 4 inches.

(f) Shims not exceeding one (1) inch in thickness, in accordance with Plan 66532-A, may be used with standard 6-inch track spikes. Special 8-inch track spikes shall be used where shims thicker than one (1) inch have been authorized by the Chief Engineer-M.W. Shims must be securely attached to ties with 10d or 20d nails depending on the thickness of the shim.

(g) When a rail is shimmed more than 1-1/2 inches, it must be securely braced on at least every third (3rd) tie for the full length of the shimming.

(h) When a rail is shimmed more than 2 inches, a combination of shims and 2-inch or 4-inch planks, as the case may be, must be used with the shims on top of the planks, except as provided in §213.131(b).

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

§213.131 Planks used in shimming.

(a) Planks used in shimming must be at least as wide as the tie plates, but in no case less than 5-1/2 inches wide. Whenever possible they must extend the full length of the tie. If a plank is shorter than the tie, it must be at least 3 feet long and its outer end must be flush with the end of the tie.

(b) When planks are used in shimming on uneven ties, or if the two rails being shimmed heave unevenly, additional shims may be placed between the ties and planks under the rails to compensate for the unevenness.

(c) Planks must be nailed to the ties with at least four (4) 8-inch wire spikes. Before spiking the rails or shim braces, planks must be bored with 5/8 inch diameter holes.

§213.133 Turnouts and track crossings.

(a) The fastenings in turnouts and track crossings must be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail must be kept free of obstructions that may interfere with the passage of wheels.

(b) Tracks must be equipped with rail anchors through turnouts and crossovers, and on each side of track crossings, switches, frogs and guard rails, to restrain movement of rail affecting the position of switch points and frogs.

(c) Each flangeway at turnouts and track crossings must be at least 1-1/2 inches wide.

§213.135 Switches.

(a) Each stock rail must be securely seated in switch plates, but care must be used to avoid canting the rail by overtightening the rail braces.

(b) Each switch point must fit its stock rail properly, with the switch stand in either of its closed positions to allow wheels to pass the switch point. Lateral and vertical movement of a stock rail in the switch plates or of a switch plate on a tie must not adversely affect the fit of the switch point to the stock rail. Immediate protection and prompt corrective action are necessary when a switch point is found to stand open more than 3/16 inch.

(c) Each switch must be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.

(d) The heel of each switch rail must be secure and the bolts in each heel must be kept tight.

(e) Each switch stand and connecting rod must be securely fastened and operable without excessive lost motion.

(f) Each throw lever must be maintained so that it cannot be operated with the lock or keeper in place.

(g) Each switch position indicator must be clearly visible at all times.

(h) Unusually chipped or worn switch points must be repaired or replaced. Metal flow must be removed to insure proper closure. Immediate protection and prompt corrective action are necessary when a switch point is found to have an unprotected flat vertical surface 5/16 inch or more in width at a depth of 3/4 inch below the top of the stock rail.

§213.137 Frogs.

(a) The flangeway depth, measured from a plane across the wheel-bearing area of a frog, in class 1 track may not be less than 1-3/8 inches, or less than 1-1/2 inches in classes 2 through 6 track.

(b) If a frog point is chipped, broken, or worn more than five-eighths (5/8) inch down and 6 inches back, operating speed over that frog may not be more than 10 miles per hour.

(c) If the tread portion of a frog casting is worn down more than three-eighths inch (3/8") below the original contour, operating speed over that frog may not be more than 10 miles per hour.

§213.139 Spring rail frogs.

(a) The outer edge of a wheel tread may not contact the gage side of a spring wing rail.

(b) The toe of each wing rail must be solidly tamped and fully and tightly bolted.

(c) Each frog with a bolt hole defect or head-web separation must be replaced.

(d) Each spring must have sufficient compression to hold the wing rail against the point rail.

(e) The clearance between the hold-down housing and the horn may not be more than one-eighth (1/8) of an inch.

§213.141 Self-guarded frogs.

(a) The raised guard on a self-guarded frog may not be worn more than three-eighths (3/8) of an inch.

(b) If repairs are made to a self-guarded frog without removing it from service, the guarding face must be restored before rebuilding the point.

§213.143 Frog guard rails and guard faces; gage.

(a) Frog guard rail gage is the distance from the wheel flange face of guard rail to the gage line of frog point, measured at right angles to the gage line. Frog guard rail gage must not be less than that prescribed in the following table:

Class of track	Maximum allowable speed (mph) F - P	Frog guard rail gage - minimum	
		One piece manganese and hook-flange type of braced design	Tee guard rails and hook-flange type of unbraced design
1	10-15	4' 6-1/4"	4' 6-3/8"
2	25-30	4' 6-1/4"	4' 6-3/8"
3	40-60	4' 6-3/8"	4' 6-3/8"
4	60-80	4' 6-3/8"	4' 6-3/8"
5	70-90	4' 6-1/2"	4' 6-1/2"
6	70-100	4' 6-1/2"	4' 6-1/2"

(b) The guard rail distance (back to back) between the wheel flange face of the guard rail and the wheel flange face of the frog wing rail must not be more than 4' 5" regardless of the class of track.

Subpart E
Track Appliances and Track-Related Devices

§213.201 Scope.

This subpart prescribes minimum requirements for certain track appliances and track-related devices.

§213.205 Derails.

(a) Each derail must be clearly visible. When in a locked position a derail must be free of any lost motion which would allow it to be operated without removing the lock.

(b) When the lever of a remotely controlled derail is operated and latched it must actuate the derail.

§213.207 Switch heaters.

The operation of a switch heater must not interfere with the proper operation of the switch or otherwise jeopardize the safety of railroad equipment.

Subpart F - Inspection

§213.231 Scope.

This subpart specifies the frequency and manner of inspecting track to detect deviations from the limits and requirements prescribed in this part.

§213.233 Track inspections.

(a) All track must be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under §213.7.

(b) Each inspection must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. Mechanical or electrical inspection devices may be used to supplement visual inspection when authorized by the Chief Engineer M.W., who will obtain the approval of the Federal Railroad Administrator, if necessary. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings, highway crossings or turnouts.

(c) Each track inspection must be made in accordance with the following schedule:

Class of track	Type of track	Required frequency
1,2,3	Main track and sidings	Weekly with at least 3 calendar days interval between inspections; or before use, if the track is used less than once a week; or twice weekly with at least 1 calendar day interval between inspections, if the track carries passenger trains or carried more than 10 million gross tons of traffic during the preceding calendar year.
1,2,3	Other than main tracks and sidings	Monthly with at least 20 calendar days between inspections.
4,5,6	.....	Twice weekly with at least 1 calendar day interval between inspections.

(d) If the person making the inspection finds a deviation from the limits or requirements of this part, he shall immediately initiate remedial action, correcting the condition if within his capability and notifying his supervisor.

§213.235 Switch and track crossing inspections.

(a) Each switch and track crossing must be inspected on foot at least monthly, except as provided in paragraph (b) of this section.

(b) In the case of track that is used less than once a month, each switch and track crossing must be inspected on foot before it is used.

§213.237 Inspection of rail.

(a) A continuous search for internal rail defects must be made of all CWR and jointed rails at least once a year in classes 4 through 6 track, and in class 3 track over which passenger trains operate, in addition to the track inspections required by §213.233, except as provided in paragraph (b) of this section.

(b) If new rail is inductively or ultrasonically inspected over its entire length, before installing or within six (6) months after it is laid in track, and all defects are removed, the next continuous search for internal defects need not be made until three (3) years after that inspection, unless otherwise instructed by the Chief Engineer M.W.

(c) Inspection equipment must be capable of detecting defects in the area enclosed by joint bars, as well as in the body of the rail between joints.

(d) Each detected defective rail must be marked with a highly visible marking on both sides of the web and base.

§213.239 Special inspections.

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection must be made of the track involved as soon as possible after the occurrence.

§213.241 Inspection records.

(a) A record must be kept of each inspection over a track made in compliance with the requirements of this subpart.

(b) Each person making a track inspection under §213.233 and/or a switch and track crossing inspection under §213.235 shall prepare, date and sign a record of that inspection on the same day on which the inspection is made.

(c) The record must specify the track designation, and points between which each track was inspected. It must show the location and the nature of any observed deviation from the limits or requirements of this part, and the remedial action taken or recommended by the person making the inspection.

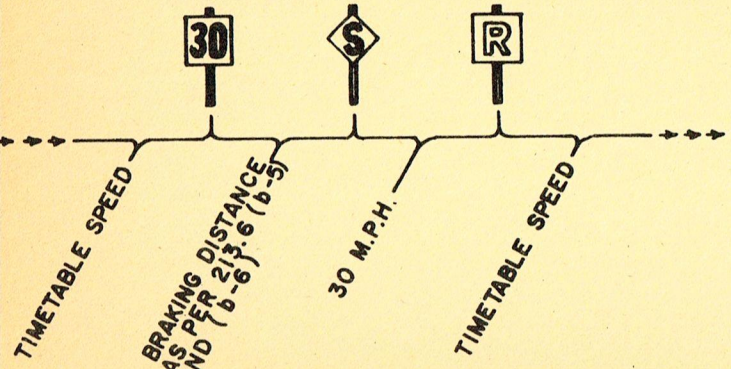
(d) Records of inspections made in compliance with §213.233 and §213.235 shall be retained at the headquarters of the Division Engineer for at least one (1) year from the date of each inspection.

(e) Rail inspection records must specify the date of inspection, and the location and nature of any internal defects found. The record shall also show the remedial action, and the date such action was taken.

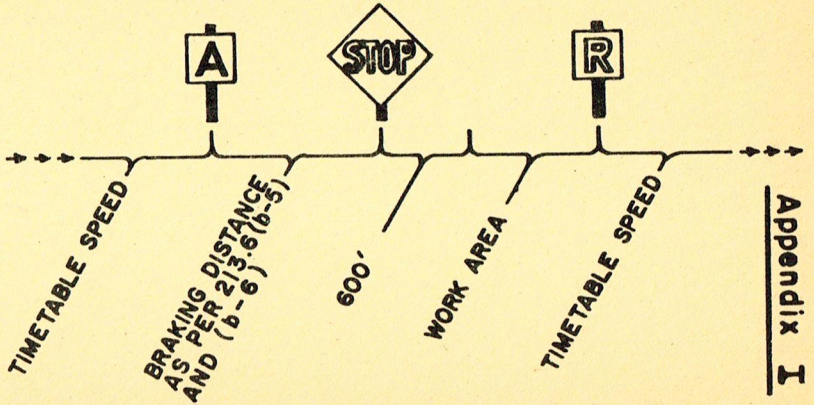
(f) Records of rail inspections shall be retained at designated headquarters for at least two (2) years after the inspection, and for at least one (1) year after remedial action is taken.

(g) Records of inspections required under this section must be made available for inspection and copying by the Federal Railroad Administrator.

PLACEMENT OF TEMPORARY SPEED SIGNS



PLACEMENT OF STOP SIGN



M.W.4
Appendix I

Signs to be placed facing traffic at right angle to, and to the right of, and adjacent to the track to be protected.

C.E.M.W. 1-21-74

PENN CENTRAL
TRANSPORTATION COMPANY

MANUAL

FOR CONSTRUCTION

AND MAINTENANCE OF

TRACK

M.W. 4

PART II

CONSTRUCTION AND
MAINTENANCE PRACTICE

OCTOBER 1, 1975

Contents Of Part II

Section

Subpart A - General

Subpart B - Roadbed and Right of Way

Subpart C - Track Geometry

Subpart D - Track Structure

Subpart E - Mechanisms, Appliances and Devices.

Subpart A - General

§1.0 Scope of part.

(a) Part II supplements Part I and provides economical standards for the construction and maintenance of track. It is for the guidance of Division Engineers, Supervisors-Track, Engineer Corps, Inspectors, Foremen-Track, other Maintenance of Way forces, contractors and others building or repairing track. Any portions of this part may be included in a contract and carry the same force as specifications, when so used.

(b) It is not the intent of this part to establish arbitrary procedures or values, but to serve as a guide which must be considered in the light of experience and the requirements of the service.

Subpart B - Roadbed and Right of Way

§33.0 Drainage.

(a) Drainage is of prime importance for economica. maintenance of track. Water mixing with materials of the roadbed tends to make the entire track structure unstable in varying degrees depending on the kind of material and the quantity and flow of water.

(b) Water seeping or flowing toward the track should be conducted across the roadbed or be intercepted and diverted before it reaches the roadbed.

(c) Water falling upon the roadbed should be quickly drained.

(d) Adequate cross drains should be maintained, particularly where bridges, road crossings, and sags interfere with longitudinal drainage.

(e) Maintenance of drainage systems must satisfy the requirements of §213.33.

§35.0 Cross section.

Roadbeds, embankments and excavations should be constructed in accordance with standard cross sections and thereafter so maintained. Deviation from approved cross sections should not be made without authorization by the Chief Engineer M.W.

§37.0 Vegetation.

(a) Growth of vegetation should be encouraged on slopes of embankments, cuts and deep ditches to prevent erosion.

(b) Vegetation growth must be controlled in accordance with the requirements of §213.37.

§39.0 Signs and posts.

Track signs and posts must be placed and maintained in accordance with Standard Plans and special instructions. They should be maintained in their proper places and kept plumb.

§41.0 Highway grade crossings.

§41.1 Authority for protection.

In addition to signals prescribed in "Rules for Conducting Transportation," public grade crossings shall be protected according to degree of hazard, state statutes, township and municipal ordinances and public service commission regulations with the sign or device approved by the governing body.

§41.2 Forms of protection.

(a) Whistle signs in accordance with Standard Plan 78410-( ), except that in overhead electrified territory they shall be attached to a catenary pole in accordance with Plan 78411-( ).

(b) Highway crossing signs conforming to Standard Plan 78302-A.

(c) Automatic protection:

(1) Automatic flashing light signals and highway crossing signs conforming to Standard Signal Plan.

(2) Automatic crossing gates with flashing light signal assemblage and highway crossing sign conforming to Standard Signal Plan.

(3) Where track circuits for crossing protection are applied to sidings or yard tracks, the limits of the circuits on such tracks shall be indicated by a "CC" sign or by a yellow stripe approximately 10 inches wide painted on the inside and outside of the head, web and base of both rails, which must be kept clear of snow, ice, dirt and weeds, and must be repainted as often as necessary.

(d) Manual protection:

(1) Crossing gates, painted in accordance with PRR Standard Plan 78320-( ), and 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 PRR 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 are permitted. Installations shall be made in accordance with Standard Instructions.

§41.3 Maintenance.

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

(b) Crossings should be kept clean, and attention given to the following:

(1) Drainage, sloping the surface if necessary, and constructing underground drains.

(2) Surface water flowing along highway toward the railroad should be diverted before it reaches the tracks.

(3) The width of the crossing shall be sufficient to extend at least two (2) feet beyond each edge of the travelled width of the highway. The crossing surface should be supported by shoulders placed in the spaces between tracks.

(4) Highway approaches to track areas should be on smooth grades without abrupt breaks, so that low road clearance vehicles carrying large shipments, such as heavy machinery, may pass over the tracks without touching the rails or surface of crossing with their underframes.

(5) Flangeways shall be 2-1/2 inches wide and not less than 4 inches deep. They must be kept clean at all times.

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

(7) 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.

§41.4 Conduct of work.

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

§43.0 Wire lines.

§43.1 Communication and signal lines.

(a) When repairing and working on wire lines, all applicable safety rules must be strictly observed.

(b) All Maintenance of Way employees must observe the general condition of poles and wires along and across the tracks and right-of-way, and report any conditions needing correction, such as: broken wires, up-rooted trees or broken branches in the wires, or broken or leaning poles, to responsible C.& S. employee and the Supervisor-Track.

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

Subpart C - Track Geometry

§53.0 Gage.

§53.1 Standards for gage.

The standard gage for track, measured between the running rails at right angles to the alinement of the track, 5/8 inch below the top of rail, is:

(a) Tangents:

(1) 4 feet 8-1/2 inches (4 feet 8-1/4 inches is permitted in classes 4,5 and 6 track, except through straight runs of turnouts and crossovers).

(2) 4 feet 8-1/2 inches on straight runs through turnouts and crossovers in all classes of track.

(b) Curves:

(1) 4 feet 8-1/2 inches up to 13 degrees, inc.

(2) 4 feet 9 inches over 13 degrees.

(c) Turnouts and crossovers:

(1) 4 feet 8-1/2 inches on turnout runs from tangent for turnouts, Nos. 8 and higher.

(2) 4 feet 9 inches on turnout runs from tangent for turnouts less than No. 8.

(3) In accordance with paragraph (b), above, for turnout runs from curves.

(d) Gage through specially fabricated trackwork, such as movable point and slip crossings, shall be as authorized by the Chief Engineer M.W.

(e) Where existing gage conforms to standards previously in effect, and is in compliance with §213.53, change need not be made until rail is renewed or out-of-face gaging is performed.

(f) Changes in prescribed gages should be made in uniform increments of not more than 1/4 inch per 31 feet of track.

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

§53.2 Maintenance of gage.

(a) Gage shall be measured with a standard track gage or other authorized device. Track gages must be checked at frequent intervals for accuracy by the Supervisor-Track.

(b) Provided gage is uniform, the following deviations from that maintained should not be exceeded:

(1) In classes 5 and 6 track:

Tangents - Plus or minus 1/4 inch.
Curves - Plus 1/2 inch to minus 1/4 inch.

(2) In classes 1 through 4 track, where the rails are securely fastened to the ties and in correct alinement:

Tangents - Plus 1/2 inch to minus 1/4 inch.
Curves - Plus 3/4 inch to minus 1/4 inch.

§55.0 Alinement.

Alinement consists of series of straight lengths of track, referred to as tangents, connected by simple, compound or reverse curves.

§55.1 Maintenance of alinement.

(a) Outer rails of curves and field side rails on tangents should be selected as the line rails.

(b) When general alinement is to be corrected, such as the removal of long swings on tangents and the restoration of curves to circular curvature, laying out of spirals, etc., the throws should be determined from field measurements.

(1) A transit or rail mounted telescope should be used to determine the corrections required on tangents.

(2) The string line method should be used to determine the alinement of curves and to calculate the required corrections or throws.

(c) For detail corrections of irregular line, the required throws may be determined by using a line wire and indicator device, plotting a graph on curves, or with automatic lining equipment.

(d) Alinement must be maintained within the limits prescribed in §213.55.

(e) The alinement of track and elevation on curves in overhead electrified territory must not be changed until proper notice has been given to the Supervisor-Electric Traction and his approval has been received.

§55.2 String lining curves.

(a) String lining of curves is based on the following principles:

(1) The mid-ordinates of a curve are indicative of its degree of curvature.

(2) The mid-ordinates of a circular curve are equal for chords of uniform length.

(3) For practical purposes, the mid-ordinate varies directly with the degree of curvature.

(4) Where track is thrown in or out at any single station on the curve, the mid-ordinate of the curve at the station is affected by the amount of the throw and the mid-ordinates at the adjacent stations are automatically affected by one-half (1/2) of the amount, but in the opposite direction.

(b) String lining of curves is a method for determining the most advantageous alinement that can be obtained with reasonable amounts of throw.

(c) Any of the established mathematical methods, such as the "Bartlett Method" or "Bracket Method", may be used to calculate the throws of curves. All calculations should be checked to ascertain that the calculated throws will actually produce the required changes in mid-ordinates.

(d) The ARC "Curveliner" machine is an approved device for mechanically calculating the throw of curves. The operator of the "Curveliner" machine must be properly trained in its operation.

(e) Track shall be stationed for string lining on the gage side of the outer (high side) rail of the curve, with stationing marked on the web or base of the rail.

(1) Stationing shall begin at a point on tangent sufficiently far ahead to permit the measurement of any reverse curvature or "dog-leg", and continue throughout the curve to a point sufficiently far on the tangent to permit measurement of any reverse curvature on the leaving end.

(2) 31-foot stations (62-foot chords) should be used for most curves found in main tracks, in which case a mid-ordinate of one (1) inch will indicate one (1) degree of curvature. It may be desirable to use 44-foot stations for curves under 30 minutes, or to use 22-foot stations for sharp curves.

(3) The practical relationship between station and chord length, mid-ordinate and degree of curvature for various stationings is shown in the following table:

Degree of curvature	Station length	Chord length	Mid-ordinate
1°00'	15'6"	31'	1/4"
1°00'	22'	44'	1/2"
1°00'	31'	62'	1"
1°00'	44'	88'	2"

(f) Mid-ordinates should be measured to the gage side of the string in sixteenths (16ths) of an inch.

(1) String line holders or offset blocks should be used to position the string a distance of one (1) inch away from the gage line of the rail, so as to permit measurement of any reverse curvature. A typical string line holder is shown in figure 1.

(2) Mid-ordinate measurements should be taken with the string line pulled taut, not affected by the wind, and with the string line holders and the scale held horizontal and perpendicular to the gage.

(3) If a conventional rule is used to measure the mid-ordinate, the actual scale reading should be recorded and a correction made to compensate for the 1 inch offset of the string line from the rail when calculations are made, to avoid field errors. Direct compensated readings of mid-ordinates may be recorded by the use of a scale similar to that shown in figure 2.

(4) Form M.W. 94 - String Line Data - should be used to record field measurements and for making mathematical calculations. The latest calculation or record of field measurements should be retained by the Supervisor-Track for record purposes.

(g) Track center distances should be measured and recorded at least every five (5) stations in two or more track territory, and more frequently where close track centers are encountered. The distance from center line of track to any obstruction which might interfere with the lining of the curve should be measured and recorded so that limiting throws for these tight spots may be determined.

(h) The location of both ends of each elevation runoff should be noted so that the relationship between spirals and runoffs can be maintained.

§55.3 Referencing track for lining.

(a) In single track territory stakes shall be used to mark the desired alinement. Stakes may be used in "Third Rail Territory" or at other locations in multiple track territory where their use may be expedient.

(b) A "scratch" board or rod may be effectively used to mark required throws for curves on multiple tracks. These are devices for referencing existing alinement of the track to be lined to an adjacent track, which must not be disturbed until the lining operation has been completed:

(1) Scratch boards have one notched end, to be placed on the head of a rail, and have a scriber or sharpened spike on the other end for "scratch marking" ties on the adjacent track. There are usually several notches to permit use of the board on curves having different track center distances. A typical scratch board is shown in figure 3.

(2) Stations are seldom directly opposite ties in the adjacent track. Locations on the rail head where the notch is placed must be marked, so that when the track lining operation is performed the board can be placed in the same location as when the scratch marks were made.

(3) Scratches are made by placing the board with the selected notch firmly against the intertrack side of the head of one rail, preferably the line rail, at marked locations described in paragraph 2. A scratch mark is then made on the near end of a tie in the adjacent track with the sharpened spike or scriber.

(4) Tacks are driven into "scratched" ties at distances equal to the calculated required throws from scratches. Special care must be taken to set the tack in the proper direction from the scratch so that, when track is properly lined in accordance with calculated throws, the point at the scratch end of the board will be directly over the center of the tack head.

(5) After the curve is tacked, the same scratch board or rod used to scribe the marks must be left with the person assigned to supervise correction of the alinement, and used throughout that lining operation. The notch end of the board shall be placed on the intertrack side of the head of the rail selected for referencing and the track lined until the point at the scratch end of the board is directly over the center of the tack in the adjacent track.

STRING LINE HOLDER

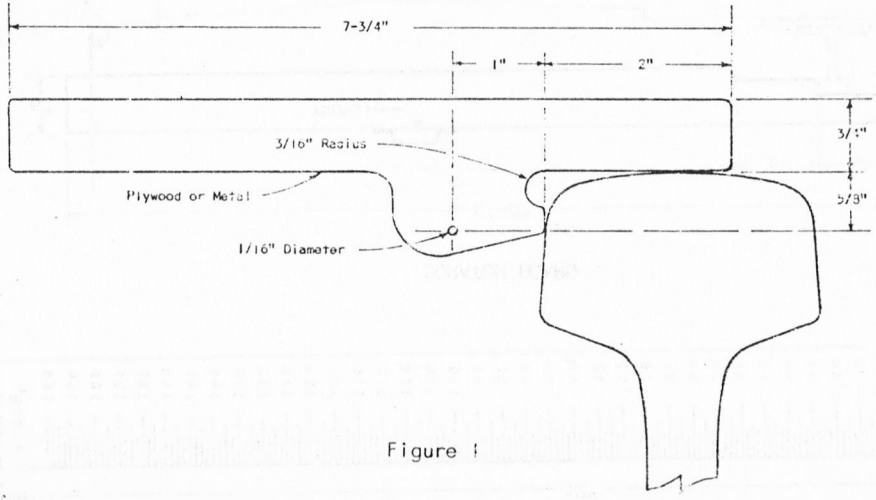
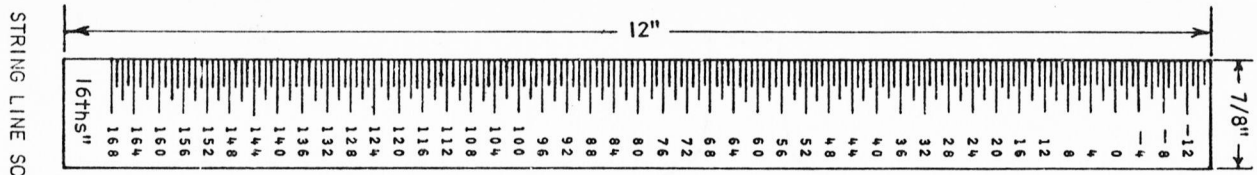


Figure 1

M.W. 4



STRING LINE SCALE

Figure 2

SCRATCH BOARD

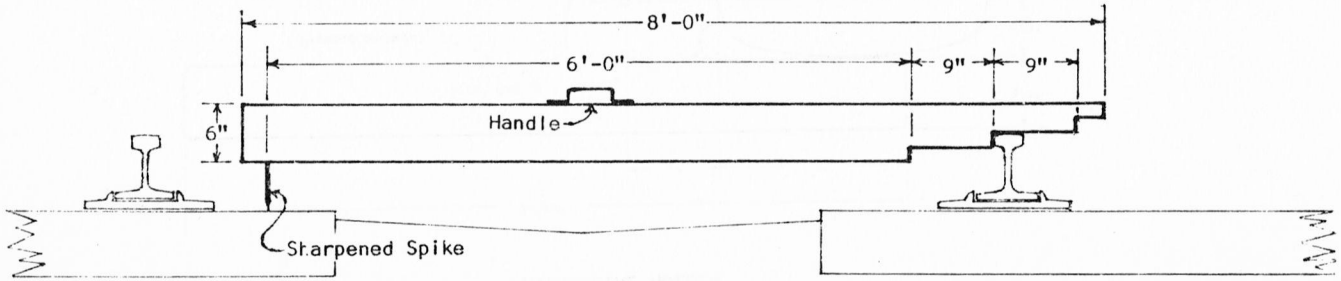


Figure 3

§57.0 Curvature, elevation and speed.

§57.1 General.

(a) Elevation, or superelevation, is the vertical distance of the outer rail of a curve above the inner rail. It is provided to overcome or partially overcome the effects of curvature and speed.

(b) Equilibrium elevation is that which exactly overcomes the effect of negotiating a curve at a given speed for any given degree of curvature, placing the resultant of the centrifugal force and weight of equipment in a direction perpendicular to the plane of the track.

(c) Underbalance is the amount that an elevation is less than equilibrium elevation for any given combination of speed and curvature.

(d) Overbalance is the amount that an elevation exceeds equilibrium elevation, and is produced by the operation of a train around a curve at less than equilibrium speed, or stopping on the curve.

(e) Authorized speed is that specified in the current employee's timetable.

§57.2 Elevation.

Division Engineers shall establish the amount of elevation to be placed and maintained on each curve, within the limits permitted, as shown in §213.57.

§59.0 Spirals and elevation runoffs.

§59.1 Spirals.

(a) Spirals shall be provided in main tracks at the ends of simple curves and segments of compound curves. Spirals should be provided in other tracks, where practicable, to facilitate curve negotiation by long cars.

(b) A spiral should be used in which the degree of curvature and the amount of elevation at any point vary directly as the distance.

(c) The length of spiral should be sufficient to accommodate the entire length of elevation runoff. If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, a maximum of one (1) inch elevation may be run off on tangent track.

(d) On light curves in classes 5 and 6 track, the length of spiral needed to accommodate the minimum elevation runoff may not be sufficient to permit a comfortable transition between equilibrium train operation on tangents and underbalanced operation on the curves. The minimum desirable length spiral for comfortable high speed train operation should be determined from either of the following formulas, and used where it is longer than the spiral needed to accommodate the minimum length elevation runoff:

(1) $L = 1.63 E_u V$ - To be used where track center distances and clearances permit.

(2) $L = 1.22 E_u V$ - To be used where physical characteristics restrict the use of the spiral determined from the formula in paragraph (1)

Where:

L = Minimum desirable length of spiral in feet.
E_u = Underbalanced elevation in inches.
V = Maximum authorized train speed in miles per hour

§59.2 Elevation runoffs.

(a) The change in elevation should be in uniform increments, and the rate of change per 31 feet of track should not be more than the following:

Maximum authorized speed	Maximum rate of change
Up to 60 mph	1/2 inch
61 to 90 mph	3/8 inch
91 to 100 mph	1/4 inch

(b) At least 100 feet of tangent track, with zero cross level, should be provided between the zero elevation points in adjacent curves of opposite direction, where practicable.

§59.3 Marking.

(a) The required amount of elevation shall be designated at uniform intervals, not greater than 31 ft. apart, on elevation runoffs at the ends of curves and between different degrees of curvature on compound curves by fastening a metal elevation marker tag, Plan 691786-A, to the top of the nearest tie, 12 inches from the high rail.

(b) Tags should be placed to be read while facing along the track excepting the tag at full elevation which shall be placed to read facing the high rail, to plainly indicate the authorized full elevation.

(c) Tags shall be stamped in inches and increments of not less than eighths of inches.

§61.0 Curve data records.

(a) Curve data records must be maintained for each curve in classes 4 through 6 track in accordance with §213.61. Such records, also, should be maintained for curves in lower class main tracks.

(b) Curve records may be maintained by using a suitable consolidated form for the track, line and territory involved, or by notations on track and program charts.

§62.0 Clearances and track centers.

§62.1 Track centers.

(a) In maintaining alinement, the existing track centers, including equivalent centers on curves, must not be reduced below the minimum established for the territory.

(b) A permanent record of track centers between main tracks, and between main and adjacent side tracks should be maintained by Division Engineers.

(c) For new construction or reconstruction, the following track centers should be used for tangents, and be increased for curves in accordance with paragraph (d), unless otherwise instructed by the Chief Engineer M.W. -

Designation of Tracks	Track Centers on Tangents
(1) Adjacent Main Tracks, including additional main tracks	14'-0"
(2) Adjacent Yard, Industrial and other Side Tracks	14'-0"
(3) Main Track and any adjacent track, other than another main track or a yard ladder track ...	17'-0"
(4) Secondary, Running, Industrial or Passing Track and any adjacent track, other than a yard ladder track	17'-0"
(5) Yard Ladder Track and adjacent track, except other yard ladder.	18'-0"
(6) Adjacent Yard Ladder Tracks	19'-0"

(d) On curves, to provide clearance between cars and locomotives equivalent to that obtained on adjacent tangents, tangent track center distances in paragraph (c) should be increased, as follows:

(1) Where the amount of elevation is the same on adjacent tracks or the elevation of the inner track is greater than that of the outer track, increase the tangent track center distance 1 inch for each 30 minutes of curvature.

(2) Where the elevation of the outer track is greater than that of the inner track, the tangent track center distance should be increased 1 inch for each 30 minutes of curvature, plus 3-1/2 inches for each 1 inch of difference in elevation of the two tracks considered.

(e) Track centers required to provide a minimum clearance of 6 inches between any combination of diesel and/or electric locomotives, passenger cars and AAR Plate "C" cars are shown in the following table:

Track Center Requirements

(Where elevation is the same on adjacent tracks.)

Distance From Center To Center Of Tracks On Curves To Provide At Least 6" Clearance Between Any Combination Of Diesel Locomotives, Electric Locomotives, AAR Plate "C" Cars And Passenger Equipment At 1-1/2" Underbalanced Speeds As Shown In Table In §213.57(d).

Degree of Curvature	Elevation of Tracks					
	1"	2"	3"	4"	5"	6"
1°	11' 10-1/8"	11' 10-1/8"	11' 10-1/8"	11' 10-1/8"	11' 10-1/2'	---
2°	11' 11-3/8"	11' 11-3/8"	11' 11-3/8"	11' 11-3/8"	12' 0"	12' 1-1/8"
3°	12' 0-1/2"	12' 0-1/2"	12' 0-1/2"	12' 0-1/2"	12' 1-5/8"	12' 2-5/8"
4°	12' 2-3/8"	12' 2-3/8"	12' 2-3/8"	12' 2-3/8"	12' 3"	12' 4-1/8"
5°	12' 3-5/8"	12' 3-5/8"	12' 3-5/8"	12' 3-5/8"	12' 4-5/8"	12' 5-7/8"
6°	12' 5-1/8"	12' 5-1/8"	12' 5-1/8"	12' 5-1/4"	12' 6-3/8"	12' 8"
7°	12' 6-1/2"	12' 6-1/2"	12' 6-1/2"	12' 7-1/8"	12' 8-1/8"	12' 9-1/8"
8°	12' 8"	12' 8"	12' 8"	12' 8-7/8"	12' 10"	12' 11-3/8"
9°	12' 9-3/8"	12' 9-3/8"	12' 9-7/8"	12' 10-3/4"	13' 0"	13' 0-3/8"
10°	12' 10-7/8"	12' 10-7/8"	12' 11-5/8"	13' 0-5/8"	13' 1-5/8"	13' 3-1/2"

(1) Where the outer track has less elevation than the inner track on a curve, the track centers shall be as required by the table for the curvature and elevation of the outer track.

(2) Where the outer track has more elevation than the inner track, the track center distance shall be as required by the table, plus 3-1/2 inches for each 1 inch of difference in elevation for the two tracks considered.

§62.2 Intertrack clearance limiting objects.

(a) For the following signals placed between the tracks, track center distances shall not be less than 25 feet:

(1) One arm position light signals, where the center of the background is less than 18 feet above top of rail.

(2) Two arm position light signals, where bottom arm other than a marker or vertical aspect is used, and the center of the bottom arm aspect is less than 18 feet above top of rail.

(3) Search light or color light signals, where the overall width of the signal is in excess of 24 inches at any point less than 18 feet above top of rail.

(b) For signals, other than those described in paragraph (a), the track center distance shall not be less than 19 feet.

(c) For signal bridge supports, pedestal signals or switch stands with intermediate or high staff, the track center distance shall not be less than 19 feet.

§62.3 Other clearance limiting objects.

For clearance limiting objects other than those described in §62.2, see Standard Plan 70051-A, "Minimum Roadway Clearances."

§63.0 Grades.

§63.1 Limitations.

No grades shall be introduced exceeding a rate of 2-1/2 percent unless authority has been obtained from the Chief Engineer M.W.

§63.2 Compensation on curves.

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

(a) At places where trains frequently stop the grade should be reduced at the rate of 0.05 percent for each degree of curvature.

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

§63.3 Vertical curves.

(a) Where changes in grade occur, gradient lines should be connected by vertical curves, observing the following provisions:

(1) The length of a vertical curve is determined by the difference in grades to be connected and the rate of change adopted.

(2) For high speed main tracks the rate of change should not be more than 0.05 foot per station of 100 feet in sags, and not more than 0.10 foot per station of 100 feet on summits.

(3) For other main line and secondary tracks the rates of change may be twice those for high speed tracks.

(4) For tracks of lesser importance the rates of change may be relatively large but not greater than practical conditions permit.

(b) On curves the low rail will be kept to established grade.

(c) Minimum radii which may be used on vertical curves of hump tracks in gravity yards are:

(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 vertical radius at the top of inclines leading to car dumpers.)

§64.0 Track surface.

§64.1 General.

(a) Track surface is the relationship of opposite rails to each other in profile and cross level. Track profile is the running surface along the top of the grade rail. Cross level is the difference in elevation of the tops of heads of opposite rails measured at right angles to the track alinement. The ideal surface is a uniform profile consisting of straight gradients connected by vertical curves, with zero cross level on tangents and predetermined cross level on curves.

(b) When constructing, reconstructing, or changing the alinement of tracks, rates of change in cross level shown in §59.2 should be used as a maximum.

(c) The profile of track being surfaced should not be raised above established grades, except under instructions from the Division Engineer, who will give consideration to the required elevations and clearances in tunnels, under catenary systems and overhead structures, and at interlocking plants, undergrade bridges, platforms and highway grade crossings.

(d) Any encroachment upon the published minimum overhead or side clearances from a track will adversely affect the movement of oversize shipments that are regularly made, and may cause unnecessary expense in restoring track to its proper grade.

§64.2 Maintenance.

(a) The following criteria will serve as a practical guide for maintaining smooth riding conditions in existing tracks:

	Speeds in Miles per Hour				
	Up to 15	16 to 50	51 to 70	71 to 100	Over 100
Run-off per 31 feet at end of raise, max.	2"	1-1/2"	3/4"	1/2"	3/8"
Change in cross level on spirals of curves in 31 feet, max.	1-1/2"	1"	3/4"	1/2"	3/8"
Change in cross level between any two points less than 62 ft. apart on curves between spirals and on tangents, max.	1-1/2"	1"	3/4"	1/2"	3/8"
Variation in elevation on curves, spirals or tangents from that designated, max.	--	3/4"	1/2"	1/2"	3/8"

(b) The basic tool for determining correct track surface is the standard track level, which should be checked by the Supervisor-Track periodically and by the Foreman-Track, or employee inspecting track, each day it is used. If found to be incorrect, it must be accurately adjusted or replaced. Other approved devices may be used for determining cross level, but their accuracy should be determined by comparison with a standard track level in correct adjustment.

(c) When surfacing or raising track, one rail, which shall be the lower rail on curves and usually the line rail on tangents, shall be selected as the grade rail. The other rail must be brought to surface by adjusting the cross level as needed.

§64.3 Special attention.

(a) Special attention must be given to the surface and line of track at the ends and approaches of bridges, crossings and platforms.

(b) When placing or tamping ties, particularly in interlocking plants, care must be taken to avoid breaking or damaging bond wires, pipes, cables or wire connections to the tracks.

(c) In overhead electrified territory, care must be exercised to avoid reducing clearance between the top of rail and contact wire at established low points, or to establish new low points. Advance notice must be given to Foreman-Electric Traction when it is necessary to raise tracks under overhead structures or low spots under the catenary system.

(d) In very hot weather, special attention must be given to creeping rail, frozen joints, skeletonized track, and at the foot of heavy grades or in sags, to avoid displacement of tracks or "sun-kinks." Joint condition must be checked before installing ties or surfacing, and frozen joints loosened to allow the rail to move.

(e) During freezing and thawing weather, attention must be given to the surface of track likely to be affected by heaving due to frost action. Surface irregularities due to frost action that cannot be corrected by usual procedure may be temporarily corrected by use of track shims. Shimming must be performed in compliance with §213.129 and §213.131.

§64.4 Raising track.

(a) When track is given a general raise, both rails should be raised simultaneously. When track jacks are used, they should be placed opposite each other, and must not be placed between the rails except when absolutely necessary, and then only under proper protection.

(b) On tracks of assigned direction, track raising should be performed against the current of traffic, except on grades of more than one (1) percent, where it may be desirable to work up grade.

(c) Before raising track in hot weather, there must be assurance that the track will not warp or buckle. Bolts should be loosened and subsequently retightened where necessary.

(d) Adequate ballast for dressing to the required ballast cross section should be distributed in advance of raising.

(e) Track which has been worked and is being returned to service will be inspected by the Supervisor in charge before releasing, and again after the passage of the first train. The first train over the new work shall be restricted to a maximum speed of 30 mph.

(f) Track should not be raised in interlockings or automatic signal territory until advance notice has been given to the Signal Maintainer or Inspector so he can adjust any switches that may be involved.

(g) When raising track laid with continuous welded rail (CWR), requirements of §213.120 must be met.

§70.0 Secondary, yard and industrial tracks, and sidings.

§70.1 General.

(a) Weight and size of cars and locomotives, and requirements for satisfactory negotiation of curves, reverse curves, crossovers, ladder tracks and side track connections by long cars must be considered in the design of all tracks, so that they will not lose their utility for the desired use, due to the increasing size of equipment.

(b) New side track designs, including alinement, grade and clearances, when in accordance with these provisions, shall be approved by the Superintendent, upon recommendation by the Division Engineer.

(c) Unconnected ends of secondary and yard tracks must be curved away from adjacent main tracks.

(d) 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.

§70.2 Turnouts.

(a) No. 10 or No. 15 turnouts should be used where heavy drawbar forces may be anticipated in order to reduce the lateral forces produced by long cars.

(b) No. 8 turnouts should be used only where cars are moved in light drafts.

(c) Turnouts having curvature greater than No. 8 shall not be used without the approval of the Chief Engineer M.W.

§70.3 Curvature.

(a) No curves shall be constructed or realined resulting in a curvature greater than that adopted for permanent use in the district where located. Every opportunity should be taken to lessen the curvature in existing track. The introduction of curvature between the heel of frog and the last long turnout tie should be avoided.

(b) In the construction of new yards and side tracks, the minimum radius of curvature shall be 459 feet (maximum curvature 12°-30') except with special approval of the Chief Engineer M.W.

§70.4 Spirals.

(a) Wherever practicable, a spiral easement of not less than 62 feet should be provided on all yard and side track curves.

(b) Between reverse curves, where spiral easements have not been provided, and between opposing adjacent turnouts of the same hand, there should be a length of tangent track equivalent to the longest car or unit operated over the track, but not less than 40 feet.

Subpart D - Track Structure

§101.0 Material.

§101.1 General.

Included in "track structure" are: Sub-ballast, Ballast, Ties, Rails, Rail Fastenings, Turnouts, Track crossings, and other associated materials.

§101.2 Handling and care.

(a) Moving materials from place to place, and caring for materials on hand is costly. For these reasons, the amount of material 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 cooperation with Material Management Department.

(b) Threaded and/or insulated materials and parts should be protected from the weather. If exposure to the weather is unavoidable, threaded materials should be coated with a protective oil.

§101.3 Classification.

Materials are considered to be in one of the following conditions:

(a) New - Unused, as manufactured or modified.

(b) Rehabilitated - Materials removed from track upon which work has been performed since removal, as:

(1) Reformed joint bars and rail anchors.

(2) Rebuilt frogs, switches and crossings.

(3) Recut switch points.

(4) Repunched tie plates.

(c) Fit - Usable (second-hand), as removed from track with no work performed upon it, as Fit rail (Relayer rail).

(d) Scrap.

§103.0 Ballast.

§103.1 General.

(a) Ballast shall conform to Penn Central Standard Specifications and may be obtained only from approved quarries.

(b) Crushed stone shall be used for ballast, except that ballast other than stone ballast may be used at locations specifically approved by the Chief Engineer M.W.

(c) The class and size of ballast to be used for the various lines and tracks shall be determined by the Chief Regional Engineer and approved by the Chief Engineer M.W.

(d) When ballast received is of inferior quality, has improper grading, or contains quantities of screenings, dirt or foreign matter, report shall be made to the Division Engineer, so that corrective action may be taken.

(e) If ballast is shipped under weight agreement, the Division Engineer should arrange for periodic checks of weight to protect against shortages or overloading of cars.

§103.2 Distribution.

(a) To the extent practicable, ballast should be unloaded in position for use with a minimum of redistribution and dressing, using special ballast cars when available.

(b) Ballast must be distributed or immediately dressed so that ample clearance is provided for rolling equipment, switches are not fouled, and guard rails are unobstructed.

§103.3 Cross section.

(a) Ballast and sub-ballast cross sections should conform to Standard Plans.

(b) A speed restriction must be placed where there is insufficient ballast to provide a stable track.

§103.4 Ballast cleaning.

When ballast in track becomes fouled, it should be mechanically cleaned or scarified to restore proper drainage.

§103.5 Size and gradation.

The nominal size of crushed stone used for ballast shall be as follows, unless otherwise authorized by the Chief Engineer M.W.

Ballast size - No. 4	1-1/2" to 3/4"

§107.0 Cross ties - wood.

§107.1 Size.

The sizes of cross ties shall be in accordance with Penn Central Specifications for Cross Ties and designated as Numbers 1, 2, 3 (6 inch) and 3A, 4, 5 (7 inch).

§107.2 Use.

(a) 7 inch ties shall be used in main tracks. 6 inch ties are suitable for light traffic tracks.

(b) The Chief Regional Engineer shall determine the sizes to be used in any specific situation requiring interpretation of these instructions.

(c) The number of ties which shall be considered as standard for each line and class of track shall be designated by the Chief Regional Engineer, in accordance with the service requirements, based on the following spacing from center to center:

Main tracks	20 inches
Other tracks	24 inches

§107.3 Installation.

(a) Ties should be placed in track with the kerf up, the wider heart wood face down and square to the line of the rail.

(b) The ends of standard 8 ft.- 6 in. ties should be brought to a uniform line 18-1/2 inches from the edge of the base of rail with the kerf on the line side as follows:

(1) On single track roads, and in tracks of unassigned direction, line the right hand ends of ties going north or west.

(2) On roads with two or more main tracks, line the right hand ends of ties going in the assigned direction of traffic.

(3) Exceptions may be made where, in the use of tie installation machinery, it is advisable to line the opposite ends or where it is desired to retain an existing line side.

(4) When necessary to use less than standard length ties, they shall be centered in the track.

(c) Ties shall be kept sufficiently spaced and square to the line of rail to permit proper tamping. When necessary, ties should be respaced as track is rehabilitated by gangs equipped with suitable machinery.

(d) In third rail territory, the distance between third rail bracket ties will govern intermediate tie spacing. Bracket ties should be installed in accordance with approved plans.

§107.4 Damage to ties.

(a) When handling or spacing ties, care shall be taken not to damage them with picks or spiking hammers. Tie tongs, lining bars, other suitable tools or tie spacing equipment shall be used.

(b) When necessary to adze treated ties, the cut surface should be immediately slushed with pentachlorophenol in oil or creosote.

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

(d) Standard tie plugs must be used to plug holes when spikes have been drawn.

§108.0 Switch ties.

For number required, size and length see appropriate standard plans.

§109.0 Bridge ties.

(a) Oak ties shall be used on all open floor bridges where the curvature is 3 degrees or more, or where the annual gross tons exceed 9,000,000. They should be used at other locations when available.

(b) Bridge ties shall be adzed, framed and sized according to framing plans prior to treatment. Suitable holes must be bored for drive spikes which fasten tie spacing bars or timbers. Where ties are bored or adzed in the field, they shall be treated with pentachlorophenol in oil or creosote.

§113.0 Rails.

§113.1 General

(a) As used in these instructions, "rails" include conventional rails as produced by steel mills for laying with bolted joints, referred to as "jointed" rails, and also rails fabricated into long strings by butt welding, referred to as "continuous welded rail" and designated by the initials "CWR".

(b) Except where laid in succession, or as buffer rails between strings of CWR, butt welded rails not more than 160 feet in length between bolted joints are considered to be jointed rails and are subject to instructions governing same. Jointed rails from 79 feet to 160 feet in length are subject to rail anchoring instructions in §125.1(g).

(c) Butt welded rails more than 160 feet in length, butt welded rails 79 feet or longer where laid in succession, and any rails laid as buffer rails between strings of CWR are subject to the specific instructions governing the use and maintenance of CWR in §119.0, as well as appropriate general rail instructions.

§113.2 Classification and identification.

(a) By mill inspection.

Rails are classified and identified in accordance with A.R.E.A. "Specifications For Steel Rails", as follows:

No. 1 - Rails.

Rails with carbon and manganese content above the mean of the specified range	Blue ends
Rails with carbon and/or manganese content at or below the mean of the specified range ..	No paint on ends
Rails less than 39 feet in length	Green ends
"A" Rails - all lengths	Yellow ends

No. 2 - Rails.

Rails of all lengths	White ends, with the figure "2" stamped on both end faces.

"X" - Rayls.

Rails of all lengths ..... (Not purchased by Penn Central)	Brown ends, with the letter "X" stamped on both end faces.

(b) By service developments.

Failed rails.

(1) Rails removed from track on account of any defects listed in §213.113(a), except end defects described in paragraph (2) below, must have the top of the rail head noticeably damaged, using a cutting torch, so that they will not be mistakenly returned to service in track, or be butt welded in fabricating strings of fit CWR.

Such failed rails, damaged as above, are to be classified for scrap in its proper category.

(2) Rails removed from track on account of end defects, such as a bolt hole crack or head-web separation where a portion of the rail end is not physically broken out, must have the top of the rail head noticeably damaged at the location of the defect, using a cutting torch to insure that a rail of this type is not returned to service in track without cropping off the defective end.

§113.3 Service assignments.

(a) New rails.

Class of rail	Use
No. 1 Blue end or No. 1 Rails	In main tracks without restriction. For stock rails or lead rails of turnouts and manufacture of frogs, switches and special trackwork.
No. 1 "A" Rails	In main tracks without restriction. For stock rails or lead rails of turnouts, but not for manufacture of frogs, switches or special trackwork.
No. 2 Rails	Same as No. 1 "A" rails.

(b) Cropped or fit rails.

(1) Rails in main track service may be relaid or fabricated into CWR strings without restriction as to their mill classification.

(2) Rails removed from track having end defects, only, such as bolt hole cracks or head-web separations within joint bar areas, from which defects have been eliminated by cropping to usable lengths, may be used without restriction.

(3) Fit rail for relaying in track should be graded according to its head wear and physical consition and classified for reuse in accordance with §113.5. Grading and marking of rail for reuse will be performed only at cropping plants.

§113.4 Disposition and shipment.

(a) Rails released from renewals and retirements must be shipped to cropping plants, unless other disposition is authorized by the Chief Engineer M.W.

(b) All rail anchors must be removed from rails before loading rails into cars.

(c) For shipment to cropping plants, rails of any weight or classification may be loaded in the same car without stripping between layers, except that medium manganese rail must be loaded separately and identified.

(d) Rails shipped for direct reuse, to points other than cropping plants, must be examined by the Supervisor-Track making the shipment to assure that the rails are suitable for the reuse intended. Such rails must be loaded in cars with wood strips between layers.

§113.5 Grading and marking rail for reuse.

(a) The suitability of rail for reuse will be determined on the basis of physical condition and head wear by designated inspectors.

(b) Rails containing recognizable flaws or damage not eliminated by cropping will be scrapped.

(c) Rails containing surface bends or kinks that are correctable by straightening at cropping plants may be reused.

(d) Vertical wear will be indicated by the number of stripes, approximately 1 inch wide, painted across the rail head. The grade of rail will be identified by the color of the stripes, indicating its suitability for relaying in track as follows:

Color of stripe and service	Vertical wear per stripe
White - Main track relayer	1/16 inch
Green - Siding and yard	1/8 inch

(e) Wear and damage criteria for various rail sections and classes of track are shown in the following table:

Rail sections (pounds per yard)	MTR	S&Y
(1) Vertical head wear.		
155, 140, 136, 133, 119	5/16"	5/8"
152, 132, 130	4/16"	4/8"
131, 127, 115, 100	3/16"	3/8"
112, 107, 105	2/16"	2/8"
(2) Horizontal wear.		
155, 152, 140, 136, 133, 132, 130	6/16"	12/16"
131, 127, 119, 115, 112, 107, 105, 100	4/16"	10/16"
(3) Web-base reduction (thickness).		
All rail sections.	1/16"	3/32"
(4) Corrugations (correctable by grinding train).		
All rail sections.	1/64"	1/16"

§113.6 Transposing rail on curves.

(a) To obtain the maximum service life of rails on curves, the high and low sides should be transposed before horizontal wear, vertical wear or flow of metal in the head makes this impractical because of undesirable rail head stresses that may be produced leading to possible failure of the rail itself.

(b) In general, high and low sides should be transposed when the horizontal wear on the high rail is between 3/8 inch and 5/8 inch, and before the metal in the low rail flows excessively.

(c) High side rails may be turned when horizontal wear does not exceed 1/2 inch.

§113.7 Distribution.

(a) Rails should be unloaded, as far as possible in position for laying with a minimum of further handling, giving special attention to accurately locating the ends of CWR.

(b) Rails should be placed parallel with the track and base down, avoiding excessive bending or damage, making use of suitable mechanical equipment, when available. Care should be taken to avoid placing rails on manhole covers or close to air lines.

(c) In yards and at locations where employees must walk close to the track, rail should be placed as near to the ends of ties as possible to avoid obstructing the walkway area.

(d) When rails are distributed along the track so that there may be danger of employees falling over them, a message stating their location shall be sent to the Superintendent, in order that employees may be notified.

(e) Tie plates, joint bars, bolts, nut locks, spikes, tie plugs or strips, rail anchors, etc., should be distributed as nearly as possible where they will be used, taking care to keep them off tops of ties, out of tie cribs and from getting burried or lost.

§113.8 Preparation and care.

(a) As far as practicable, track should be placed in good line and surface prior to rail renewals. Track to be laid with CWR should be fully ballasted, and preferably, programmed tie renewals should be completed in advance of rail laying.

(b) Rails should be examined prior to laying in track to detect any sharp bends, damage or surface conditions that will make them unserviceable.

(c) Care of rail should be taken the day on which it is laid, so that no damage to rail or fastenings will result from continued use under normal traffic. Loose ties should be tamped to a good bearing under the rail immediately behind rail laying operations.

§113.9 Laying jointed rails.

(a) Jointed rails should be laid, one at a time, with space allowance for expansion being provided between rail ends in accordance with the following table:

33 ft. Rail		39 ft. to 160 ft. Rails	
Rail temperature (Deg.-F.)	Rail end space (inches)	Rail temperature (Deg.-F.)	Rail end space (inches)
Below -10	5/16	Below 6	5/16
-10 to 14	1/4	6 to 25	1/4
15 to 34	3/16	26 to 45	3/16
35 to 59	1/8	46 to 65	1/8
60 to 85	1/16	66 to 85	1/16
Over 85	None	Over 85	None

(b) To insure the space allowance required, rail ends should be brought squarely together against approved expansion shims of proper thickness and the rail joints bolted before spiking.

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

(d) A standard rail thermometer shall be used to determine the rail temperature. The thermometer shall be laid close to the web on the side of the rail base which is shaded from the sun's rays in advance of the laying operation and left there long enough to record the temperature accurately. The supervisory employee in charge shall see that rail temperature is checked frequently and that proper rail expansion shims are used. All thermometers must be checked by the Supervisor-Track to see that they are accurate.

(e) Except as otherwise provided, rails should be laid so that the joints of one line of rails shall be opposite the quarter point of rails in the other line with permissible variations as follows:

(1) Except through turnouts and at insulated joints, the staggering of the joints on one side should not vary more than 30 inches in either direction from the quarter point of the opposite rail, preferably not exceeding 18 inches.

(2) Rails laid with the joints of one line of rail opposite the middle of rails in the other line in accordance with former standards need not be relocated until out-of-face rail renewals are made.

(3) Where approved by the Division Engineer, joints on tangents in newly constructed track laid by the panel method, other than main track, may be left opposite, but joints on curves should be staggered in accordance with Paragraph (1), above.

(f) Rails less than 18 feet in length should not be used in main tracks, except that rails not less than 14 feet may be used for:

(1) Connections within turnouts and crossovers.

(2) Temporary closures

(3) Temporary replacement of broken rails.

Rails not less than 14 feet in length used in accordance with previous standard practice need not be removed until rails are changed or relaid.

(g) When laying rail, placing bolted joints in or closer than 12 feet to the edges of road crossings, within the limits of switch rails or guard rails, or closer than 6 feet to the ends of open floor bridges, trestles or viaducts should be avoided, using long rails where necessary.

(h) Rails of the same section should be used on open floor structures, through road crossings and paved track areas of station platforms, and to the greatest extent possible in turnouts and crossovers.

(i) Rails of unequal wear and different sections must be brought to an even surface at joints. If the difference in height of rails must be run off by the use of shims, wood or metal shims of proper thickness, with holes provided for spikes and of ample size to permit secure fastening to the ties, must be placed between the tie plates and the ties. When shimming is performed, the requirements of §213.129 must be met.

(j) The use of shims or spring washers between the web of the rail and the joint bar to aline the gage sides of rail heads or the use of acetylene torches or grinding to manufacture or change the dimensions of compromise joints is prohibited. Adjustments must be accomplished by:

(1) Compromise joints of approved design.

(2) Grinding or approved method of welding.

(k) When necessary to make a temporary connection for the passage of a train at normal speed, the connection must be made with a piece of rail not less than 14 feet long with compromise or standard joints with the full number of bolts and with all rail holding spikes driven. Use of switch points to make temporary connections when laying rail is prohibited.

§113.10 Bolt holes.

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

(a) When new holes are necessary, they must be drilled and not punched, slotted or burned with a torch. All holes shall be of the full diameter and located in accordance with drilling instructions on the standard plan for the rail being drilled. They should be drilled with the joint bars removed or before their application, either by marking the location of the center of the hole, preferably with a proper size template block and center punch, and placing drill bit directly against the web of the rail, or by drilling through an approved template. New bolt holes should not be drilled through the joint bars.

(b) When bolt holes are drilled with a power track drill, a uniform feeding pressure should be maintained and then reduced as the bit point breaks through the opposite side of the web. Forcing the drill may produce a ragged hole, with possibility of resultant bolt hole cracks.

(c) After drilling is completed, bolt holes should be brushed out and inspected. Any burrs or chipped edges should be removed by grinding to a smooth edge around the entire circumference of the hole.

(d) The distance from the end of a rail to center of first bolt hole must not be less than twice the diameter of the hole, except where the standard plan for that rail provides for a lesser distance, this distance shall be minimum.

(e) The distance between centers of any two holes of the same diameter must not be less than four (4) times the diameter of the hole, and in the case of holes of different diameters not less than 3-3/4 times the average diameter of the two holes.

(f) The connection between rail ends should be made with fully bolted joint bars.

(g) When it is necessary to use a cut rail at a compromise or insulated joint location, the mill or shop drilled end of the rail should be placed in the compromise or insulated joint. The bolt holes must be of full diameter and drilled before the joint is applied, and in accordance with provisions of paragraph (a) of this sub-section regardless of the weight of rail.

§113.11 Cutting rail.

(a) The tools which may be used for cutting rails are listed below:

(1) Rail saws.

(2) Track chisels.

(3) Abrasive cutting wheels.

(4) Gas cutting torches, in accordance with standard instructions, for side and yard tracks, only. In emergency, they may be used in main tracks with appropriate speed restrictions, but rails so cut must be replaced before the track is restored to normal speed.

(b) When using a track chisel, a sledge must be used. The use of spiking hammers is prohibited.

(c) Except for the welding of driver burns in accordance with approved methods, and except for application of welded bonds, gas or electric arc welding is prohibited on any portion of the rail, except the top of the rail within the limits of joint bars.

(d) Gas cutting torches must never be used on rail except as covered by paragraph (c), above. Any rail in main track, other important track or in an adjacent track accidentally damaged by torches must be promptly removed from track.

§113.12 Rails bonded for track circuits.

(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 indicate that the signals display their most restrictive indication and, in cab signal or train control territory, that coded track circuits are inoperative, and that facilities to bond the new rail 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, care shall be exercised to insure that at least one return path for electric traction current is maintained, before disconnecting leads of impedance bonds or removing rails, frogs, etc. When making rail renewals, etc., before the rail is disconnected, a return path for current shall be provided by using a temporary bond, Plan E-413610-( ), across the track each side of the section of rail to be removed, making sure that no insulating rail joints interfere with this cross bonding circuit. In emergencies, when the signal maintainer is not present, he shall be notified that the rail bonds have been broken.

§119.0 Continuous welded rail (CWR).

§119.1 Use.

(a) CWR fabricated by an approved process may be laid without restriction in fully ballasted tracks on tangents and on curves up to 6 degrees.

(b) CWR may be laid across open deck bridges where bridge ties are spaced with timber blocks between ties, provided that the following conditions are satisfied:

(1) All ties and blocks in a panel are tightly jacked and fastened together with guard timbers or spacing bars secured by lag screws in every third tie.

(2) Bridge ties are securely fastened to steel structure by means of hook bolts, tie anchors or other holding devices in a manner approved by the System Engineer Structures - Maintenance.

(3) The bridge structure is properly anchored to abutments and piers to prevent any movement other than normal expansion.

(4) CWR is anchored to the bridge ties in both directions in accordance with §213.120(g).

(c) Where bridge ties are not spaced with timber blocks between ties, CWR may be laid across open deck bridges under the following conditions:

(1) Across bridges up to and including 100 feet in length on tangents, provided every third bridge tie is fastened to the steel structure by means of approved tie anchors and the CWR is anchored on every tie in both directions for at least 200 feet on each approach to the bridge in accordance with §213.120(g). Rail anchors should not be used on ties across the bridge.

(2) On bridges more than 100 feet in length and up to and including 300 feet in length, as required by paragraph (1) above, except that every other bridge tie should be fastened to steel structure.

(3) Bolted rails not longer than 78 feet should be laid across open deck bridges on curves and on open deck bridges longer than 300 feet on tangents.

(d) After application, hook bolts, tie anchors or other approved holding devices must be checked and retightened weekly, until ties have fully seated on top flanges of built up members.

§119.2 Connecting CWR.

(a) CWR strings may be field butt welded by an approved process into long lengths in all classes of tracks. Where necessary to use a short rail to connect CWR strings, that rail should be at least 14 feet long.

(b) Field butt welds must be protected by the application of reinforcing straps as shown on Plan 66549-B or 66550-B in tracks where authorized speed is 30 m.p.h. or greater, or where passenger trains are operated.

(c) If it becomes necessary to apply joint bars temporarily, the end bolt hole in each rail must not be drilled to permit subsequent prompt field welding. It may be necessary to apply additional rail anchors to prevent pull apart prior to field weld being made. These additional anchors should be removed after field welds have been made.

(d) Except where field butt welded, CWR strings are to be fastened to each other or to buffer rails with fully bolted rail joints, except as provided in paragraph (c) above.

§119.3 Rail anchoring.

Each CWR string is to be anchored in accordance with §213.120(g).

§119.4 Rail temperature.

(a) A standard rail thermometer shall be used to measure the rail temperature of all CWR before it is laid in track. The thermometer should be laid on the base of the rail, shielded from direct rays of the sun and left there long enough to determine the temperature accurately.

(b) CWR must be anchored at or adjusted for a rail temperature of 85 degrees Fahrenheit (85°F.) or higher.

(c) When the rail temperature is lower than 85°F., an approved rail heating device may be used for expanding the CWR to make proper adjustment.

(d) Where CWR has been anchored at a temperature below 85°F., and not adjusted for temperature during the rail laying operation, it should be adjusted as soon as weather conditions have brought the rail to a temperature of 85°F. or higher.

(e) The Supervisor-Track shall be responsible for recording on Form MW-155 the rail temperature for which each CWR is anchored. He should forward this form to the Division Engineer, retaining one copy for his record.

§119.5 Adjustment for other rail temperatures.

(a) To adjust CWR for a temperature higher than that at which it was anchored, its length or the length of its buffer rails must be decreased. When it is to be adjusted for a temperature lower than that at which it was anchored, the length must be increased.

(b) The number of inches by which a CWR should be decreased or increased to adjust its length for a temperature higher or lower than that at which it was anchored or adjusted may be calculated by taking the difference between the two temperatures, multiplying that difference in degrees Fahrenheit by the length of the CWR in feet, and multiplying the product by 0.000078. For example, to adjust the length of a 1450-ft. CWR, anchored at a rail temperature of 40 degrees, to correspond to the length of this rail at 85 degrees, subtract 40 from 85 to obtain a difference of 45 degrees and then multiply as follows:

45 x 1450 x 0.000078 = 5.1 inches

(c) For practical purposes, the increase or the decrease in length required to adjust selected lengths of CWR for the difference between their actual measured temperatures at time of anchoring or adjustment and a rail temperature of 85°F., may be taken from the following table:

Adjustment of CWR for Temperature Change

Measured CWR temperature (degrees-F)	Length of CWR in feet					
	950 to 1049	1050 to 1149	1150 to 1249	1250 to 1349	1350 to 1449	1450 to 1550
111 to 120	+2"	+3"	+3"	+3"	+3"	+4"
101 to 110	+2"	+2"	+2"	+2"	+2"	+2"
91 to 100	+1"	+1"	+1"	+1"	+1"	+1"
80 to 90	0"	0"	0"	0"	0"	0"
70 to 79	1"	1"	1"	1"	1"	1"
60 to 69	2"	2"	2"	2"	2"	2"
50 to 59	2"	3"	3"	3"	3"	4"
40 to 49	3"	3"	4"	4"	4"	5"
30 to 39	4"	4"	5"	5"	5"	6"
20 to 29	5"	5"	6"	6"	7"	7"
10 to 19	5"	6"	7"	7"	8"	8"
0 to 9	6"	7"	7"	8"	9"	9"
-10 to -1	7"	8"	8"	9"	10"	11"
-20 to -11	8"	9"	9"	10"	11"	12"

Note: + indicates increase; otherwise length is to be decreased.

Adjustment for other CWR lengths may be determined by direct proportion.

§119.6 Adjustment by mechanical heating.

(a) Rail may be expanded after it has been laid in the tie plates before or after spiking, but must be expanded before it is anchored.

(b) CWR should be heated so that expansion is introduced from one end of each string to the other in the direction of rail laying.

(c) The number of inches each CWR string should be expanded during the rail laying operation may be determined by calculation according to §119.5(b) or from the table in §119.5(c).

(d) Space equal to the amount of expansion needed for each string of CWR should be provided between the end of that string and the near end of the next adjacent string. A minimum of 10 ties should be box anchored on the near end of the adjacent string to hold it in place and avoid closing the expansion gap of the string being heated.

(e) Heating should be commenced at the beginning of the first CWR string and steadily applied while moving forward until the required expansion has been obtained at the end of the string. Uniformity of expansion is to be controlled by marking each quarter of the string and introducing expansion as follows:

1/4 point - 1/4 of total required expansion
1/2 point - 1/2 of total required expansion
3/4 point - 3/4 of total required expansion

(f) Quarter points should be marked on the rail and the tie plate, so the amount of expansion can be accurately determined. The tie plate used for marking as a reference point must be one that is either doweled by a Dunn-Rite Gauger or has been spiked, so that it will not move as rail expands.

(g) In the event the first half of the heated CWR string does not have the required expansion at each quarter point, the heater will back over the heated portion, without applying heat, and then reheat the rail until the necessary expansion is obtained.

(h) As heating is progressed, a minimum of one (1) anchor per 39 feet of rail should be applied on the side of the tie that will prevent the rail from losing expansion.

(i) At the end of the completely expanded string, a minimum of ten (10) ties should be box anchored, in accordance with standard pattern, immediately after the gap is closed, to hold the expansion.

(j) The entire CWR is to be anchored in accordance with §213.120(g) before trains are permitted to operate over it.

§119.7 Adjustment by natural temperature change.

(a) When it is necessary to adjust CWR already in track, the required increase or decrease may be found by taking the difference between desired and recorded temperatures of each string of CWR and calculating the amount of adjustment as shown in §119.5(b) or determined from the table shown in §119.5(c).

(b) All rail anchors must be removed from strings of CWR requiring adjustment to permit the desired expansion or contraction. Tie plates should be tapped with a hammer or approved mechanical device used to free the rail. All rail anchors must be reapplied immediately after the desired change in rail length has been obtained.

(c) Where buffer rails are used between adjacent strings of CWR, the necessary adjustment should be made by removing the buffer rails, cutting at least 18 inches from the end of each affected CWR string, to remove bolt holes, and field welding in rails of required length.

(d) When it is necessary to adjust CWR strings in territory where buffer rails have been eliminated the following should be done:

(1) Where each of several adjacent strings need adjustment, it is desirable to make the adjustment for 3 or 4 strings at a time, if possible. For this purpose, a rail cut should be made near the center of the adjustment area.

(2) Where adjoining CWR strings are connected directly by a bolted rail joint, the adjustment for either compression or tension should be made by cutting out the drilled end of each CWR and field welding in a rail of required length.

(3) Where CWR strings are field butt welded together, the adjustment may be made by cutting and butt welding by an approved process or welding in a piece of rail.

§119.8 Replacement of defective rail or weld.

Defective rails and welds should be cut out using a power rail saw and replacement rail field welded in. The entire rail must be removed where longitudinal defects or transverse defects in non-control cooled rail are involved.

§121.0 Rail joints.

(a) Abutting rail ends shall be fastened together by bolted standard or compromise joints, insulating joints or glued joints, except where butt welded.

(b) Rail joints in track must satisfy requirements of §213.121 as to design and condition.

§121.1 Bolted rail joints.

(a) General.

(1) Bolted rail joints consist of either head free or head contact standard bars and head contact compromise joint bars held in position by track bolts having sufficient tension to firmly support abutting rail ends, but not too tight to prevent longitudinal movement in joints to accommodate expansion and contraction due to variation in rail temperature.

(2) Head free bars must have the inner surface of the head of the bar held tightly against the rail head fillet with the heel of the bar standing out the proper distance from the base fillet, where all of the "draw-in" for wear is concentrated.

(3) Head contact bars must have the top surface of the bar held tightly against the fishing surface under the rail head outside of the rail head fillet area. Bars must be secured in a vertical position without "cocking".

(b) Application.

(1) Before applying bolted rail joints in laying new or fit rail, applying or renewing joint bars out-of-face, and in general maintenance, protection against corrosion should be provided by coating the rail ends within the joint bar areas including webs, fishing surfaces, bolt holes and inside surfaces with an approved oil or grease.

(2) Joint bars shall be applied with their full number of bolts, nuts and spring washers according to standard plans and specifications.

(3) New bolts, nuts and spring washers should be used when new or reformed joint bars are applied or renewed out-of-face.

(4) When initially applying joint bars, the bolt tension should be brought in the range of 20,000 to 25,000 pounds, and for subsequent retightening from 15,000 pounds to 20,000 pounds. This may be approximated by an average man with a 36 inch track wrench.

(c) Head free joints.

The following procedure should be followed in applying head free joint bars:

(1) Set bars in position, insert all bolts and apply spring washers and nuts by hand.

(2) Run up the No. 3 and No. 4 nuts with a power track wrench in high gear, without fully tightening to avoid locking the bars in an improper position.

Strike the bead on the heads of both inside and outside bars at both ends with a hammer to force the inside faces of bars tightly against rail head fillets. Do not strike the toe of the bar as this tends to force the head of the bar outward.

Tighten remainder of bolts from center of joint bars outward in high gear.

(3) Tighten all bolts in low gear, working from center of joint bars outward. During this final tightening, drive the toes of the bars inward by tapping with a spike maul or sledge.

By following the above procedure, proper contact will be obtained between inner face of head of bar and the rail head fillet. Also, the heel of the bar will stand out the proper distance from the rail base fillet.

(d) Head contact joints.

The following procedure should be followed in applying head contact joint bars:

(1) Set bars in position on rail, insert all the bolts and apply spring washers and nuts by hand.

(2) See that bars are in a vertical (uncocked) position as one of the center bolts is tightened by:

(i) Using joint bar clamp and head stops.*

(ii) Inserting a bar in a bolt hole.*

(iii) Tapping toes of joint bars as bolt is tightened.

* - Necessary when applying 131 lb. or 152 lb. joint bars only.

(3) Tighten all bolts in low gear, working from center of joint bars toward ends, tapping the toes of joint bars with a spike maul or sledge so that their vertical position is maintained.

(e) Maintenance.

(1) Drilled ends of new rails are ground to remove burrs at the mills.

(2) To avoid chipping or spalling under service due to overflow of steel, the rail end faces should be cross cut by grinding with a 1/8 inch wheel to a depth of not less than 3/16 inch below the surface of the head. The maximum cut should not be wider than 1/8 inch. If the rails are not in contact, the overflowed metal should be removed from both end faces.

(3) When bolted joints are applied, other than insulating joints, the bolts should be tightened at the time they are applied, retightened within a week and again within a month after application.

(4) Bolts should be retightened periodically at intervals of not more than one year, and in all cases following program track raising or surfacing.

(5) To prevent undue rail stress on account of expansion or contraction at the changes of seasons and wide temperature changes, sufficient joint bars

should be loosened to permit the rails to adjust themselves, immediately after which bolts should be retightened. Where necessary, a piece of rail should be cut out to avoid heat kinks or buckling of track.

(6) Wear in the fishing spaces of rail should be compensated for by the application of oversize joint bars.

§121.2 Insulating rail joints.

(a) Position.

For new work or rail renewals in track circuit territory, insulating joints shall be located as follows:

(1) Where track circuits adjoin within limits of interlockings, in cab signal territory, electrified territory or in territory where stray current is likely to be prevalent, insulating joints shall be staggered not more than 56 inches nor less than 32 inches.

(2) To provide for effective electric locking, insulating joints, staggered as prescribed in paragraph (1) above, shall be located with respect to signals as follows:

(i) No insulating joint shall be placed less than 5 feet nor more than 13 feet in advance of a high signal, except that where there are opposing high signals at the same location, the insulating joints shall be placed as nearly opposite the signals as practicable.

(ii) Insulating joints shall be placed as nearly opposite dwarf signals as practicable.

(3) At locations other than those listed above, insulating joints may be staggered not more than 10 feet.

(4) Insulating rail joints need not be specially staggered at the end of a track circuit where there is no adjoining track circuit or fixed signal.

(5) Insulating rail joints in turnouts and crossovers, and at highway grade crossings shall be located in accordance with Standard Signal Plans.

(6) Insulating rail joints located in accordance with former PC, PRR, NYC or NH specifications need not be relocated until rail is renewed.

(b) Application of continuous insulating joints.

(1) An insulating joint should not be applied to rails with battered or rough cut edges as they will damage insulating fibers. Such edges which come in contact with the fiber parts of the joint, i.e., under the rail head, web and top and bottom of the rail base should be rounded to approximately 1/8 inch radius by grinding or filing.

(2) Rails should be spaced so the ends will bear firmly against fiber end post to avoid damage to bolts and fiber bushings. If the opening between

rail ends is too small, the rail ends should be forced apart with an approved rail expander. Use of a track chisel or wedge may leave rough edges that will destroy the insulating material. The end posts should not project above or beyond rail heads.

(3) Ties, preferably three under each continuous type insulating joint 36 inches or more in length, should be spaced and tamped to provide uniform support. Parkway outlets ("boot legs") should be moved if they will interfere with arranging ties accordingly.

(4) Abrasion plates must be used under continuous insulating joints.

(5) Before insulating joints are applied, the parts of the rails to be covered by the insulating joint should be thoroughly cleaned to remove all rust, scale and dirt. All metal parts of the joint should be thoroughly cleaned, and all surfaces of fiber head and base pieces, and adjoining inside surfaces of rail and joint bars, liberally coated with approved rust preventative before application.

(6) First insert the end post. Then apply the fiber base plates and metal joint bars to each side of the rails and drive them on the rails with a sledge or hammer, striking only the lower edge of the bars until there is just enough room left to insert the fiber head pieces. After the fiber head pieces are in place, insert fiber bushings in bolt holes, and apply the fiber washer plates and metal washer plates with the bolts and nuts.

Before placing bolts in the joints, they should be dipped in approved grease, thoroughly coating the entire length of bolt except the head. Joint bars should 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 with 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. Do not drive the heads of the bars. They will be drawn into place by bolt pressure. Bolts in continuous insulating joints must be kept sufficiently tight at all times to prevent movement of the rail in the joint.

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

(8) Continuous insulating joints require more frequent and careful attention than conventional joints. Bolts should be tightened within three days and again within a month after joints are applied. While tightening, bars and bolt heads should be tapped with a hammer to insure proper contact in fishing spaces.

(c) Application of bonded insulating joints.

(1) Bonded insulating joints should be used in CWR track, except on the turnout side of turnouts where conventionally bolted insulating joints should be used.

(2) Rails connected by bonded insulating joints must be field welded in place.

(3) All bonded insulating joints are to be installed as suspended joints.

(4) Double shoulder tie plates must be used on the two ties under bonded insulating joints.

(5) Rail holding spikes must be carefully driven to assure that spike head is not left in contact with the bar, which could result in the joint being short circuited. All bonded insulating joints will have plate holding spikes installed.

(6) No attempt should be made to tighten bolts in bonded insulating joints. In the event the bolts in the joint become loose, the Division Engineer should be notified for further handling.

(7) Any rail head overflow at a bonded insulating joint is to be removed by the use of a hand file or hack saw. Extreme care must be exercised to assure that the end post is not damaged. The overflow should be removed only to the rail end, so that the joint gap will not be greater than the original 3/16 inch. A cross grinder should not be used to remove the overflow.

(8) No additional rail anchors will be required at bonded insulating joint locations in CWR. The bonded insulating joints will be considered as butt welded rail joints for purposes of compliance with the requirements of §213.120(g).

(d) Care of joints.

Insulating joints should be supported on sound smooth ties, well tamped and well drained with clean ballast at all times.

§123.0 Tie plates.

§123.1 Use.

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

(b) Canted tie plates replacing level tie plates should only be applied in out-of-face stretches.

(c) Only double shoulder tie plates should be used under CWR.

§123.2 Placement.

Care must be taken that the shoulders of single shoulder tie plates and the outside shoulders of repunched double shoulder tie plates will have full bearing against the base of rail.

§123.3 Tie pads.

Tie pads may be used with the approval of the Chief Engineer M.W.

§125.0 Rail anchors.

§125.1 Number required.

(a) A sufficient number of anchors must be applied and in a manner to effectively control longitudinal rail movement, as required by §213.125(a).

(b) The number of rail anchors required to control longitudinal rail movement for a given location can be fixed only by experience and judgment, and is to be determined by the Supervisor-Track with approval of the Division Engineer. Insufficient anchors may result in improper distribution of expansion allowance, or stresses in CWR, and consequent distortion of line and surface, which can create a hazardous condition.

(c) Additional anchors must be applied when there is evidence that rails are moving progressively under traffic.

(d) It should be recognized that when track is raised out-of-face, the resistance to creepage is reduced and additional anchors may be required in order to avoid undue movement.

(e) In general, main line high-speed main tracks require eight (8) anchors per 39 feet of rail applied against movement in the normal direction of traffic. Additional anchors against reverse movement may also be required. For tracks of lesser traffic, including main tracks of branch lines, from 4 to 6 anchors per 39 feet of rail or even less may be sufficient.

(f) On single track, or on other tracks having traffic in both directions, a sufficient number of anchors shall be applied in each direction to stabilize the rails and, in addition to preventing progressive movement in one direction, to prevent backward and forward movement of ties and resultant disturbance of tamping.

(g) When anchoring rails greater than 39 feet and up to 160 feet in length, additional anchors are required because of the relative reduction in the expansion allowance per foot of track. A minimum of 24 anchors per 78 feet of rail in the normal direction of traffic (more or less in proportion for other lengths) with one-fourth (1/4) of the anchored ties boxed for reverse anchoring is needed in order to restrain the tendency of such track to gain expansion.

(h) The number of anchors to be applied when CWR is laid and subsequently maintained is prescribed in §213.120(g).

(i) Additional anchors as needed shall be applied on the approach and leaving rails:

(1) To main track turnouts and crossovers.
(2) To track crossings.
(3) To highway grade crossings.
(4) To open floor bridges.
(5) To insulating joints.
(6) At hot box detectors.

(j) Rail anchors shall not be used on open deck bridges, trestles or viaducts, except where the deck and bridge meet the requirements of §119.1(b), or their use is approved by the Chief Engineer M.W.

§125.2 Application.

Rail anchors shall be applied as follows:

(a) Anchors shall be applied at both ends and on the same side of the tie. They should be spaced throughout the rail length as evenly as practicable, except at those locations where on account of tests, special authorization or conditions, etc., other spacing may be desirable. Wherever practicable, rail anchors shall be applied from the gage side of the rail.

(b) When laying rail, the necessary anchors shall be applied before trains are permitted to pass over the track.

(c) Anchors should be applied against sound ties.

(d) Where anchoring for both directions of traffic is required, reverse anchors should be applied to ties already having anchors in the normal direction. In other words, the practice of boxing the tie, and not the tie crib, must be followed.

§125.3 Maintenance.

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

(b) In order to avoid damage to rail anchors, only proper tools or machines should be used in applying and removing. Anchors may be moved along the base of the rail with an approved device, but should not be driven along the base with a hammer.

(c) When the bearing of rail anchors against the tie is disturbed, when renewing or respacing ties or moving rail, the anchors must be mechanically shifted or taken off and then reapplied in proper position. All anchors removed must be reapplied before track is restored to service, replacing any broken or defective anchors and adding additional anchors, if necessary.

(d) Proper opening between rail ends is provided and maintained by the use of adequate rail anchors. Where rail openings are excessive, the rails should be driven back to provide uniform space allowance for expansion, necessary rails of suitable length inserted, and an adequate number of rail anchors applied to hold the rails against running in either direction. Where insufficient expansion allowance has developed so that line kinks can result in hot weather, similar adjustment should be made in order to increase the allowance, inserting shorter rails of suitable length where necessary, again applying sufficient anchors to control creepage.

The use of rail anchors should be in accordance with the following service assignment:

(a) Use new or reformed anchors in laying:

(1) New bolted or continuous welded rail.

(2) Continuous welded fit rail.

(b) Use fit anchors if available (with shims if necessary) in:

(1) Laying bolted fit rail.

(2) Applying additional or replacement anchors without restriction.

§127.0 Spiking.

§127.1 Number required.

(a) The requirements of §213.127 must be satisfied as to minimum number and location of effective spikes in track.

(b) Additional spikes may be used where, in the judgment of the Supervisor-Track, they are needed to hold gage.

(c) Plate holding spikes shall be driven with the head pointed toward the rail.

§127.2 Application.

(a) Spikes must be started vertically and square, and driven straight. The shank of rail holding spikes must have full bearing against the base of rail. Spikes should be kept driven home, being careful not to overdrive.

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

(c) Spikes in main tracks when badly throat cut or rusted should be replaced.

(d) All old spikes shall be sorted when pulled for reuse or scrapping.

§132.0 Track crossings.

§132.1 Use.

(a) Crossings of manganese steel or bolted heat treated rail construction shall be used as approved by the Chief Engineer M.W. at intersections where there is heavy or high speed traffic on either run.

(b) Non-heat treated bolted rail crossings should only be used where traffic is light or in emergency.

§132.2 Installation.

(a) When handling or placing, care should be taken to avoid damage to crossing frogs, using a crane where practicable. Whenever it becomes necessary to use jacks on crossing frogs, they should be set under the frog proper, and not under the arms.

(b) Crossings should be installed on sound treated timbers or framed foundations, located to permit satisfactory tamping.

(c) An ample bed of well drained ballast should be provided.

§132.3 Maintenance.

(a) Rigid, slip and movable point crossings should be maintained to the alinement and to the ordinates from the diagonal shown on manufacturer's plans.

(b) Lipped metal should be removed from crossing frogs by grinding in accordance with standard instructions.

(c) Bolts should be kept tight and broken bolts renewed promptly.

(d) Ballast should be kept well tamped so that the surface of the frog is maintained at a uniform grade with the adjacent track.

(e) Crossing frogs may be built up in the field by the electric arc method in accordance with standard instructions. Those which cannot be welded in the field should be sent to the designated point for reclamation.

Ground clamps employed for welding must be applied to the rail or piece of steel being welded as reasonably close to the work as possible.

(f) The requirements of §213.53 and §213.143 must be met in maintaining proper track gage, guard face gage, and "back to back" distance through track crossings.

(g) The requirements of §213.133 and §213.137 must be met in maintaining track crossings in their proper condition.

§133.0 Turnouts and crossovers.

§133.1 Use.

Turnouts and crossovers are designated by their frog numbers and should be used as follows:

(a) No. 20 - 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 normal speed is 50 miles per hour or more.

(b) No. 15 - At interlocking plants for movements to another main track normally used in the same or reverse direction, where conditions do not justify or afford the distance required for No. 20 frogs.

- For diverting trains to sidings or other tracks and returning trains to main tracks through power operated or spring switches.

(c) No. 10 - For all other turnouts from main tracks and sidings where practicable, and in yards and terminals where road locomotives operate.

(d) No. 8 - For turnouts where the use of a No. 10 frog is not practicable.

(e) Turnouts smaller than No. 8 must have approval of the Chief Engineer M.W.

§133.2 Speeds through turnouts.

(a) The maximum permissible speeds through level turnouts, when located in tangent track will be as follows:

Frog No.	Switch Rail Length	Permissible Speed - MPH
20	39 ft. or 45 ft.	45
20	30 ft.	35
15	26 ft. or 30 ft.	30
10	16-1/2 ft., 18 ft. or 20 ft.	15
8	16-1/2 ft., 18 ft. or 20 ft.	15
6	10 ft. or 11 ft.	5

(b) When turnouts or crossovers are located in curved tracks, speeds must be adjusted to agree with the table in §213.57(d).

§133.3 Installation.

(a) Turnouts and crossovers constructed in track or at the site shall be built to and conform to Standard Plans.

(b) Prefabricated turnouts shipped in panels in accordance with approved plans may be used where economical.

(c) As far as practicable, when being constructed or renewed in existing main tracks, turnouts should be completely installed with switches connected to their operating mechanisms and properly adjusted before trains are permitted to move over the turnout.

(d) Where only one switch rail (closed point) has been installed in a turnout under construction or renewal in existing main track, and it is necessary to move trains over the turnout on the main track, the following precautions must be taken:

(1) All switch plates on the turnout side must be fully spiked in correct position.

(2) The main track switch rail must be securely held against its stock rail by driving a spike in each of the first two ties back of the point, and where possible, spikes must pass through holes in the switch plates.

(3) The free end of stock rail must be fastened to prevent movement.

(4) Facing train movements shall be made only under slow speed restriction.

(e) Where both switch rails have been installed, but not properly connected to the switch operating mechanism, the following must be done before trains are permitted to move on the main track over the turnout:

(1) Switch rods must be installed.

(2) The main track switch rail must be spiked against its stock rail as required by paragraph (d)(2) above.

(3) The diverting switch rail (open point) must be blocked by driving a wooden wedge, not less than 18 inches long, between the switch rail and its stock rail. The wedge must be secured in place by means of: a lag screw or heavy nail through one clip bolt hole; a piece of wood placed against the end of the wedge and spiked to the first and second ties ahead of the point; or a light flat headed bolt through a hole in the wedge adjacent to the side of the first tie under the switch rail and between this tie and the No. 1 or head rod, with the bolt secured in place by a cotter pin or split key below the bottom of the wedge.

(4) Unless the curved lead has been installed and spiked to prevent movement, a connecting rail shall be fastened to the heel of the open switch rail and moved away from the running rail so as to provide at least 5 inches clearance between rail heads.

(f) The main track guard rail must be correctly placed and spiked, if the frog has been installed.

(g) Unconnected ends of lead rails or the toe of frog must be protected by a riser wedge fastened to the tie.

(h) Where track is signaled, a switch circuit controller shall be installed by a C.& S. employee in accordance with the C.& S. 23 Rev.

(i) To the extent practicable, avoid placing turnouts and crossovers on curves, particularly on spirals or elevation runoffs at the ends of curves.

(j) Where turnouts are located in elevated curved tracks, elevation in track behind the frog must be run off at a rate not exceeding 1/2 inch in 31 feet.

§135.0 Switches.

§135.1 Use.

(a) All switches must be constructed in accordance with Standard Plans.

(b) The following table indicates the lengths of switches to be used with designated frogs:

Frog number	Length of switch
20	39 ft.
15	26 ft.
10	16 ft.- 6 in.
8	16 ft.- 6 in.
6	11 ft.

(c) Switch rails of other lengths are to be used only for replacements in kind in existing turnouts.

§135.2 Maintenance.

(a) The requirements of §213.135 must be met in maintaining switch rails and stock rails.

(b) Switch rails and movable points of crossings should be kept in good line and surface and in good order with all bolts tight and cotter pins in place.

(c) They should fit the stock rails closely and accurately, with a full bearing against the head. If a wear pattern indicates bearing only along the top edge of point, corrections should be made by grinding in accordance with standard instructions.

(d) Running of switch rails and stock rails should be prevented by adequately anchoring the adjoining rails.

(e) Vertical switch rod bolts must be placed with threaded ends up, and nuts locked by cotters.

(f) Switch plates and movable parts should be kept clean and lubricated. A permanent type of coating may be applied.

(g) Switch rails shall be replaced or repaired by an approved method when worn or chipped so that the top, at any place, is more than 7/8 inch below the plane across the tops of stock rails.

(h) Switch rails, but not including movable point rails of crossings, shall be replaced when raised portion of switch rail is worn down to the level of the top of the stock rail

§135.3 Reduction in wear.

Approved methods for reduction of unusual wear of switch rails under facing traffic are:

(a) In main tracks without restriction:

(1) Use of heat treated switch rails.

(2) Use of "Samson" design switch rails with undercut stock rails.

(3) One-quarter (1/4) inch maximum depth recess in the gage side of stock rail, in accordance with standard instructions, with conventional switch rails. Recesses must not be cut for switch rails unless they are equipped with heel blocks.

(b) In main tracks, yards and terminals where the maximum authorized speed does not exceed 15 mph:

(1) Switch point guard of approved manufacture applied to the outside of stock rail.

(2) Reverse bend (goose neck) in the stock rail to house the switch rail. Switch rails must be equipped with heel blocks.

§135.4 Protection.

(a) When necessary to disconnect a switch, movable point crossing or a derail from its operating mechanism, or to disconnect the No. 1 switch rod, the following precautions must be taken:

(1) The closed switch rail or movable point rail must be spiked against the stock rail as required by §133.3(d)(2).

(2) The switch must be blocked in position by driving a wooden wedge, as required by §133.3(e)(3), between the open switch rail or movable point rail and the stock rail or knuckle rail.

(3) If a switch, movable point crossing or derail is in track circuit territory, or if its position controls the indication displayed by a signal, the work of disconnecting switch rods must be done in charge of the Foreman-Track in cooperation with the Signal Maintainer.

(b) Where both No. 1 and No. 2 switch rods are to be disconnected, train movements shall not be made over the switch until one or both rods are properly connected to the switch or movable point rails and the switch or movable point crossing is secured and protected as required by paragraph (a) above.

(c) If the open switch rail is removed, trains may be moved over the turnout under the following conditions:

(1) Trailing movements may be made after closed switch rail is spiked as required by §133.3(d)(2).

(2) For facing movements, in addition to properly spiking the closed switch rail in accordance with §133.3(d)(2), the near end of connecting or lead rail must be moved away from the running rail to provide at least 5 inches clearance between rail heads and be protected by a riser wedge fastened to the tie. Train movements shall be made only under slow speed restriction.

§135.5 Inspection.

(a) Switch rails and parts, and connections, must be examined frequently. It is important that the stock rails have no lateral movement in the switch

plates and that switch plates have no movement on the ties. Regular inspections shall be made as required by Form M.W. 41 and necessary adjustments made at once.

(b) Chipping or unusual wear on any switch rail should be investigated, its cause determined and corrective action taken. When wear or chipping has produced a sloping top surface which may tend to raise a wheel having an imperfect flange, the switch rail should be further examined to locate any point of hard contact, which would necessitate repair or replacement.

(c) The requirements of §213.235 must be met as to minimum frequency of inspection, and the provisions of §213.135 must be considered when determining the condition of the switch.

§137.0 Frogs.

§137.1 Use.

(a) Rigid frogs of various angles, as designated by frog number, shall be used with turnouts of the same number in accordance with §133.1 and §133.2.

(b) The service assignments of the various types of frogs shall be as follows:

(1) Manganese steel center frogs should be used in heavy traffic and/or high speed tracks.

(2) Spring frogs, in service, may be permitted to remain in track until their replacement becomes necessary.

(3) Carbon steel bolted rigid frogs may be used on branch lines of light traffic at moderate speeds and in yard tracks where fit manganese frogs are not available and where it is known that they will give satisfactory service.

(4) Self-guarded frogs should be used, where practicable, where speed does not exceed 15 mph.

§137.2 Maintenance.

(a) The requirements of §213.137, §213.139 and §213.141 must be met in maintaining frogs.

(b) All fins and lips of flowed metal should be ground from frogs promptly, and the gage and guard edges of castings rounded.

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

(d) Consideration should be given to repairing worn frogs in track by approved method of welding and grinding.

(e) When their condition warrants, frogs not fit for main tracks should be used in yards and other slow speed tracks.

(f) All frogs requiring repairs which cannot be made in track, or at the site, shall be shipped to the destination point for reclamation.

§143.0 Frog guard rails.

§143.1 General.

Guard rails shall be furnished in accordance with standard plans and specifications or manufacturer's designs approved for use by the Chief Engineer M.W.

§143.2 Use.

(a) "Hook Flange" type guard rails of the braced design and one-piece manganese type guard rails of cast high manganese steel, marked Manganese, MS or M, may be used without restriction in main tracks, including turnout side of main track crossovers. The one-piece cast manganese type is particularly desirable at locations where abrasive action is severe.

(b) "Hook Flange" type, bolted "tee" type or fit or repaired one-piece manganese type guard rails should be used in light traffic branch line main tracks with moderate speed and in yard and side tracks where self-guarded frogs are not used.

(c) Bolted "tee" type guard rails may be used in main tracks of main lines and important branches only where guard rails of unusual dimensions are required to suit special conditions.

§143.3 Length.

(a) The following table indicates the lengths of "Hook Flange" type guard rails to be used with designated frogs:

Frog number	Length of guard rail
20	13 ft.
15	13 ft.
10	9 ft.*
8	9 ft.*
6	9 ft.*

* - One-piece cast manganese type may be used.

(b) The length of guard rails of the "tee" type for use in yard and side tracks, and main tracks as specified in §143.2(b), shall not be less than 11 feet 0 inches.

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

(d) Guard rails installed in accordance with previous standard practice may be continued in general use until their replacement becomes necessary.

§143.4 Gage and distance.

(a) Maintenance limits:

(1) Frog guard rail gage for turnouts in track must not be less than prescribed in §213.143(a).

(2) The back-to-back distance between guard rail and frog wing rail may not be more than 4 ft. 5 in. as required by §213.143(b).

(b) Installation dimensions:

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

(1) One-piece manganese and "Hook Flange" type guard rails of braced design - 4 feet 6-5/8 inches, except where curvature exceeds 8 degrees it must be 4 feet 6-3/4 inches, regardless of track gage, in accordance with Standard Plan 71801-( ).

(2) "Hook Flange" and "tee" guard rails must be 4 feet 6-3/4 inches, unless otherwise specified.

The distance between wheel flange face of guard rail and the wheel flange face of frog wing rail (back-to-back) must not exceed 4 feet 5 inches.

§143.5 Application.

(a) Guard rails should be set as follows:

(1) One-piece cast guard rails and "Hook Flange" type of braced design in accordance with Standard Plan 71801-( ).

(2) "Tee" guard rails and "Hook Flange" guard rails without braces shall be set in accordance with Standard Plans.

(b) The end of guard rails should be placed upon a tie or be otherwise protected, so that no loose or dragging object may become hooked on the guard rail ends.

§145.0 Inner bridge guard rails.

§145.1 General.

(a) Where inner bridge guard rails are required, they must be properly installed and maintained to prevent serious structural damage, with possible failure of bridge, in the event of a derailment. Installation of inner guard rails on structures should be held to a minimum to eliminate the extra maintenance needed, and to permit proper surfacing, lining and economical renewal of ties on bridge approaches. Where existing guard rails do not meet the above requirements, installations or removals should be made the next time the track is worked through the area.

(b) A "single" guard rail is a continuous line of rails fastened to ties adjacent to the gage side of one running rail. A "full" guard rail consists of two such lines of rail, one adjacent to the gage side of each running rail.

§145.2 Use.

The use of inner bridge guard rails shall be, as follows:

(a) Thru truss bridges and structures supported on piers or on bents that may be struck by derailed equipment with possible failure of the structure, i.e., where piers or bents have considerable batter or extend beyond the bridge trusses due to angular crossing of road, stream, etc.:

(1) Single track - Full guard rail.

(2) Double track - Single guard rail in each track to deflect derailed wheels away from adjacent truss.

(3) Three or more tracks - Single guard rail in each outside track to deflect derailed wheels away from adjacent truss. No guard rail is to be placed on other tracks.

(b) Movable bridges:

Full guard rail in each track.

(c) Special and large structures:

Installation of guard rails must have the approval of the Chief Regional Engineer.

§145.3 Material.

(a) Preferably, scrap rail will be used, of such a section that the top of guard rail is approximately 1 to 2 inches below the top of running rail.

(b) Joints may be either 4 or 6 hole bars with a minimum of 4 bolts, without washers, per joint.

(c) No tie plates or braces will be used with inner bridge guard rails.

§145.4 Application.

(a) Inner guard rails shall extend a sufficient distance (approximately 30 feet) beyond the bridge backwalls on either side to have the guard rails parallel to and 11 inches from the gage of running rails throughout the entire length of the structure to be protected.

(b) Full guard rails shall end on a tie in the middle of the track, with the ends beveled, bent down or fitted with a proper end casting, so as to divert a derailed wheel without catching dragging equipment.

(c) Single guard rails shall end on a tie, approximately 12 inches from the gage of the outside running rail, and beveled or bent down so as to avoid catching dragging equipment.

(d) To facilitate diverting derailed wheels, the guard rail shall be lined to a smooth uniform curve and/or tangent from bridge backwall to the guard rail end.

(e) Inner guard rails must be installed to protect the structure from traffic on both directions on that track.

(f) Inner bridge guard rails will be spiked on each cross tie or bridge timber with one spike on each side of the rail or casting, spikes being offset from each other to avoid splitting timber. Spike holes should be prebored.

§145.5 Inspection.

Inner guard rails shall be inspected periodically to make certain that bolts and joints are tight, spikes firmly against base of rail, and castings fastened securely yo rail ends, or ends properly beveled or bent down.

Subpart E - Mechanisms, Appliances and Devices

§201.0 Switch operating mechanisms.

§201.1 Use.

Switches shall be operated by approved types of mechanisms as follows:

(a) Manually or power operated switch mechanisms in accordance with "Specifications for Signal and Interlocking Systems."

(b) Manually operated switch mechanisms, which are supplemented by slow acting spring devices, which permit wheels to trail through switches set for the opposite route, referred to as "slow acting spring switch mechanisms," may be used with the approval of the General Manager and Chief Engineer M.W., as follows:

(1) In tracks other than yard tracks, when they are equipped with electric switch lamp or switch position indicator, "SS" spring switch marker and facing point locking for the switch in its normal position and provided with signal protection in accordance with "Specifications for Signal and Interlocking Systems."

(2) In yard tracks, without facing point lock and signal protection.

(c) Manually operated mechanisms, combined in one unit, which throw the switch rails and also provide for locking them in normal and/or reverse position, referred to as "locking switch stands," may be used as follows:

(1) In main tracks in automatic block territory.

(2) In main tracks in other than automatic block territory and in other tracks where switches are protected by signals controlled over track circuits.

(3) In tracks, other than covered in paragraphs (1) and (2) above, only when approved by the General Manager and Chief Engineer M.W.

Approved types of mechanisms are:

Wabco Style T-20	G.R.S. Model 9

(d) Manually operated switch mechanisms, of the non-automatic type, which throw the switch rails, referred to as "switch stands," may be used as follows:

(1) In main tracks, if new or rehabilitated by a reclamation shop designated by Chief Engineer M.W.

(2) In other tracks, except main tracks, if new, rehabilitated or fit.

Approved types of switch stands are:

New Century	Ramapo No. 26-E
Economy	Ramapo No. 112-D
Big Four No. 20	Odenkirk

(e) Manually operated mechanisms, the position of which is automatically reversed by wheels trailed through a switch set for the opposite route, and referred to as "semi-automatic switch stands," may be used in yards and sidings where authorized by Timetable Special Instructions.

(1) Approved types of stands are:

Bethlehem No. 22
Ramapo No. 20 and No. 22
C.F.& C. No. 60 and No. 620

(2) Where Timetable Special Instructions permit trains and locomotives to trail through a switch set for the opposite route, the color of the switch stand shall be orange. The color shall be black at other locations.

§201.2 Spring switches.

(a) Specially reinforced switches for use with slow acting spring switch mechanisms are shown on Standard Plan 73151-( ).

(b) Where slow acting spring switch mechanisms are in service, maximum permissible speeds for trains and locomotives shall be:

Train Movements	Speed	
	Over turnouts in §201.1(b)(1)	Over turnouts in §201.1(b)(2)
Facing, or Trailing - Not springing switch.	As otherwise authorized for turnout or track.	As authorized for turnout or track, but not to exceed 20 mph.
Trailing - Springing switch.	As authorized for turnout or track, but not to exceed 45 mph.	As authorized for turnout or track, but not to exceed 20 mph.

§201.3 Application of switch stands.

(a) Manually operated switch stands shall be placed so that the operating rod is in tension when the switch is set in normal position in main track, and at the siding end of crossovers between main track and siding.

(b) Each switch in a crossover shall be equipped with a switch stand.

(c) Where crossover switches are protected by signals, a switch locking arrangement shall be provided in accordance with Standard Signal Plans.

(d) Where crossover switches between main tracks, or main track and siding, are not protected by signals, when approved by the General Manager and the Chief Engineer M.W., mechanical switch locking shall be provided in accordance with Standard Signal Plans.

(e) Switch stands for all other tracks shall be located to serve the safety and efficiency of employees in the best manner.

§201.4 Location of switch stands.

(a) Switch stands, except locking switch stands, with or without switch point position indicators, and stands for indicators must be placed so that the distance from the gage of nearest rail to the center of spindle will be:

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

Track center distance	Minimum distance from gage to center of spindle
12 ft. 2 in. to 13 ft. 0 in.	3 ft. 8-3/4 in.
13 ft. 0 in. or more	4 ft. 1 in.

(2) For stands when not between tracks, a minimum distance from gage to center of spindle:

With low masts - 4 ft. 1 in.
With intermediate or high masts - 7 ft. 0 in.

(3) Where switches are so close together that switch position indicators, if of the same height, would not be separately visible from the locomotive cab, one stand should be placed further from the track than the other, preferably by a distance of 18 inches where track center distances permit.

(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 for a Wabco Style T-20 and 42 inches for a G.R.S. Model 9.

§201.5 Padlocks.

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

(b) 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.

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

§201.6 Maintenance.

(a) Switches, switch stands and operating rods must be examined frequently. Broken, damaged or missing parts shall be renewed immediately.

(b) Regular inspections shall be made as required by Form M.W. 41. If necessary, corrective action must be taken immediately.

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

(d) The requirements of §213.135 (e) and (f), and §213.235 must be met in maintaining and inspecting switch stands.

§202.0 Switch point position indicators.

§202.1 General.

(a) To give a clear and distinct indication of the position of switch points, when non-interlocked, colored targets, lamps with colored enamel discs, or reflectorized targets - Standard Plan 73917-( ), in place of lamps at locations approved by the General Manager, shall be provided in addition to switch stands, except where it has been decided that due to the character of traffic the indication is not necessary.

(b) Switch position indicators, lamps, targets and reflectorized targets are classified according to the height of the center of lens, disc or target above the track ties as follows:

(1) "Low" - Not exceeding 20 inches.

(2) "Intermediate" - 7 feet 3 inches.

(3) "High" - 17 feet.

(c) Indicators should be used, when required, at non-interlocked switches as follows:

(1) Low type with lamp and colored enamel discs or reflectorized target should be used generally in all tracks.

(2) Intermediate type with lamp and target or reflectorized target, but no discs, should be used only at facing switches in non-automatic territory where sufficient visibility is not afforded by the low type, and a high type is not warranted.

(3) High type with either lamp and target or reflectorized target, but no discs, should be used only at facing switches in non-automatic territory where sufficient visibility is not afforded by the intermediate type.

§202.2 Application.

(a) Switch point position indicators may be placed on a low switch lamp stand and connected to the switch points in accordance with PRR Standard Plan 73910-( ), or they may be placed directly on the switch stand.

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

§202.3 Maintenance.

Switch point position indicators should be kept clean and of uniform brightness and visibility.

§203.4 Position indication.

(a) Day and night color of position indicators for switch points shall be in accordance with the following table:

Color Indications for Switch Point Positions.

Location of Switch	Switch Normal		Switch Reverse	
	Day	Night	Day	Night
	Discs or Targets	Colored Lenses or Reflectors	Discs or Targets	Colored Lenses or Reflectors
(1) In main tracks	White or Green	Green	Red	Red
(2) In all other tracks including siding switch or crossover between siding and main track.	White or Green	Green	Yellow	Yellow

(3) Siding switches at ends of middle sidings.

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
Discs or Targets	Colored Lenses or Reflectors	Discs or Targets	Colored Lenses or Reflectors	Discs or Targets	Colored Lenses or Reflectors
Purple	Purple	Yellow	Yellow	Red	Red

(b) Electric switch lamp connected to spring switch indicates:

(1) Green when switch is closed and locked.

(2) Red when switch is unlocked or open.

Note 1. Regulations issued by public authorities require the use of lamps under certain circumstances, and must be complied with.

Note 2. Where the use of a switch lamp or target is normally required, and a switch has been placed out of service, the lamp or target shall remain in service unless the switch, frog and lead rails have been entirely removed.

§203.0 Hot box detectors.

§203.1 Application.

Hot box detectors should be placed on tangent track, and at least 500 feet from nearest turnout or end of curve.

§203.2 Track condition.

(a) At all hot box detector locations, special attention must be given to the maintenance of good gage, surface and line for 100 feet approaching and through the detector to insure that the top of the rail is at proper height with respect to scanners and that the wheels are properly centered with regard to the gage of the track in passing over the detector.

(b) Rail joints should be at least 5 feet from the transducers.

(c) The rail on which the transducers are located should be effectively anchored to restrict movement of the rail.

§203.3 Track work in vicinity.

Whenever track work is to be done in the vicinity of the detector, which may affect the vertical or horizontal relationship of the rails with respect to scanners, the C.& S. Department must be notified so that the device can be regaged.

§203.4 Interference by metal objects.

Employees must be careful not to pass any iron or steel object closely over transducers (coils that are mounted on the side of the rail) between the time that a train has passed over the detector and until the train has passed the home signal in advance to avoid possibility of causing home signal to display stop aspect in face of the train.

§205.0 Derails.

§205.1 Position.

The "Normal" position of a derail shall be to derail wheels of rolling equipment. The "Reverse" position shall be to leave the rails unobstructed for free movement of the equipment.

§205.2 Use of derails.

Derails shall be used as follows:

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

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

(1) Where on account of ascending grade and/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 dirt and weeds, and repainted as often as necessary. (In determining the ascending grade that will prevent equipment from drifting beyond the point of safety, grades on the entire track must be considered. Wind pressure will cause rolling equipment to move against any ascending grade less than 0.5 percent.)

(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," PRR Standard Plan 73930-( ) shall apply. If such a 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 the derailed rolling equipment will not foul the adjacent track. If such a 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 M.W.

(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.

§205.3 Types of derails.

(a) Derails are generally of two kinds, the "split switch" and the sliding or hinged "block" type.

(b) Where derails are prescribed, the split switch type shall be used as follows:

(1) Within interlocking limits, in main tracks and in secondary tracks.

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

(3) In all other tracks where it is possible for the speed of rolling equipment to exceed 15 mph.

(c) Approved block type derails shall be used at locations other than those in paragraph (b) above, where derails are required.

§205.4 Application.

(a) A derail shall be placed a sufficient distance back of the clearance point, not less than 12 feet, to assure that derailed rolling equipment will not foul the main or other protected track. Clearance requirements and track center distances are defined in Section 62.

(b) Methods for installing block type derails are shown on Standard Plans 73920-A and 73921-B.

(c) Where tracks are not parallel at the derail location, or due to other local conditions, it may be necessary to use a deflecting rail to make sure that derailed rolling equipment will not continue moving over the ties to foul the protected track.

(d) Where deflecting rails are used:

(1) The minimum length shall be 18 feet.

(2) The nearest end shall be 10 feet from the derail.

(3) The flangeway opening at the end nearest to the derail shall be 4 inches.

(4) The end farthest from the derail shall be set to provide a 12 inch clear opening between running rail opposite the derail and the deflecting rail.

(5) The deflecting rail shall be of a section and weight not greater than that of the running rails, and preferably less.

(6) The deflecting rail should be spiked to every tie with two rail holding spikes, one on each side of the rail base.

(7) Neither tie plates nor rail braces are to be used unless special circumstances indicate the need.

(8) Existing installations of derails need not be changed to meet these provisions until renewals are otherwise necessary.

§205.5 Operation of derails.

(a) In signaled territory outside of interlocking limits:

(1) Where the main track switch is protected by a facing point lock, the derail may be operated by a pipe line connected to the main track switch throwing and locking mechanism, which operates both the switch and the facing point lock in accordance with Standard Signal Plan.

(2) Where a pipe connected derail is not provided, an independently operated derail at fouling point shall be used, which must be equipped with a track circuit controller, so connected that the signal protecting the main track switch will display its most restricting indication when the derail is not in derailing position.

(b) In manual block territory, the derail may be operated by a pipe line connected to the main track switch stand in accordance with PRR Plan 73920-( ), where considered necessary and authorized by the Chief Engineer M.W.

(c) Lever stands of approved types may be used for operating derails. The distance from center line of lever stand spindle to the gage of nearest rail shall be at least 4 feet 1 inch, where practicable.

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

§205.6 Position indication.

The position of non-interlocked 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 in normal position to derail, and a yellow light in the reverse position. Where authorized by the Chief Engineer M.W., a reflectorized target may be used instead of a self-illuminated light.

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

§205.7 Maintenance.

(a) Derailing blocks shall be painted yellow. Other parts of derails shall be painted black.

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

(c) Dirt and weeds must be kept away from derails.

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