

The New York, New Haven and Hartford
Railroad Company
and
The Central New England
Railway Company

RULES AND INSTRUCTIONS
FOR THE
MAINTENANCE OF WAY
AND STRUCTURES

Effective September 1st, 1916

No. _____

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OF THE

NEW YORK, NEW HAVEN & HARTFORD
RAILROAD COMPANY

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The New York, New Haven and Hartford
Railroad Company

AND THE

Central New England Railway Company

RULES AND INSTRUCTIONS
for the Maintenance of Way
and Structures

Effective September 1, 1916.

The following rules and instructions are issued for the information and guidance of those in charge of maintenance of way and structures.

A receipt, signed in ink, must be taken from each employe to whom a copy of these rules is issued; this receipt to be filed with the superintendent of the division.

They supersede all previous instructions inconsistent therewith.

Special instructions may be issued by proper authority.

W. J. BACKES,

Engineer, Maintenance of Way.

EDWARD GAGEL,

Chief Engineer.

C. L. BARDO,

General Manager.

The New York, New Haven and Hartford

GENERAL NOTICE.

To enter or remain in the service is an assurance of willingness to obey the rules.

Obedience to the rules is essential to the safety of passengers and employes, and to the protection of property.

The service demands the faithful, intelligent and courteous discharge of duty.

To obtain promotion, capacity must be shown for greater responsibility.

Employes, in accepting employment, assume its risks.

Each employe is expected and required to look after and be responsible for his own safety, as well as to exercise care to avoid injury to others.

Any negligent act on the part of any employe may be made the subject of discipline, and employes who are not prudent and careful in protecting themselves and others, and the property of the Company from injury will not be retained in the service.

When it is the opinion of any person whose duty it is to enforce a rule, that the rule cannot be enforced in the interest of the Company or in fairness to employes, he is required to bring the rule to the attention of his superior officer. Employes are invited to call the attention of their superior to any rule, which, in their opinion, is superfluous, impracticable or unfair.

DEFINITIONS.

(Copied from the Operating Book of Rules.)

ENGINE: A locomotive propelled by any form of energy.

TRAIN: An engine, or more than one engine coupled, with or without cars, displaying markers.

REGULAR TRAIN: A train authorized by a time-table schedule.

SECTION: One of two or more trains running on the same schedule displaying signals or for which signals are displayed.

EXTRA TRAIN: A train not authorized by a time-table schedule. It may be designated as—

Extra—for any extra train, except work train.

Work Extra—for work train extra.

SUPERIOR TRAIN: A train having precedence over another train.

TRAIN OF SUPERIOR RIGHT: A train given precedence by train order.

TRAIN OF SUPERIOR CLASS: A train given precedence by time-table.

TIME-TABLE: The authority for the movement of regular trains subject to the rules. It contains the classified schedules of trains with special instructions relating thereto.

SCHEDULE: That part of a time-table which prescribes class, direction, number and movement of a regular train.

DIVISION: That portion of a railway assigned to the supervision of the superintendent.

SUB-DIVISION: A part of a division so designated on the time-table.

MAIN TRACK: A track extending through yards and between stations, upon which trains are operated by time-table or train order, or the use of which is controlled by block signals.

SINGLE TRACK: A main track upon which trains are operated in both directions.

DOUBLE TRACK: Two main tracks, upon one of which the current of traffic is in a specified direction, and upon the other in the opposite direction.

THREE (or more) TRACKS: Three (or more) main tracks, upon any of which the current of traffic may be in either specified direction.

CURRENT OF TRAFFIC: The movement of trains on a main track, in one direction, specified by the rules.

STATION: A place designated on the time-table by name, at which a train may stop for traffic; or to enter or leave main track; or from which fixed signals are operated.

SIDING: A track auxiliary to the main track for meeting or passing trains, limited to the distance between two adjoining telegraph stations.

SIDE TRACK: A track auxiliary to the main track, for purposes other than for meeting or passing trains.

FIXED SIGNAL: A signal of fixed location indicating a condition affecting the movement of a train.

YARD: A system of tracks within defined limits provided for the making up of trains, storing of cars and other purposes, over which movements not authorized by time-table, or by train order, may be made, subject to prescribed signals and regulations.

YARD ENGINE: An engine assigned to yard service and working within yard limits.

PILOT: A person assigned to a train when the engineman or conductor, or both, are not fully acquainted with the physical characteristics, or running rules, of the road, or portion of the road, over which the train is to be moved.

(NOTE—*Numbers in parenthesis indicate number of the same rule in Book of Rules of the Operating Department.)

STANDARD TIME.

1. (*1) Standard time, obtained from Yale or Washington Observatories, will be telegraphed to all points from designated offices at 12:00 noon daily.

CERTIFICATE OF WATCH INSPECTION.

2. Watches that have been examined and certified to by a designated inspector must be used by track supervisors, section foremen, supervisors of bridges and buildings, district bridge and building foremen, bridge and building foremen, signal supervisors, signal foremen, extra gang foremen and such other employes as may from time to time be designated, unless exempted by proper authority.

Watches must be inspected semi-annually, in the months of April and October, and the certificate in prescribed form must be renewed and filed with the superintendent.

An "Employee's Card Certificate" will be furnished employes by the local watch inspector. These certificates must be carefully preserved and presented semi-monthly to the local watch inspector who will enter thereon the record of watch comparisons.

Those who have not access to a standard clock must compare daily with and regulate their watches by those of conductors, engineers, or others who have standard time.

TIME-TABLE.

3. (*4) Each time-table from the moment it takes effect supersedes the preceding time-table, and its schedule takes effect on any sub-division at the leaving time at their initial stations on such sub-division. But when a schedule of the preceding time-table corresponds in number, class, day of leaving, direction, and initial and terminal stations with a schedule of the new time-table a train authorized by the preceding time-table will retain its train orders and assume the schedule of the corresponding number of the new time-table.

Schedules on each sub-division date from their initial stations on such sub-division.

Not more than one schedule of the same number and day shall be in effect on any sub-division.

(Note: On a division which has no sub-division the provisions of this rule shall apply to the division.)

4. (*5) Not more than two times are given for a train at any station; where one time is given, it is, unless otherwise indicated, the leaving time; where two, they are the arriving and the leaving time.

Unless otherwise indicated, the time applies to the place where passenger traffic is received or discharged; where there is no place where passenger traffic is received or discharged, it applies to the switch where an inferior train takes the siding; where there is neither siding nor place where passenger traffic is received or discharged, it applies to the place from which fixed signals are operated.

Schedule meeting or passing stations are indicated by figures in full-faced type.

Both the arriving and leaving time of a train are in full-faced type when both are meeting or passing times, or when one or more trains are to meet or pass it between those times.

When trains are to be met or passed at a siding extending between two adjoining stations, the time at each end of the siding will be shown in full-faced type.

Where there are one or more trains to meet or pass a train between two times, or more than one train to meet a train at any station, attention is called to it by small type adjoining the full-faced type or by a reference letter, thus:

1171 12.30 or b 12.35

1172 1.05 1.00

5. (*6) The following signs when placed before the figures of the schedule indicate:

“s”—Regular stop.

“f”—Flag stop to receive or discharge passengers or freight.

“A”—Arrive.

“L”—Leave.

The following signs on the time-table indicate:

“D”—Day telegraph office.

“N”—Day and night telegraph office.

“S-S”—Signal station.

Other reference letters will be explained on the page on which they occur.

GENERAL RULES.

6. Safety should have the first consideration and in cases requiring urgent attention, take prompt measures to avoid accident.

In case of doubt, take the safe course.

7. The head of each sub-department and each foreman are required to be conversant with the rules of the maintenance of way department, see that copies are supplied to all employes under their direction, whose duties are in any way prescribed, have them examined on such rules, see that the rules are understood and obeyed, and report to the proper officer all violations, with action taken.

8. Employes whose duties are prescribed by these rules and instructions, must provide themselves with copies, and have a copy accessible while on duty.

9. Employes must be conversant with and obey all rules. If in doubt as to their meaning, they must apply to their immediate superior officer, whose duty it shall be to see that his explanation is understood.

10. Any violation of the rules, special instructions or safety regulations must be reported.

11. Employes must pass the required examination.

12. Employes shall conform to the prescribed standards, plans and specifications in the execution of work under their charge.

They will also be governed by any special instructions and safety regulations pertaining to their duties.

13. The use of intoxicants by employes while on duty is absolutely prohibited. Their use, or frequenting of places where they are sold, is sufficient cause for dismissal.

14. Employes must exercise care and watchfulness to prevent injury to themselves, other employes and the public, and to prevent damage to property.

15. Anything that interferes with the safe passage of trains at full speed is an obstruction.

16. In case of danger to railroad property, employes must unite to protect it.

17. Employes must do all in their power to prevent accidents even though, in so doing, they occasionally perform the duties of others.

18. Co-operation is required between all employes whose work or duties may be jointly affected.

19. Employes whose duties are in any way affected by the time-tables, must always keep standard time and have a copy of the current time-table with them when on duty and will be governed by the instructions shown therein. Time-tables that have been superseded must be destroyed.

20. Persons employed in any service on maintenance of way and structures, are subject to the rules and special instructions.

GENERAL REGULATIONS.

21. Civil, gentlemanly deportment is required of all employes in their intercourse with the public, their subordinates, and each other. Boisterous, profane, or vulgar language is forbidden. Courtesy and attention to patrons is demanded. Employes must not enter into altercation with any persons, no matter what provocation may be given, but will make note of the facts and report to their immediate superiors.

22. Employes who are dishonest, immoral,

quarrelsome, or otherwise vicious, will not be retained in the service.

23. Employes are required to report any misconduct or negligence affecting the interest of the Company. Withholding such information will be considered proof of negligence or indifference, and treated accordingly.

24. Employes are required to report by engine numbers all trains that exceed the speed prescribed by slow order, disregard caution signals or fail to answer "Stop" with the whistle.

25. Employes must always be vigilant to protect, and must promptly report anything detrimental to the Company's interest.

26. Employes are held responsible for the strict performance of their duties, and for the proper use and protection of all property intrusted to their care or subject to their management and control.

27. In case of damage to Company's property, employes must unite to protect it. Any employe observing an obstruction upon or damage to the road or structures will take the necessary steps to insure the safety of traffic, and immediately report the circumstances by telegraph to all concerned.

28. Minors must not be allowed in any department without the written consent of their parents or guardians on prescribed form, which must be executed before such employment begins. A record of service shall be kept of such employes by their supervisor.

29. Unless specially authorized, employes must not use the Company's credit, and shall neither receive nor pay out money on the Company's account.

30. It is required that payrolls and reports show correctly the occupation of the persons

whose names appear thereon. No time is to be allowed except for work actually performed.

33. The Company reserves the right to terminate the employment of any employe without notice. Payment will be made only for services performed up to the termination of such employment.

34. The assignment of wages by employes is prohibited.

The attachment of any employe's wages by legal process will be considered cause for dismissal. Any cost or expense incurred by the Company because of such attachment must be repaid to it by the employe.

35. No persons suspended or dismissed from the Company's service (other than laborers) shall be re-employed without the consent of the officer who dismissed them or that of the head of the department from which they were discharged, except in cases where they were relieved from service on account of reduction in force.

36. Employes desirous of appealing to the head of the department must do so through the proper officer.

37. Persons whose hearing, sight or color perception is known to be defective, must not be employed in any capacity where such defect might endanger life or property.

38. Employes must devote themselves exclusively to the railroad's service, attending during the prescribed hours, and residing wherever required. They must not, directly or indirectly, engage in any other business or trade without permission. Employes who are liable to be called upon for duty at any time, must keep the proper officer advised as to where they can be found.

39. The giving of presents by employes to

their superiors and the acceptance by employes of gratuities or rewards from patrons of the railroad are prohibited.

40. Employes will be regarded as in line for promotion and advancement depending upon the faithful discharge of duty and capacity for increased responsibility.

41. Foremen may employ their own men and suspend or discharge them for incompetency or insubordination.

42. The selection of new men for permanent service, in a capacity other than laborer, shall be made only upon written application on prescribed form.

43. No appointment or promotion to the position of foreman will be made until after the applicant has been examined as to knowledge and understanding of all rules which relate to his duties and has received a certificate of qualification signed by the proper official.

44. No person should be employed in any capacity other than laborer who cannot write and read writing with ease, except by special authority.

45. Employes entering the service are required to read, or have read to them, outstanding instructions or rules involving their own safety or that of others.

46. Persons formerly employed upon other railroads must not be allowed to enter the service unless satisfactory evidence is obtained as to their record.

47. Employes must, on leaving the service of the Company, or upon demand of proper authority, return all property of the Company which may be in their possession, making good any loss or damage done to it through misuse or neglect.

48. The right is reserved to withhold from

wages due, the value of such articles as are lost or are not surrendered on leaving the service.

49. Employes must not absent themselves from duty, exchange duties with others, or engage substitutes, without proper authority from superior officer.

50. The heads of sub-departments, foremen and others, who are liable to be called upon at any time, are required to keep the proper officer advised as to where they can be found. They shall keep a record of the addresses, telephone and telegraph calls, of all the men under their charge, so that they can be promptly called in case of emergency.

51. Employes subject to call shall notify their immediate superior officer of any change in address, whether temporary or permanent.

52. Employes are subject to call in handling snow and other emergencies and shall perform the duties assigned to them.

53. The use of tobacco by employes while on duty in or about passenger stations or on passenger coaches is prohibited.

54. Employes whose duties require service on more than one division or sub-division are under the jurisdiction of the officers of the division or sub-division on which the service is being performed.

55. Excavations shall be carefully made, track will be subject to rules governing maintenance of track.

56. Excavations shall be carefully made, using shoring or sheet piling if necessary to avoid disturbing neighboring structures and track, or possibility of slides.

57. Detention of traffic must be avoided. Work will be so arranged that track and bridges will be made passable for regular trains

when due, unless foremen are otherwise instructed.

58. Slow orders should be promptly cancelled when no longer necessary.

59. Private tracks or structures on right of way, or involved in the operation of the Company's trains, are subject to these regulations unless otherwise ordered.

60. The observance of rules for prevention of fire, as set forth in notices displayed, is required, and all employes must be familiar with them.

61. Employes must, at all times, hold themselves in readiness to aid the passage of trains and in case of accident or delay, will render all assistance in their power.

62. Should trains be delayed by accident or from other cause, the conductor is authorized to call on any employe for assistance. Foremen will respond promptly when so called and must assist with their entire force if necessary. The foreman upon whose section an accident occurs must appoint the necessary watchmen who will remain on duty until the Company's property has been removed or until they are relieved from such duty by the track supervisor or other official.

63. Trainmen are required to handle their own switches. Except to prevent an accident, employes unauthorized to do so will not handle switches for trainmen. Ordinarily switches must not be thrown for velocipede or hand-cars; such cars must be lifted over. When necessary to throw switches for loaded push-cars, and motor cars, it must be done only under the personal supervision of the foreman, and switch must be immediately returned to its original position.

64. Switches must be left set and locked for the main track, after having been used.

Employees of the maintenance of way department shall not open or close switches at the request of trainmen or for trains except in case of emergency.

65. Employees must not unlock main track switches, nor stand within twenty feet of switch on the approach of, or during the passing of, any train.

66. No attempt shall be made to close the switch until the last wheels are off the switch rails. The person who locks the switch must grasp the chain and pull the lock and see that it is securely fastened, and, after having done so, must look at the switch points and know that they are in their proper position.

67. Both switches to a crossover leading to main tracks must be locked in their normal position during the passage of any train on the main track, and must not be unlocked or opened until the train is ready to use the crossover.

68. If any switch upon the main track is found to be defective or to have a defective lock, the switch must be secured and reported by telegraph by the person discovering it to the superintendent and others concerned.

69. Switch keys will be furnished to such employees as may be directed by the proper officer. Employees entrusted with such keys must receipt for them on proper form.

70. All accidents involving injury to persons, or damage to track, structures, or rolling stock, must be reported promptly by telegraph to the proper officer and confirmed by mail. In case of injury to persons, the names and addresses of as many witnesses as possible must be obtained.

71. In reporting accidents and unusual occurrences the situation must be fully stated, with all the facts and particulars necessary to a clear understanding, as known to the person making the report, without necessity for inquiries to obtain such information. Any material which may be of use in determining the cause of accident must be preserved. A careful estimate of material necessary to repair damage must be made. Requisition for the emergency material to be used under such circumstances must be carefully made and necessities, so far as possible, anticipated, in order to avoid delay to the work. Exaggerations must be avoided.

72. Personal injuries must be promptly reported no matter how trivial they may be, on prescribed forms stating whether the person is an employe or not. Foremen are not permitted to exercise their discretion as to the necessity for such report. If such injuries are serious they must be reported by wire to superintendent, effort made to promptly obtain medical assistance, and remove the injured person to most available place for proper treatment.

73. Material received on cars must be promptly unloaded, so that there may be no unnecessary detention to equipment. In loading cars, care must be taken not to exceed their capacity. Piles, timber and structural material must be loaded in such a manner as to insure safe passage through bridges and tunnels. Foremen must be conversant with the Master Car Builders' Rules governing loading and comply therewith. Rails, stone or other heavy material must be distributed on the cars uniformly.

74. Track supervisors, supervisors of

bridges and buildings, signal supervisors and others in charge of work must see that all material, supplies and tools received are carefully inspected and checked by invoice.

75. Storehouses, repair shops, tool houses and boxes, hand and push-cars, bunk houses, and other buildings, must be kept neat and orderly. Materials of all kinds, including spikes, bolts, washers, rivets, etc., should be properly sorted and kept in readiness for use.

Every employe is required to keep the premises subject to his control in a neat and clean condition.

76. Ties, lumber and other material must be piled in regular order, not within the standard clearance, and so placed that it cannot fall upon, or obstruct, the track, thereby interfering with the safe passage of trains. Material must never be piled between passing and main tracks, or upon any public highway. When stone or other material is unloaded, it must be immediately moved a sufficient distance from the track to avoid damage thereto, or to trains.

77. All foremen must exercise great care in handling heavy material to avoid damage to such material, and injury to men.

78. Foremen and other employes must not take coal from cars in transit, or from coal bins. Foremen will see that this rule is obeyed and promptly report any violation of it.

79. Foremen and other employes should keep on good terms with land owners and other citizens, and treat them politely, so as to gain their good will for the railroad; they should listen patiently to complaints of land-owners or their tenants about road crossings, cattle guards, drainage, or damage said to have been done to their property by the railroad or its

employes, and report such complaints, with the facts relative to them, to the supervisor.

80. Employes shall furnish no information regarding the Company's property or business to outside parties, except through the proper officers.

81. Employes must not permit experimental trials of appliances or devices, not standard with the Company, except by proper authority, and will not answer communications from manufacturers and dealers in various tools. Such communication should be forwarded through official channel to the engineer, maintenance of way, with complete expression of views with reference to the matter in question.

82. Buildings of private industries must not be located less than standard distance from any track, without special authority, and shall in no case be located on main or passing track, or on any lead track.

83. The telegraph must not be used unless advisable in the railroad's interests, and telegrams must be as brief as possible, consistent with clear understanding.

84. Locomotives or cars with tires worn over one-quarter ($\frac{1}{4}$) inch in depth, or that have flat wheels, should be promptly reported.

85. Messages or orders relative to the condition of track, roadbed or structures, must be in writing.

86. Stone bounds marking the railroad centre line of location, or property lines, must not be broken or disturbed and engineer's stakes must be carefully preserved. When necessary to remove, or change the position of a stone bound, it shall be done only under the direction of the engineer of real estate.

87. All employes in an official capacity should have a general knowledge of railroad

laws governing in their territory. Supervisors will, when necessary, provide foremen with copy of special laws governing forest fires.

88. Employes shall work the prescribed number of hours daily.

WARNINGS.

89. Every person accepting employment does so with full knowledge of the dangers incident to the operation of railroads and agrees to exercise due care in the performance of his duties to prevent accident to himself or others.

90. Every employe is required and warned to see for himself that the machinery, appliances, tools, hand, push, motor and velocipede cars, which he is expected to use, are in proper condition for the service required, and if not, to put them in proper condition, or see that this is done, before using them.

91. Employes are warned that at various points along the line of this road there are platforms, sheds, roofs, water tank frames, telegraph poles, bridges, scales, mail cranes, cars, and other side obstructions, and bridges, trolley wires of street railways, telegraph and telephone wires and other overhead obstructions that will not clear them when on the top or sides of cars or engines, and they must inform themselves as to the location of such obstructions and use all necessary care to avoid injury thereby.

92. The railroad does not have all of its main tracks and side tracks ballasted or surfaced, and said tracks are likely to have slivers on the rails; also, there are cattle guards and uncovered drains on main tracks and side tracks, and other openings between or obstruc-

tion upon the ties, and employes are hereby notified to advise themselves thereof.

93. No officer or employe of this railroad is authorized to request or require any employe to use defective tracks, cars, machinery or appliances of any kind. Any employe using defective tracks, cars, machinery or appliances of any kind does so at his own risk.

94. The schedule of all time-table trains must be observed, but employes are warned that extra and special trains may run at any time. Trains may run on any track, in either direction, without notice, except to those whom it is necessary to advise in order to insure proper movement of such trains. Foremen must not assume that a train may not come for any certain time, or act under the assurance of any person to that effect, but will at all times protect themselves with proper signals. Track supervisors, bridge and building supervisors, and signal supervisors will be held responsible for proper understanding and strict observance of these rules by themselves and those under them. Foremen must know that their gangs and track walkers are always supplied with proper signals, flags, lanterns, torpedoes, etc., and must instruct as to their use.

95. It is dangerous to assume that signals given to the engineman or fireman have been seen, and if seen will be obeyed, when obedience to these signals on the part of the engineman or fireman is essential to the safety of an employe in the performance of his duty. He must know that the signal has been seen, understood and obeyed before placing himself in a dangerous position; otherwise, without such knowledge, he assumes all risks of danger arising from any misunderstanding or disregard of signals.

96. Stepping upon the front of approaching engines, or riding upon the pilot, jumping off or on trains or engines moving at high speed, getting between cars in motion to uncouple them, and all similar imprudences are dangerous and in violation of duty. Employees are warned that if they commit them it will be at their own peril and risk.

97. Track jacks must not be used except under proper protection.

98. Supervisors, foremen and all other employes shall warn the public of the danger of walking on the tracks or roadbed, and, so far as practicable, prevent trespassing on the tracks or right of way.

99. Employees who are careless of the safety of themselves or others will not be continued in the service.

PRECAUTIONS.

100. Foremen and others in charge of work must always bear in mind that safety is the first and most important consideration.

101. Supervisors and foremen must forbid their men placing themselves in dangerous positions. Employees must promptly get out of the way of approaching trains and move a sufficient distance away from the track or tracks on which such trains are being operated to avoid being struck by the trains or by coal, stone, car doors or other articles which may fall from the sides or tops of engines or cars in the trains, and employes should remove tools to a safe distance from such track or tracks. At points where there are two or more main tracks, employes must stand outside of and clear of all main tracks. All employes are further warned that they must not rely on others to notify them of

the approach of a train. The men must not be permitted to get on or off hand-cars or trains while in motion, nor to stand between main tracks or upon adjacent sidetrack while trains are passing. Foremen must also be watchful at all times to protect their men against injury, especially during fogs and storms.

102. Except in case of emergency, work that will obstruct the track or render it unsafe for the usual speed must not be done during fogs or storms.

103. The greatest care must be exercised in protecting obscured track, if work must be done during fog. Such work as is practicable should be postponed until the fog lifts.

104. When two gangs are working close together, care must be taken to prevent confusion of Caution and Stop signals. The foremen must confer together and arrange for full protection of the work as provided by the rules. Both foremen will be held equally responsible for confusion of signals.

105. Hand, motor, push and velocipede cars must be used only for Company business. They must not be attached to trains. Foremen must accompany them on the main track, and when not in service they must not be left standing on track, but shall be removed and placed at least six feet from the nearest rail, and fifty feet from a road crossing; locked and secured, if not otherwise protected. Unauthorized persons will not be permitted to ride on these cars. On two or more tracks, foremen will be held responsible for operating their cars in the proper direction. Hand cars must be kept a sufficient distance apart to insure absolute protection to employes using them. Water kegs, track jacks and other tools liable to derail the car must be carried on the side or rear.

106. Loaded push cars must be protected in both directions by Stop signals. They must never be used in fogs or at night unless absolutely necessary.

Hand cars must be run with great caution at all times, and particularly at night and in fogs. Frequent stops to listen for approaching trains must be made, and flagmen must be sent ahead around all curves as an additional precaution. If in foggy weather the destination of the men is within a mile either way of the section house, they should walk to work; the car must not be used.

107. Hand cars, push cars, motor cars, etc., are to be operated only on freight tracks where there are separate tracks for passenger and freight service, except in case of emergency.

108. Hand and push cars with metal wheels, or metal track gauges, that are not insulated, must not be used on any track that is bonded, to guard against interference with the signal system and the possible giving of a wrong signal indication.

109. Only employes of the Railroad Company in the discharge of their duties will be permitted on the tracks of the Company on velocipedes, motor cars, hand cars, or push cars, unless special permits are given in writing by the division engineer or the division superintendent, after the necessary release has been signed.

(See also special rules for the Operation of Motor, Hand and Push Cars and Velocipedes.)

110. All employes will observe trains closely and if anything dangerous is noted, such as a hot box, defective coupling, brake rod or brake beam dragging, or if trains are running too closely together, must call attention of trainmen and enginemen to the fact, by signal.

111. Should a piece of broken wheel flange be found on or near the track, foreman must proceed at once to the nearest telegraph office and report the fact by wire to the superintendent and track supervisor. All rails damaged by broken flanges must be promptly reported by wire to the track supervisor, and those seriously damaged removed.

112. During extremely cold weather accidents are liable to result from ice forming at water stations. Foremen on whose section water stations are located shall see that the ice is kept below the top of rails and properly flanged out. At water stations where pumpers are regularly stationed, foremen will notify them to attend to this duty.

113. All cases of leaky tanks or tank valves should be reported promptly, by wire if necessary, to the supervisor of bridges and buildings.

114. The discovery of unsafe track, bridges, culverts, obstructions and all conditions likely to affect the safety of trains, such as storms, fires, floods, etc., must, after being protected in accordance with the rules, be promptly reported by wire to the superintendent, division engineer and supervisor concerned. In case of threatening or prevailing storms, track must be patrolled and all bridges, culverts or particular localities in track liable to be affected by such storms, must be closely watched. Forces will be freely used to patrol the track under such conditions. When traffic is obstructed, the completion of repairs must be promptly reported.

115. Foremen, track walkers and other employes must notice all derails and report to the superintendent and track supervisor any that are not set to derail, whether there are cars on the track they protect or not.

116. In case of damage to trains or structures, wherein the security of Company property or freight is involved, it is the duty of all concerned to see that watchmen are immediately stationed, and that arrangements are promptly made for the protection of such property against thieving or loss from other causes.

117. Every precaution must be taken to prevent loss or damage by fire. Instructions of the insurance inspector must be immediately obeyed; rubbish, oily waste, rags, straw, waste paper or other combustible material must not be allowed to accumulate in or about cars, offices, stations or other buildings of the Company. Matches, oil and lamps must be kept separate and in secure places. Electric wires, chimneys, stovepipes, stoves and steam pipes must be known to be safe, and should be examined frequently.

118. Station platforms, fences, tool houses, overhead foot-bridges, driveways and grounds at stations and yards must be kept in good order and defects that might cause injury to persons be promptly protected, repaired if possible, otherwise, reported to the supervisor concerned.

119. When it is necessary to obstruct or in any manner change the nature of the ground where trainmen or others habitually walk or alight from trains, or any radical change is to be made in track, structures or appliances in habitual use, the superintendent must be notified so that notice may be issued and the necessary precautions taken.

120. When any radical change is to be made in tracks, structures or appliances in habitual use, the proper officials must be ad-

vised, so that notice may be issued and the necessary precautions taken.

121. In case of injury to an employe while using tools, such tools must be marked for identification and preserved for inspection.

122. When children, and persons who are apparently under the influence of liquor, or demented, are seen in the vicinity of stations or tracks, they should be carefully guarded from approaching trains and as soon as possible taken to a place of safety. Foremen must caution pedestrians against walking on tracks, roadbed or right of way.

SIGNAL RULES.

123. (*7) Employes whose duties may require them to give signals, must provide themselves with the proper appliances, keep them in good order and ready for immediate use.

124. (*8) Flags of the prescribed color must be used by day, and lamps of the prescribed color by night.

125. (*9) Night signals are to be displayed from sunset to sunrise. When weather or other conditions obscure day signals, night signals must be used in addition.

126. Any danger signal, except fixed signals hereinafter described, while in use, shall always be accompanied by a man.

127. Red, green or yellow clothing may be mistaken for signals, and must not be worn by maintenance of way employes while on duty.

VISIBLE SIGNALS.

Color Signals.

128. (*10).

COLOR	INDICATION
(a) Red (or Purple)....	Stop.
(b) Green	Proceed and for other uses prescribed by the rules.
(c) Yellow	Proceed with caution, and for other uses prescribed by the rules.
(d) Green and White..	Flag stop. See Rule 28.
(e) Blue	See Rule 26.

129. (*11) A fusee on or near the track burning red must not be passed. When burning yellow it is a caution signal.

130. (*12).

MANNER OF USING	INDICATION
(a) Swung across the track	Stop.
(b) Raised and lowered vertically.	Proceed.
(c) Swung vertically in a circle at half arm's length across track.	Back.
(d) Swung vertically in circle at arm's length across the track.	Train has parted.
(e) Swung horizontally above the head.	Apply air brakes.
(f) Held at arm's length above the head.	Release air brakes.

131. (*13) Any object waved violently by anyone on or near the track is a signal to stop.

When a train has one engine, signals to the engineman must be given according to the way the engine is headed.

When a train has more than one engine either headed in opposite directions or placed in different parts of the train, the conductor must have a proper understanding with the enginemen and train crew to avoid misunderstanding of signals.

AUDIBLE SIGNALS.

Engine Whistle Signals.

132. (*14).

Note:—The signals prescribed are illustrated by "o" for short sounds; "—" for long sounds. The sound of the whistle should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

SOUND	INDICATION
(a) o	Stop. Apply brakes.
(b) ---	Release brakes.
(c) - o o o	Flagman go back and protect rear of train.
(d) - - - - -	Flagman return from west or south.
(e) - - - - -	Flagman return from east or north.
(f) - - - -	When running, train parted; to be repeated until answered by the signal prescribed by Rule 12 (d). Answer to 12 (d).
(g) o o	Answer to any signal not otherwise provided for.
(h) o o o	When train is standing back. Answer to 12 (c) and 16 (c). When train is running, answer to 16 (d).
(j) o o o o	Call for signals.
(k) - o o	To call the attention of yard engines, extra trains or trains of the same or inferior class or inferior right, also signalmen at interlocking plants, to signals displayed for a following section.
(l) - - - o o	Approaching public crossings at grade,
(m) - - - - -	Approaching stations, junctions and railroad crossings at grade.
(n) o o -	Answer to 16 (aa) or to conductors hand signal prescribed by Rule 90a.
(o) - o o o repeated	Fire alarm.
(p) o o o o	On electrically operated trains to call trainmen, except flagmen, forward.
(r) o o o o o o	To notify signalman that train will take outlying siding.

A succession of short sounds of the whistle is an alarm for persons or cattle on the track.

On double, three or more tracks, the following whistle signals will be used for signaling the flagman to return:

SOUND	INDICATION
(aa) - - - - -	Flagman for Track No. 1 return from the east or north.
(ab) - - - - -	Flagman for Track No. 2 return from the west or south.
(ac) - - - - - o	Flagman for Track No. 3 return from the east or north.
(ad) - - - - - o	Flagman for Track No. 4 return from the west or south.
(ae) - - o o o	Flagman for Track No. 5 return from the east or north.
(af) - - o o o o	Flagman for Track No. 6 return from the west or south.
(ag) o - - - - -	Flagman for Track No. 1 return from the west or south.
(ah) o - - - - -	Flagman for Track No. 2 return from the east or north.
(ai) o - - - - - o	Flagman for Track No. 3 return from the west or south.
(aj) o - - - - - o	Flagman for Track No. 4 return from the east or north.
(ak) o - - o o o	Flagman for Track No. 5 return from the west or south.
(al) o - - o o o o	Flagman for Track No. 6 return from the east or north.

133. (*15) The explosion of two torpedoes, not more than two hundred feet apart, is a signal to reduce speed and look out for stop signal or track obstruction. The explosion of one torpedo will indicate the same as two, but the use of two is required.

Torpedoes must not be placed near rail joints, nor near stations and road crossings.

134. (*16).

COMMUNICATING SIGNALS.

SOUND	INDICATION
(aa) One	When train is running, approaching meeting point. To be answered by 14 (n).
(a) Two	When train is standing, start. See Rule No. 84.
(b) Two	When train is running, stop at once.
(c) Three	When train is standing, back the train.
(d) Three	When train is running, stop at next station.
(e) Four	When train is standing, apply or release air brakes.
(f) Four	When train is running, reduce speed.
(g) Five	When train is standing, call in flagman.
(h) Five	When train is running, increase speed.
(k) Six	Increase heat
(l) Seven	Brakes sticking. (See rules 741 and 765).

When a train has one engine, signals to the engineman must be given according to the way the engine is headed.

When a train has more than one engine either headed in opposite directions or placed in different parts of the train, the conductor must have a proper understanding with the enginemen and train crew to avoid misunderstanding of signals.

TRAIN SIGNALS.

135. (*17) The head-light will be displayed to the front of every train by night.

136. (*18) Yard engines will display the head-light to the front and rear by night. When not provided with a head-light at the rear, two white lights must be displayed. Yard engines will not display markers.

137. (*19) The following signals will be displayed, one on each side of the rear of every train, as markers to indicate the rear of train:

By day, marker lamps without lights.
By night, yellow lights to the front and side and red lights to the rear, except when the train is clear of the main track when yellow lights must be displayed to the side and rear. When a train is turned out against the current of traffic, yellow lights must be displayed to the side; and to the rear a yellow light on the right and red light on the left side.

On four tracks, a train running with the current of traffic on track 3 or 4 will display to the rear a yellow light on the left side and a red light on the opposite side.

During snow and sleet storms by day, the lights in marker lamps must be kept burning to prevent snow or ice obscuring them, and under conditions provided for by Rule 9.

138. (*20) All sections except the last will display two green flags, and in addition, two green lights by night, in the places provided for that purpose on the front of the engine.

139. (*21) Extra trains will display two white flags and, in addition, two white lights by night, in the places provided for that purpose on the front of the engine, except as provided in Rule 21a.

140. (*21a) On double, three or more tracks, the display of white flags and white lights will be omitted on extra trains except trains composed of passenger equipment with or without caboose; and except that an extra train making part of its trip over single track and part over double, three or more tracks, may display white flags and white lights to or from its terminating or originating station.

On double, three or more tracks, light en-

gines, freight trains and work trains will not be run as sections of first class schedules.

141. (*22) When two or more engines are coupled, the leading engine only shall display the signals as prescribed by Rules 20, 21 and 21a.

142. (*23) One flag, marker lamp, or light displayed where in Rules 19, 20, 21 and 21a two are prescribed, will indicate the same as two; but the proper display of all train signals is required.

143. (*24) When cars are pushed by an engine (except when shifting or making up trains in yards) a white light must be displayed on the front of the leading car by night or when the train is obscured by fog or other causes.

144. (*25) Each car on a passenger train must be connected with the engine by a communicating signal appliance.

145. (*26) A blue flag by day and a blue light by night, displayed at one or both ends of an engine, car or train, indicates that workmen are under or about it; when thus protected it must not be coupled to or moved. Workmen will display the blue signals and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to intercept the view of the blue signals, without first notifying the workmen.

146. (*26a) A yellow flag by day and in addition a yellow light by night must be displayed at each end of boarding cars standing on side-tracks.

If cars are placed ahead of boarding cars the yellow signals must be placed so as to afford protection, and if cars so placed are removed, the signals must immediately be displayed at the end of the boarding cars.

The employe in charge of the boarding cars must know that the yellow signals are displayed. When cars are placed ahead of boarding cars, or when cars so placed are removed, the conductor must arrange the signals so as to afford protection.

USE OF SIGNALS.

147. (*27) A signal imperfectly displayed, or the absence of a signal at a place where a signal is usually shown, must be regarded as the most restrictive indication that can be given by that signal, and the fact reported to the superintendent from the first open telegraph office at which the train stops.

148. (*28) A combined green and white signal is to be used to stop a train only at the flag stations indicated on its schedule. When it is necessary to stop a train at a point that is not a flag station on its schedule, a red signal must be used.

149. (*29) When a signal (except a fixed signal) is given to stop a train, it must, unless otherwise provided, be acknowledged as prescribed by Rule 14.

150. (*30) The engine bell must be rung when an engine is about to move.

151. (*31) The engine bell must be rung on approaching every public road crossing at grade, and until it is passed; and the whistle must be sounded at all whistling posts. When backing passenger trains, the trainmen must also sound the air whistle signal on the leading car, also gong, if so equipped.

152. (*32) The unnecessary use of either the whistle or the bell is prohibited. They will be used only as prescribed by rule or law, or to prevent accident.

153. (*33) Watchmen stationed at public road and street crossings must use red signals only when necessary to stop trains.

White signals must be used to prevent street traffic from crossing tracks when trains are approaching.

SAFETY FIRST.

154. Anything that interferes with the safe passage of trains at full speed is an obstruction and in case of impassable or unsafe track, flagging is the first duty.

155. Foremen must always have a supply and carry with them, flags and lamps of the prescribed color, and torpedoes ready for immediate use, when required; also a supply of printed forms, as per Rule 156.

156. When sending out flagmen, the foreman will give each flagman a sufficient supply of printed forms which have been properly filled out and signed by the foreman personally, showing the date, and kind of work being done, or other conditions which render the track unsafe, with exact location of obstruction, from a mile post, station, bridge, or other structure, as follows:

Form No.

SAFETY FIRST.

Flagging, Slow Order, and Cautionary Signal Rules.

.....19.....

ENGINEMEN:—

You are flagged on account of.....

.....Foreman.

(give nature of work or obstruction)

..... at

(give approximate length of road affected)

Do not pass that location until you get a signal from me to do so, and then run not to exceed 10 miles per hour over it.

.....Foreman.

The flagman will hand one of these signed forms to the engineer of each train flagged as per Rule 161. Engineers are instructed to throw off to the foreman the form thus delivered, as proof that the flagman has carried out his instructions.

157. The main tracks must not be obstructed without first being protected in both directions by proper signals, as extra trains may be run at any time, without notice, on any track and in either direction.

158. No work shall be undertaken, except to repair dangerous defects of track, roadway, or structures, that will obstruct the main track, or interfere with the safe passage of trains, within fifteen minutes before the time of first class trains and ten minutes before the time of other scheduled trains, without authority of the superintendent.

159. Except in case of emergency, work must not be done that would interfere with the safe passage of trains at full speed, during fog, or blinding storms.

160. Where main track is to be obstructed for repairs, or renewals, or an obstruction of the track is discovered that will interfere with the safe passage of trains at full speed, a reliable flagman must be sent in each direction, with proper signals, a sufficient distance from the obstruction to insure full protection; not less than 1200 yards (24 telegraph poles). At night, or during foggy or stormy weather, or where the view is obstructed, also on descend-

ing grades, or where other conditions require it, the flagman will increase the distance to 1800 yards (36 telegraph poles), or as much further as is necessary to insure full protection.

Block and interlocking signals will not relieve flagmen from the observance of this rule.

Signals to be used by flagmen:

By day—red flag;
torpedoes;
fuses.

By night—red light;
torpedoes;
fuses.

161. When a flagman is sent out to signal an approaching train, after going a sufficient distance to insure full protection, in addition to displaying Stop signals, he shall place two torpedoes on the rail two rail lengths apart on the engineman's side, and with red flag by day and red light by night, stop all trains and hand each engineman one of the printed forms properly filled out, as per Rule 156, and, where necessary, explain more fully the reason for flagging.

When each train thus flagged proceeds, flagman must immediately replace torpedoes and take position as in the first instance, continuing the protection until recalled.

Flagmen must repeat Stop signals until they are answered by enginemen giving two short blasts of whistle.

If an approaching train is within sight or hearing before the flagman has reached a point insuring full protection he must, at once, place torpedoes on the rail, and at night or in foggy or stormy weather, or where the view is obscured, he will, in addition, display a lighted fusee, and continue toward the approaching train, displaying stop signals until it is met.

When a flagman is recalled an employe under jurisdiction of the same foreman shall be sent to notify him that the track is safe, unless foreman can go personally.

When recalled (and not before) flagmen must remove all torpedoes.

162. When using torpedoes, they must not be placed near rail joints, stations, street or road crossings, or where workmen are engaged, or where persons would be in danger of injury by them, and torpedoes exploded or damaged by hand cars must be replaced.

No person should be within three rail lengths of a torpedo when exploded on account of the danger from flying fragments.

163. Foremen must make provision for relieving flagmen who have been on duty an unusual length of time, and arrange to provide them with night signals in ample time before such signals will be required.

164. Flagmen must be cautioned not to leave their posts under any circumstances until relieved or recalled, nor to sit while on duty, as they are likely to fall asleep and accidents result.

Foremen or others sending out flagmen must instruct them in accordance with the rules for flagging.

165. When slow orders are required for a period exceeding twenty-four (24) hours, standard temporary shield-shaped yellow slow board must be placed on the engineman's side of the track 2000 feet from the point to be protected, indicating that speed must be reduced in accordance with bulletin instructions on account of track or bridge work, and a green resume speed board, with a green light at night, shall be placed on the engineman's side of the track

50 feet beyond the limit where reduced speed is necessary, in connection with temporary slow board, indicating that speed may be resumed as soon as the last car in the train has passed it.

166. In addition to protection by proper signals, the superintendent must be notified by wire of any defect in track, roadway or structures which cannot be repaired or remedied promptly, giving location, character of defect and speed requirements, so that proper slow order may be issued to trains.

Until foreman receives copy of slow order, he must see that flags or lights are in position, and after receiving such order he must use reasonable precaution to see that flags and lights are maintained during the period that slow order is required. When no further necessity exists for a slow order, it must be promptly cancelled to avoid unnecessary delay.

167. When track is protected, either by flagmen or slow signals, foreman in charge must listen attentively and watch closely for approaching trains, and when such trains come into view give signals as the conditions and rules require, always standing apart and to one side of his men, and giving signals clearly, so that they can be understood.

168. Slow signals must not be relied upon when flagmen should be sent out.

169. On account of the possibility of misunderstanding signals, two track gangs or a bridge and track gang should not work within flag limits of each other when it can be avoided.

When necessary to do this, a full understanding must be had by both foremen, and their flagmen instructed accordingly.

170. Any disregard of either danger or caution signals, or excessive speed over bad track,

must be reported promptly to the superintendent and supervisor concerned, giving engine and train numbers, if possible, and time.

171. When track is to be obstructed within the limits of automatic block territory, the foreman in charge will, if possible, give the signal maintainer at least 24 hours' notice previous to doing any work that will affect the working of signals.

A flagman must be sent to the farthest signal on each side of the obstruction, which is held at "Stop" as a result of this work, who will stop all trains and advise engineman of the location of the obstruction.

The track must be left in safe condition for traffic until flagmen are out and signal maintainer has set automatic signals at "Stop".

FIXED SIGNALS.

172. Fixed signals are placed at junctions, crossings, stations, block stations, and other points as required.

Special instructions indicating their position and use have been issued.

Employes whose duties are prescribed thereby are required to provide themselves with copies.

DESIGNATION AND USE OF TRACKS.

173. (*40) Where there are two or four main tracks used by trains running under the authority of the same superintendent, the track on the right of, and adjoining the centre line when looking west or south, in the general direction in which trains are shown on the timetable, will be designated as Number 1; the next track as Number 3. The track to the right of

and adjoining the centre line when looking in the opposite direction will be designated as Number 2; the next track as Number 4.

Where there are more than four main tracks, the numbers of the additional tracks and the current of traffic will be specified on the time-table, or by special instructions.

174. (*41) Unless otherwise provided, west or southward trains will run on tracks 1 and 3; east or northward trains on tracks 2 and 4. The use of three or more tracks by trains will be designated by time-table or special instructions.

175. (*42) Sidings and side-tracks upon the right of the main track or tracks, when looking west or south in the general direction in which trains are shown on the time-table, will be designated by odd numbers, the track next to the main track or tracks as Number 5, the next as Number 7, and so on.

Sidings and side-tracks upon the opposite side of main track or tracks will be designated by even numbers; the track next to the main track or tracks as Number 6, next as Number 8, and so on.

176. (*43) On portions of the road so specified on the time-table, trains will run with the current of traffic by block signals, whose indications will supersede time-table superiority.

In emergencies trains may be moved against the current of traffic by pilot engine as prescribed on the time-table, or by train orders.

ORGANIZATION.

177. The maintenance of way and structures is in charge of the engineer, maintenance of way, who will report to and receive instructions from the general manager.

The organization on each division will be as follows:

(a) Division engineer, who will report to and receive instructions from the superintendent on maintenance of way and structures and to the engineer, maintenance of way, on contract work and standards.

(b) Assistant engineers, reporting to and receiving instructions from division engineer.

(c) Track supervisors, reporting to and receiving instructions from division engineer.

(d) Assistant track supervisors, reporting to and receiving instructions from track supervisors.

(e) General foremen, extra gang foremen, work train foremen and section foremen, reporting to and receiving instructions from track supervisor.

(f) Supervisor of bridges and buildings, reporting to and receiving instructions from the division engineer.

(g) Division and district bridge and building foremen, reporting to and receiving instructions from the supervisor of bridges and buildings.

(h) Bridge and building foremen, reporting to and receiving instructions from the district bridge and building foremen, unless otherwise instructed.

(i) Supervisor of signals, reporting to the division engineer on maintenance of signals and to the division superintendent on delays and causes of same.

(j) Signal foremen and foreman electrician in charge of lighting reporting to and receiving instructions from signal supervisor.

DIVISION ENGINEERS.

178. Division engineers shall have charge of the right-of-way, maintenance of tracks, bridges, buildings, water supply and signals on their divisions. It shall be their duty to see that all employes under their jurisdiction are familiar with the rules and special instructions and that they perform the duties to which they may be assigned, promptly, intelligently and faithfully.

179. They shall be responsible for the safe, efficient and economical construction and maintenance, in accordance with standard practice, of all work and property under their charge.

180. They shall make an inspection of all tracks, bridges, buildings and signals annually or more frequently if required, that they may be familiar with their condition.

181. They shall see that all patrons, shippers and adjacent property owners along the road are treated with courtesy by all employes under their jurisdiction.

182. They shall keep files of standard plans and specifications, plans of right-of-way, tracks, bridges, buildings, signals and records of all tracks, structures and signals making such periodical corrections as may be necessary. It shall also be their duty to see that standard and special plans are furnished for the guidance of those in charge of work, so that no deviation from them is made without proper authority.

183. They shall make out all reports that may be required, keep detailed accounts of all maintenance and other work in their charge in accordance with the classification of the Interstate Commerce Commission and shall forward this information to the proper officials.

184. It shall be the duty of the division engineers to see that all wire, pipe or other crossings of the Company's right-of-way, property and tracks, and all spur and side-tracks leading to industrial plants are covered by agreements protecting the Company's interests.

185. They shall make reports of all derailments and shall personally go to large wrecks where there is serious damage to track or structures reported.

ASSISTANT ENGINEERS.

186. Assistant engineers shall have charge of and be responsible for the work of all members of the engineering corps assigned to them.

187. They shall keep a careful watch over all work of their assistants, and must see that they are employed at all times.

188. It shall be their duty to see that complete files are kept of standard plans and specifications; prepare and keep files of plans of Company property and structures, and make such periodical corrections as may be required to record changes; also keep records of tracks, structures and other engineering data.

189. They shall furnish lines and levels as may be required for the work of the various supervisors reporting to the division engineer; also make such surveys as may from time to time be required. They will be assisted by the necessary draughtsmen, transitmen, rodmen and chainmen.

190. They will keep complete record of leases on their division.

191. They shall frequently check up all occupancy of ground by lessees to see that they are not occupying more than their allotted area.

192. They shall keep on file station plats, corrected to date, of all stations on their divisions, and such other plans as may be needed, showing Company property and right-of-way. All additions or changes in tracks or buildings, either at stations or other points, must be noted on the plans.

193. They must see that instruments are carefully handled and kept in good adjustment at all times and that they are not loaned to outside parties.

194. They shall make a report to the division engineer each week on the day designated, giving time of each man in the corps with proper distribution of same.

TRACK SUPERVISORS.

195. Track supervisors report to and receive instructions from the division engineer. They have charge of, and are responsible for, the safe condition and proper maintenance of roadbed, tracks, tunnels, right-of-way, station grounds, driveways, crossings, fences, cattle guards, track signs, etc., on their districts, and must make frequent inspection to insure that same are kept in safe and neat condition.

They are also in charge of, and responsible for, the safe keeping and proper disposition of all tools and material for use in the roadway department.

196. They will employ such assistants, general foremen, section foremen, extra gang foremen, work train foremen, and other forces, as may be authorized, subject to the approval of the division engineer.

197. They have charge of all foremen, sectionmen and other laborers employed by the Company on roadway work in their districts,

and shall know that all foremen have passed required examinations.

198. They shall investigate and determine so far as possible the character and habits of section foremen, and carefully note their ability to handle men and do work satisfactorily and economically.

199. They will assign the duties of each foreman under their charge, see that such duties are promptly and properly performed, and that their time is reported in the manner prescribed.

200. In the appointment of section and other foremen, they must see that each appointee is a good, practical, experienced, sober and trustworthy man, of sufficient education and intelligence to read and understand the rules, time-tables and all written orders, and to make accurate returns of the time of his men and of material used on his section, with other necessary reports.

201. Before placing new foremen in charge of work, track supervisors must personally instruct them in all their duties, examine them as to qualifications, and understanding of the rules applying to their work, know that they have passed the required examinations and that they fully understand the use of flagging, slow orders, cautionary and other signals, as prescribed by the rules.

202. They shall see that each foreman is provided with one switch key and that he gives a written receipt for it. In case the key is lost, or is not returned when the foreman leaves the service of the Company, fifty cents must be deducted from the amount due him. Supervisors must make proper endorsement regarding the switch key on the application for time check.

203. Supervisors are authorized to discharge or suspend foremen or other employes for intoxication while on duty. In the matter of other offences by foremen, they will report the case to the division engineer and await instructions.

In reporting the discharge of a foreman, they will give the circumstances so that a record of the man's standing may be kept for future reference.

204. When a foreman is discharged, or leaves the service of the Company, the supervisor must promptly prepare a complete inventory of tools and material on hand. If anything is missing or not accounted for he must make an immediate report to the division engineer so that proper settlement can be made.

205. A discharged foreman shall not be re-employed on another division of the road without permission from the engineer, maintenance of way. If a foreman who has been discharged desires an investigation, he may present his case to the division engineer and it will be considered.

206. Track supervisors shall furnish the division engineer a complete record of all track foremen under their jurisdiction.

207. They must examine track walkers in their respective districts on the essential points necessary to qualify them for the position.

208. They have immediate supervision of work train service for the maintenance of track and such construction as may come under their jurisdiction, and will employ such service only when authorized by the division engineer, doing the work by other means as far as practicable and economical.

209. They shall caution all foremen to be constantly looking out for the safety of their

men, especially those just entering the service, and if unable to do this personally, appoint a man for that purpose.

210. They shall know that foremen are promptly provided with the rules, circulars, forms, time-tables and special instructions pertaining to their duties, and that they fully understand and comply with these.

211. They shall provide foremen with copy of special State Laws governing forest fires.

212. They must know that all foremen are supplied with tools and materials necessary for the efficient performance of their duties and see that these are properly and economically used and cared for.

213. They shall conform to the prescribed standards, plans and specifications in the execution of work under their charge, issuing proper instructions to foremen so that there may be no deviations from standards without proper authority.

214. They must be constantly vigilant in the inspection of their districts, riding over them frequently on the engines of fastest passenger trains, going over every section, either walking, by hand car, or velocipede, at short intervals, observing condition of track, frogs and switches, roadway, right-of-way, station grounds, driveways, crossings, fences, track signs, telegraph poles, etc.

215. Supervisors will see that foremen are not only instructed how to do work, but that they follow instructions.

They will converse with foremen relative to their work, calling attention to bad and inefficient practices, and should by personal contact and conversation avoid the unnecessary issuance of written instructions.

When it is evident that a certain portion of

the track is not being maintained properly, supervisor should walk over it with the foreman in charge and decide upon the best method of effecting an early improvement.

216. They shall personally walk over their entire districts with the foreman of each section and mark such ties as are to be taken out during the coming season, making report of the number required.

217. They must, at all times, keep a close check on the number of men employed in their districts, and of the time report, including overtime, and be prepared to pass upon the correctness of the time-books as sent in, before approving them. They must see that the monthly expense for labor does not exceed the appropriation.

218. They shall promptly report to the division engineer and such other officers as he may direct, any defective condition which might endanger or delay the movement of trains. In case main track is obstructed or damaged they must proceed at once to the place with the forces, tools and material at their command and do everything possible to quickly clear the track and make temporary repairs of the defects, other necessary repairs to be made as promptly as conditions require.

219. In case of accident to train, they will immediately proceed to the place, with such force as is required, or available, and take charge of all trackmen who report for duty, calling for such additional force as may be necessary and rendering such assistance as is called for. When the derailment or wrecking of cars necessitates transferring or otherwise caring for freight, it must be handled carefully, and protected so far as possible from injury or theft.

220. They shall investigate and report accidents which may be attributed to defects in, or result in damage to, track, roadbed, or structures.

221. When evidence is found of damage to track, from wheels with flat tires, or with tires worn deep enough to damage frogs and switches, or other defects in rolling stock, they must report the matter at once and take prompt action to locate the cause.

222. They shall co-operate with the supervisor of bridges and buildings and signal supervisor in protecting the Company's interests in all respects, observe the condition of trestles, culverts, water supply, signals, etc., reporting any apparent defects to the supervisor of bridges and buildings and signal supervisor, also to the division engineer, when necessary.

223. They must see that the rails are properly bonded when this is required for electrical operation, and that insulation between rails is properly maintained.

224. They shall see that special care is taken by section foremen and their men to keep signal pipe, wires and other signal apparatus free from all obstructions.

225. On automatic block signal territory they must advise the signal supervisor and superintendent before doing any work which will interfere with the signal system, and which it is not the regular duty of the section foreman to repair.

226. They must give close attention to the proper surface, alignment and gauge of the track, particularly observe the alignment and elevation on curves, and must instruct foremen regarding the proper elevation for each curve on their sections.

227. They must frequently visit all points

where any new or special work or repairs is in progress, and have a complete knowledge and close practical control of all work and employes under their jurisdiction.

228. They shall keep themselves informed regarding all work performed in their districts by contractors or others who do not come under their charge and see that nothing is done by them that will interfere with the safety of track or movement of trains.

229. They are responsible for keeping the right-of-way and station grounds in a generally neat condition, and must inform themselves regarding the boundary lines so that no encroachment upon or occupancy of any portion of the Company's buildings, right-of-way or station grounds is permitted to exist except by proper authority.

230. They shall make frequent inspection of section houses, storehouses and other buildings in their charge and see that all tools and supplies are kept in an orderly manner and that all instructions of the insurance department relative to fire hazards are being complied with.

231. They shall see that the vicinity of all bridges and trestles is clear of all combustible matter, and that the bridge seats, tops of piers, bottom chords and other readily accessible portions of bridges and trestles are clear of cinders and dirt and that water barrels are full of water.

232. They shall see that waterways, and the approaches and outlets thereto and from, are free from obstructions.

233. They shall see that all second-hand material which is suitable for additional service is kept and used so far as practicable for

repair work, and that the most economical methods are employed consistent with safety.

234. They shall investigate wear of track material, hand cars, push cars and tools, encourage their men to do likewise, and report results of such observations to the division engineer.

235. They shall test new track gauges and levels when issued, and those in service at least every six months.

236. They must keep themselves informed by frequent examination of bulletins, regarding slow orders in their districts, so that these may be promptly cancelled when no longer necessary.

237. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

238. They must keep the division engineer and train dispatcher advised daily as to where they may be found, and probable movements.

239. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

ASSISTANT TRACK SUPERVISORS.

240. Assistant track supervisors will be governed by rules for the track supervisors, so far as they apply, and perform such duties as are assigned to them.

SECTION FOREMEN.

241. Unless otherwise directed, section foremen have immediate charge of, and are responsible for, the proper inspection and safe condition of tracks, roadbed and right-of-way

on their sections, and for the economical use of labor and material in the maintenance of same.

They must do no work thereon that will interfere with the safe passage of trains, except under proper protection.

242. They are in charge of repairs to road-bed, tracks, fences, crossings and track signs, the watching of all bridges, structures, telegraph lines, etc., not otherwise provided for, and of such protection and temporary repairs thereof as safety and prompt movement of trains may require.

243. They must go over their sections or send a reliable track walker, with suitable tools, at least once a day to make a thorough inspection, and see that track, highway crossings, bridges, culverts, fences, signals, telegraph lines, etc., are in safe condition.

They shall see that track walkers and crossing flagmen thoroughly understand their duties and are provided with and understand the use of danger signals.

244. They shall have full charge of the forces under them, and shall employ the number of men the track supervisor directs, which number must not be exceeded except temporarily in cases of emergency. They must see that employes properly perform their duties, and discharge men who are incompetent or neglectful, but in no case shall men be discharged without cause. They must keep the required records of the time of their men and material used or otherwise disposed of, and distribution of same.

245. They must have copies of the current time-table, book of rules of the operating department and book of rules and instructions for the maintenance of way and structures, and be thoroughly familiar with the rules and regulations therein, and with the time of trains

over their sections. They must carefully observe signals displayed by all trains and assure themselves before obstructing track that all trains and sections due have passed. Extra trains may be run at any time and no notice will be given of these, or of movements of trains against the current of traffic, and employes must protect themselves as prescribed by the rules.

246. In the morning before going to work, or whenever passing telegraph or telephone offices, they will ascertain from the operator whether all trains due have passed.

247. They must watch each train as it passes, observe whether notices are thrown off, note the condition of cars, and signal engineers and trainmen in case anything is discovered out of order, reporting any serious defect to the superintendent by wire if necessary, giving train number.

248. They must keep themselves supplied with the necessary flags, lanterns and torpedoes, be conversant with and pass the requisite examinations on the rules pertaining to the use of signals, train signals and flagging, keep signal appliances in condition for immediate use and be prepared to display danger or caution signals in accordance with the rules, as may be required.

249. If in their judgment the track, or any bridge or culvert, is not safe, they must at once put out the proper signals to warn approaching trains, notify the superintendent, division engineer and track supervisor of condition and do all in their power to make necessary repairs.

250. They must, in case of accident, promptly render all assistance in their power, whether

the accident occurs on their own or adjoining sections.

Where train accidents occur on their sections or those adjoining, they must go at once to the place with their men, and such tools and material as are required, or available, render assistance in clearing the track, protecting property, and doing such other work as the circumstances may require.

In the absence of the track supervisor and other ranking officers, foremen are responsible for the character of the repairs made, and must not allow the track to be used until it is known to be safe.

251. (*1289) They must report at once by telegraph on prescribed form all accidents involving personal injury, however slight, to themselves or their men; also, all accidents involving personal injury to other persons, unless they are positive that report has been made by trainmen or other employes, and follow this by written report to the division engineer as soon as possible, on form prescribed.

They must be familiar with local laws governing removal of a body after death.

252. They must investigate and report on the prescribed form all accidents occurring on their sections which may be attributable to, or result in, damage to track, roadbed or structures.

253. Except in cases of emergency, repairs to track, bridges or other structures must, if practicable, be made at such time, and in such manner, as will avoid delay to passenger and important freight trains. Track must not be obstructed for any length of time without giving notice to the superintendent, and receiving his acknowledgment, and must never

be obstructed without having proper signals displayed.

In any cases where track, bridge, culvert or roadbed is unsafe for maximum speed of trains, foremen must display Stop signals in both directions on all tracks affected, as per Flagging, Slow Order and Cautionary Signal Rules, and do everything possible to make repairs, notifying the superintendent and track supervisor by wire and following by report on prescribed form.

254. When necessary to change out a rail which is considered dangerous for a train to pass over, and there are not enough men in the gang to give proper flag protection and change the rail, section foremen will stop the first train and hold it until the rail has been changed, the train crew giving the necessary flag protection.

255. Track jacks must not be used except under proper protection.

256. Section foremen must conform to the prescribed standards, plans and specifications in the execution of work under their charge.

257. They are responsible for the proper care and use of tools and material necessary for the efficient performance of their duties, and shall make requisitions to the track supervisor monthly, except in case of emergency, when additional supply becomes necessary.

258. They must, so far as possible, remain with and personally supervise the work of their men, engaging personally in all work, except when this would interfere with their duties of supervision.

259. (*1291) They must devote themselves exclusively to the Company's service during such hours as is required. They are not allowed to absent themselves from duty without

first obtaining permission from the track supervisor, except in case of sickness, when notice must be promptly sent to the supervisor and division engineer, and the name of the man temporarily in charge given.

260. When called from work by sickness, or otherwise, foremen must leave the most reliable man in the gang in charge, but no work shall be done which would constitute an obstruction to the track until a properly authorized substitute has been arranged for by the supervisor.

261. They must exercise special care, under all conditions, to guard the safety of their men, and shall not leave them in any exposed position without having some one to give warning, in case they cannot do so personally on account of attention to other duties, or instruct the men personally in regard to protecting themselves. Men who wear mufflers to protect their ears in cold weather should have particular attention to guard them from approaching trains. They must expect trains to be run in either direction on all tracks at any time, and must protect themselves accordingly.

All section foremen and assistant foremen must provide themselves with a whistle for warning the men of approaching trains, and must see that their men move out of the way promptly, taking their tools to a safe distance from the track. Where there are two or more main tracks, trackmen must stand clear of all main tracks with the foreman, while trains are passing.

262. They must keep themselves informed in regard to all work performed on their sections by contractors, or others who do not come under their charge, and see that nothing is done

by them that will interfere with the safety of the tracks, or the movement of trains, without proper protection.

263. They should frequently go over their sections with the track walkers to satisfy themselves that a thorough inspection is being made, and must personally inspect their entire sections at least once a week or oftener if necessary, making a thorough examination of all main track switches and frogs to see if everything is clear and that there are no concealed breaks. They must examine tracks to see that nothing is wrong, and defects of any kind must be immediately repaired or reported.

264. They must give special attention to points where obstructions are liable to occur, examine the slopes of cuts, and promptly remove all earth, trees, rocks, or anything likely to fall or slide upon the track, reporting such conditions to the superintendent and track supervisor by wire if necessary, to be followed by letter of explanation.

265. During heavy storms or high water, whereby tracks or any portion of the Company's property becomes liable to damage, foremen and trackmen must be on duty, whether by day or night, and at such times they must carefully patrol their entire sections to make sure that the track is safe, taking Stop signals with them.

266. Where there is any liability of danger to the track, either from freshet or other cause, foremen must make frequent personal examination of the conditions to insure the safety of trains.

267. They must see that watchmen are properly detailed to patrol the track, watch bridges, or perform other duties when necessary for the safety of track and structures, and frequently

visit these men at such intervals, day or night, as may be necessary to see that their duties are faithfully performed.

268. They must keep the vicinity of all buildings, bridges and trestles cleared of combustible matter, such as chips, bark, dry grass, etc.

They must keep bridge seats, tops of piers, and all other readily accessible portions of bridges and trestles cleared of cinders and dirt, and see that the track over structures and on the approaches thereto is kept in good line and surface.

Where water barrels are furnished, they must keep them filled with water, as instructed.

269. They must devote sufficient time each week to cleaning and putting things in order on their sections, especially around section houses, station grounds, yards, sidings, highway and farm crossings, etc.

270. They must keep a careful lookout for fires along the track, responding promptly on hearing prescribed fire alarm or other notice, and prevent, if possible, the destruction of fences, wood or other property, and the spread of fires into adjoining fields.

They shall not burn old ties, or permit other fires to be started unless they have sufficient force to keep them under control, and obtain permit where necessary. Old ties must not be burned close to telegraph, telephone or power transmission lines. They must promptly report all fires to the track supervisor on prescribed form.

271. They must use constant care to see that waterways and the approaches and outlets are kept free from brush, driftwood and other obstructions.

272. They must not permit encroachment upon, or occupancy of, any portion of the Company's buildings, right-of-way or station grounds, or the laying of pipes or wires either underground or overhead, except by proper authority. They must make themselves familiar, so far as possible, with all boundary lines of the Company's property on their respective sections.

273. They must use every effort to keep trespassers off the right-of-way, and prevent persons walking on the track.

274. Stray live-stock must be driven from the railroad right-of-way, and where practicable returned to the field from which it came, and owner notified to prevent recurrence.

When domestic animals are killed or injured by a train, the owner shall be notified and requested to remove the carcass of the animal at once. If the owner is not known, or if he does not remove the carcass within five hours, the foreman shall bury it. If the animal is injured and the owner does not take it away promptly, the foreman may kill it if the injury is of such nature as to make recovery improbable. In all cases where domestic animals are killed or injured, report must be made on prescribed form and forwarded at once to the track supervisor.

275. Section foremen must see that the track is in good line and surface, properly spiked and jointed, and that it is in true gauge; that the cross ties are properly spaced, lined and tamped; that the rails have an even bearing on the whole width of ties; that the roadbed is in good order; that the proper slopes and ditches are preserved or provided, and that the drainage is not permanently interfered with.

276. They are responsible for the proper spiking, jointing, lining and gauging of track

on bridges and trestles at all times, and must report to the track supervisor, supervisor of bridges and buildings and superintendent by wire any dangerous defects in track or bridges.

277. They must have a daily inspection made of bridge guards, and at once restore to normal position any pendants that have become displaced, also report promptly to the supervisor of bridges and buildings, by wire, and track supervisor, by letter, any pendants that are defective.

278. They must see that no structures (unless covered by proper authority) are placed at any time within standard clearance, and that no material of any character is piled on station grounds, between the house and main tracks, or between main and passing tracks, and that no overhead wires or obstructions are permitted within 25 feet above top of rail.

279. Each foreman will be provided with a switch key, for which a receipt will be taken. In case he does not return the key when leaving the service of the Company, fifty cents will be deducted from the amount due him. The same deduction will be made should the foreman lose his key and still continue in the service. Foremen must keep their switch keys in their possession at all times. Under no circumstances will they give the key to any person, other than a substitute foreman, or allow any one to use it for them.

280. Foremen or their men must not throw switches for trainmen. When switches are to be thrown for loaded push and motor cars, it must be done only under the personal supervision of the foreman, and switch must immediately be returned to its original position and locked, and the points examined.

281. They must notify the track supervisor

of all switches which have been run through, giving the time and train or engine number if possible.

282. In case it becomes necessary to spike a switch, the superintendent, division engineer and track supervisor must be notified by wire at once, and also advised in same manner when switch is ready for use.

283. Section foremen must observe the position of derails on sidetracks and if they are not in normal position, they must be set to normal or derail position and superintendent and track supervisor notified.

284. They shall inspect private tracks when the same are used by the Railroad Company's equipment and immediately report any dangerous condition, but repairs to these tracks, except in case of emergency, must not be undertaken until instructions have been received from the track supervisor.

285. Trackmen must not wear red, green or yellow clothing, as it may be mistaken for signals.

286. For operating hand cars, see rules under "Operation of Motor, Hand and Push Cars and Velocipedes," also under "Precautions".

287. Section foremen must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

288. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

GENERAL FOREMEN, EXTRA GANG FOREMEN AND WORK TRAIN FOREMEN.

289. General foremen, extra gang foremen and work train foremen report to and receive instructions from the track supervisor.

In performing their special duties they must conform to the rules and instructions for section foremen.

TRACK WALKERS.

290. The duties of track walkers are next in importance to those of section foremen.

They must carefully examine all portions of their territory every day, and see that the track, roadbed, switches, frogs, joints, rails, line and surface, road crossings, bridges, trestles, culverts, bridge warnings, ditches, cattle guards, fences, signals, telegraph and telephone lines, etc., are in safe condition, reporting all defects noticed or repaired each day. If dangerous defects or obstructions are found that they cannot repair or remove quickly, danger signals must be displayed at once in both directions, and the section foreman notified promptly.

291. They shall carry a spike maul, spikes, wrench or such other tools as are most likely to be needed, and danger signals for reducing the speed of, or stopping trains.

292. During violent storms great precautions must be taken to prevent accidents, and when conditions require it, section foremen and track walkers must patrol track constantly day and night.

293. During extremely hot and extremely cold weather, such additional trips will be made by track walkers as, in the judgment of section

foreman in charge, are required to insure the safe condition of track.

294. During cold weather, track walkers must examine water tanks and spouts to see if they are in proper working order. Any defects found must be remedied if practicable, and if not, must be reported to the section foreman.

295. They must see that adjoining land-owners and others do not take any action that would interfere with the safety of the railroad. They must drive live-stock off the right-of-way and see that gates at private crossings are kept closed when not in use. Gates that are frequently left open should be reported to the section foreman. They shall see that cars left on side-tracks properly clear the main tracks, and that all derails are properly set.

296. Trees, rocks, etc., if in danger of falling on the track, must be removed. If not on railroad property, notify the section foreman. All earth and rock cuts, side hill fills, tunnels, etc., must be examined, and when necessary, immediate steps taken to prevent damage to tracks.

297. When patrolling track while a train is passing, track walkers shall not walk alongside of the train, but stop and move well away from track until it has passed.

298. Track walkers must observe rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

WORK TRAINS.

299. Supervisors have immediate supervision of work train service for their department and will employ such service only when authorized by the division engineer.

They shall see that snow plows, gravel or other work trains, are properly equipped for efficient handling of work.

They must inspect boarding and sleeping arrangements for the men, where these are required, see that sufficient wholesome food and comfortable quarters are provided and that the quarters are kept in a sanitary and safe condition.

300. Unless otherwise instructed, foremen of work trains are under the immediate direction of the supervisor on whose territory they are at work, and shall make such reports as may be required.

301. Work trains, or engines belonging with them, must not be run except as may be absolutely necessary for the prosecution of the work assigned them. Engineers and conductors of work trains should, if possible, be qualified to run on an entire division.

302. Work trains must not be used for distributing material that can be conveniently and economically handled by regular local freight, or through freight service.

303. The duties of work train forces must be arranged in advance, so that there will be the least possible time lost passing over the road, and every effort must be made by those in charge to avoid delays to the train, by being side-tracked, or for other cause.

304. When a train is delayed, the foreman shall, so far as practicable, employ the time of the men profitably in ditching, ballasting, cleaning station grounds, or any other matters requiring attention in the vicinity.

305. Cars not needed for handling material must not be taken in work trains without proper authority, except for shelter of the men in stormy weather.

Defective or inefficient equipment, inadequate motive power or incompetent engineers, must be promptly reported to the supervisor.

306. Foremen must take every precaution to avoid personal injury to the men employed on their trains. They must not allow the men to jump on or off the train while in motion, and shall see that they do not sit on flat or other cars with feet projecting over the side, or occupy other positions where they will be exposed to danger.

307. They must see that care is exercised in unloading material. Rails must not be unloaded while cars are in motion, unless an approved unloading device is used. In loading or unloading cars, care must be taken to keep them balanced. Too much load on one side will turn them over.

308. When handling rails or similar material on flat cars, care must be taken to secure it with good stakes.

309. While unloading cars on curve with plow and cable, no one shall be allowed to stand on the inside of the curve either on the cars or on the ground.

310. No one except men employed on the train, or an officer of the Company, shall be permitted to ride on work trains, without proper authority.

311. In case of accident to other trains, work trains will give such assistance as may be called for by the superintendent, and everything possible shall be done to facilitate the prompt and safe movement of trains.

312. When loading or unloading material, a record must be kept and a report made daily to the supervisor of the kind and quantity of material handled, and the disposition made of cars.

313. On all territory covered by joint account with other railroads, an accurate record of work train service must be kept, so that proper charges can be made for equipment and service.

314. At the close of each day's work, foremen must send to the supervisor a report of all delays experienced during the day.

315. Conductors of work trains will obey the instructions of the supervisor, general foreman or work train foreman, regarding the execution of work.

They are responsible for the safety and proper care of the trains under their charge, and will see that all cars in the trains are in safe running order.

When camp cars are hauled, they must be placed in the rear of the train.

Dump cars must not be hauled with the doors open.

ROADBED.

316. The roadbed is the foundation of the track and upon its strength and permanence depends the stability of the track.

It shall be full width, as shown on standard plans, unless modified by special instructions, and standard templates must be used in grading and ballasting unless otherwise directed.

317. Narrow banks should be widened to the standard width. Material for widening banks and raising sags should be procured when possible at points where its removal will benefit the roadbed and right-of-way by widening cuts, ditching, reducing grades or improving alignment.

318. The road-bed at sub-grade, as shown on standard plans, should be crowned to facilitate its drainage by raising the centre higher than

the sides. This rule must be followed when preparing track for re-ballasting.

319. Before material is unloaded for widening fills, all vegetation and brush must be cut and removed or burned and fills plowed or terraced with shovels to prevent new material from slipping. As soon as possible after the work on fills is completed, the ballast on shoulders must be cleaned and restored to standard section.

320. To be permanent, the slopes of embankments and cuts, except in rock, should be flat enough to readily admit of the growth of vegetation, which section foremen should encourage, in order that the slopes may be permanently protected.

321. The roadbed should be carefully watched and reports made as required to the division engineer, so that necessary improvements can be made of the following conditions:

All places where the roadbed is lower than extreme high water.

All bridge or culvert openings that are not large enough to carry off the water during heavy rains.

All cuts that are subjected to heavy flow of water and are not provided with ditches of proper size to prevent washing of ballast.

All cuts or fills where an unusual amount of track surfacing or shimming is required. The cause should be sought, and the remedy, whether tile drainage or ditching, etc., noted.

All places where ditching is often required, with a view to reducing this work by sodding, draining, paving, etc.

All banks along streams subjected to wash by action of ice and high water. Such points should be protected by rip-rap.

322. During early spring, and at such other times as may be necessary, the roadbed, sides of cuts and fills, station grounds and yards shall be thoroughly cleaned of all rubbish that may have accumulated.

DRAINAGE.

323. Drainage is the most important factor in the maintenance of good track.

Water is the worst enemy of track, and every track foreman should endeavor to lead it as quickly and as far as possible from the roadbed. Time spent in improving and perfecting drainage will be amply repaid by decreased cost of repairs.

Ditches in cuts must be kept clean and free from obstruction, so as to drain the roadbed thoroughly. The outline of ditches should be clearly defined and conform to the standard plans, so far as practicable, with ditch lines generally parallel with the track, but of such dimensions and so graded as to pass all water freely during the heaviest rains, and to thoroughly drain the roadbed.

324. The material taken from cuts or elsewhere shall not be thrown on the ballast or on the slopes of cuts, where it can be washed back into the ditches, but must be used to widen narrow embankments wherever practicable, distributing it evenly over the surface, or as may be required to make the roadbed of uniform width.

In case of shallow cuts of such length that it is not practicable to move the material out at the ends without a work train, it may be cast out of the cut and spread to make an even surface, not nearer than five feet from the top

of slope, or as may be necessary to avoid danger of washing back into the ditches.

325. When the general drainage of the ground is toward the cut, surface ditches must be made outside of the slopes of the cut, leaving a sufficient berm, not less than five feet, where practicable, with grades that will prevent water from remaining in them.

326. Ditches and waterways leading to and from bridges and culverts must be kept clear within the limits of railroad property. All culverts must be inspected frequently to see that they are open for the free and unobstructed passage of water.

327. Water should be led well away from the track at the ends of cuts, to prevent injury to embankments, and provide sufficient fall to quickly carry it off.

328. Where water washes away the earth, and approaches too near the track at the ends of cuts or other places, special effort must be made, by constructing dams of brush, old ties, rip-rap, or other methods, to stop such washes and to fill up the washed places, so that the bank will be maintained full width.

329. Ditches, culverts and drains must be kept open and in good condition at all times.

They shall be examined frequently, especially after heavy storms, and must be cleaned early in the spring and late in the fall. All new ditches shall be dug before the beginning of the winter season.

330. After a snow storm, ditches must be cut through the snow wherever a sudden thaw would be likely to flood the track, and all ditches must be cleaned when the snow is melting in the spring.

331. At road crossings where an opening is necessary to provide drainage, a pipe of proper

size should be used, with head walls to protect the ends where necessary.

332. Cross drains shall be put in at proper intervals, where required. They must not be located where slopes of embankments, or side hills, will be washed away, unless properly protected.

333. Where the material through which cuts extend is such that surface ditches are liable to cause slides, proper protection should be provided, either by substituting underground drains, or by other approved methods.

334. Where ditches cannot be drained into natural waterways, special authority must be obtained before taking any action.

335. No work shall be permitted without proper authority, on old or new drains or ditches for public or private use on the railroad company's right-of-way.

Farmers or others must not be permitted to connect their drains or ditches with the railroad company's ditches, or to construct any ditches on the right-of-way without proper authority.

336. On unballasted tracks the shoulders on fills should be cut away and sloped in accordance with standard, to afford perfect drainage.

337. In ditching, commence on down hill end so that rains occurring before work is completed will scour out instead of filling up the ditch.

338. When cuts are being widened, or any drainage work done, outlet ditches must be left unobstructed over night, to avoid danger of washouts from heavy rains.

339. Report must be made to the supervisor of all ditches that are not large enough to carry water in floods.

340. Ties unloaded in ditches must be laid up and not left in position to block waterway.

UNDERGROUND DRAINAGE.

341. When efficient side ditches in wet cuts cannot be maintained on account of the character of the material or lack of space, the ditches should be underdrained by means of stone or tile drains, and the trench filled with gravel, cinders or broken stone, as directed by the division engineer.

342. Vitrified pipe should be used for such drains, the size of pipe to be based upon not taking care of any surface drainage, although there is no objection to its taking such surface water as may seep through the material in the bottom of the ditch.

343. In laying the pipe, care should be exercised to make the trench as narrow as possible to answer the requirements, and as close to the ends of ties as possible, without weakening the foundation of the track. The pipe should be laid in the bottom of the ditch below frost line, usually four feet or more below base of rail. Where the roadbed contains quicksand or other fine material that flows readily, three or four inches of gravel, cinders or broken stone should be deposited in the bottom of the ditch before the pipe is laid, to prevent the fine material from entering with water through the joints at the bottom. In places where roadbed is especially soft, the pipes in ditches should be laid on boards to prevent unequal settlement. Cross drains should be laid where necessary and connected with main drains.

344. A true grade should be made in the bottom of the trench, and the greatest practi-

cable pitch given, especially at the outlet. The fall should in no case be less than three inches per 100 feet, and should exceed that rate where practicable.

345. Drain pipe should be laid with bell ends up grade, commencing at the outlet and continuing to the inlet. It must not be laid tight so that the water cannot enter, but shall be laid so that solid material cannot enter. The upper end of pipe should be plugged, and the outlet end protected, where necessary, by a heavy screen which will fit over the end of the pipe, and where required a concrete head wall and apron should be provided, or suitable rip-rap deposited to take care of scour.

346. After the pipe is laid, the joints should be covered lightly with hay or straw before back-filling the trench, as this will prevent fine sand or dirt from entering.

In cuts which have a tendency to slide, the trenches should be back-filled with coarse, clean gravel; and in other cases, cinders may be used. No material excavated from the trenches shall be used for back-filling, but it must all be removed and disposed of elsewhere.

347. In case of heavy rain which necessitates stopping the work for a time, when laying pipe, the opening at the end of the last joint laid should be protected to prevent mud or other obstructions from entering the pipe.

348. For draining wet cuts, a six-inch diameter pipe should be the minimum size used, and when a larger sized pipe is to be used it shall only be done when approved by the division engineer. For such purposes, second grade vitrified pipe should be ordered in preference to first grade for sizes of 12-inch diameter or less. This No. 2 pipe has chips, or is a little

under or over glazed, and can frequently be purchased for much less than No. 1 pipe.

Vitrified drain, or culvert pipe, must not be laid under main tracks, but may be laid under side tracks where the depth below ties is sufficient to avoid danger of crushing.

349. Where it is necessary to cast material from the ditches over the top of cuts, the nearest slope of such material should be at least five feet from the top edge of the slope of ditch, and the material should be leveled off so that it will sod over and become permanent instead of being left a raw surface which would wash with every rain.

350. Where material from ditches is moved across the track, in a side hill cut, wheelbarrows may be used where economy will result.

351. Pipe for draining wet cuts should not be unloaded along the line between stations at points where it is to be installed until the forces are ready to begin the work of laying it.

SOD LINE.

352. On sections where the roadbed, ballast section line, gauge and drainage are up to the standard, a grass line must be constructed on the slopes of embankments, at their intersection with the surface of the roadbed, the top of which must be flush with the surface of the roadbed, so as not to interfere with the drainage. The edge must be parallel with and a uniform depth below the rail and clearly cut.

BRIDGES AND CULVERTS.

353. The safe condition of bridges, trestles and culverts rests upon the section foremen, as well as upon the bridge department.

In addition to looking after the lining and spiking of the track, keeping water barrels filled on bridges and trestles, bridge seats clean, inspecting bridge guards, etc., they must frequently inspect the general condition of these structures on their sections.

354. After each heavy rain and at least once each month, all bridges, pipe and other culverts must be examined carefully to see that they are not obstructed by drift, weeds, brush or anything that will interfere with the flow of water or with the safety of the structure. If such obstruction is found it must be removed at once.

355. All bridge foundations under water must be examined to see that they are not being undermined. Stones or other obstructions must not be allowed to remain between the iron work and the face of the back walls. Masonry must be kept free of vegetation.

356. All bridges, including Company overhead bridges, must be cleaned of dirt, rubbish and cinders, preferably on the last working day of each month and as much oftener as necessary to keep them in good condition.

357. Track supervisors must be familiar with every bridge and culvert on their subdivision. They must frequently examine each of these structures sufficiently to know of defects.

358. Section foremen must know the condition of bridges and culverts on their respective sections by frequent personal examination and must report any defects noted to the track supervisor. If, in the judgment of the section foreman, a bridge or culvert is not safe, he must at once put out proper signals, wire the superintendent, division engineer and supervi-

sor concerned, of the condition of structure and if in his power, repair the defect.

359. Daily inspection shall be made of bridge guards, wires, etc., over main and side-tracks. Whenever any part of a bridge guard is broken or pendant missing or defective, section foreman must notify the supervisor of bridges and buildings by wire and track supervisor by letter.

360. Supervisor of bridges and buildings will provide necessary barrels and buckets for all wooden bridges and trestles. The track forces will see that the barrels are kept filled with water and barrels and buckets in proper condition.

361. The surface or the line of track on bridges or approaches shall not be changed except under direction of the track supervisor.

BALLAST.

362. Ballast is used to distribute the weight of the traffic to the roadbed, provide rapid and effective drainage, hold the track firmly in position, prevent so far as possible the freezing of the roadbed, and to secure a uniform support for the track.

363. Ballast shall be either broken stone, gravel, or cinders, and the sections must conform to standard plans.

364. The practice of mixing new ballast with old unsuitable material which was between and around the ends of ties is prohibited.

365. Preparatory to ballasting track, and before distributing ballast, centres and grade line for top of rail should be given by the engineer, and the sub-grade properly prepared. Cuts and embankments should be widened to conform to standard section, and when there

is no ballast in the track, or it is of poor quality, all unsatisfactory material above the bottom of ties must be removed and used to widen narrow embankments to standard roadbed section. The centre of roadbed should be left higher than sides to conform with the base of standard ballast section, and provide drainage.

366. After all unsatisfactory material has been removed above the bottom of ties, space for depositing the standard section of ballast shall be provided by raising the track, where there are no overhead obstructions, large track bridges, station platforms, or other obstacles to prevent this. Where it is not practicable or economical to raise the track, the roadbed must be excavated sufficiently below bottom of ties to provide space for the standard section of ballast.

367. Where ballast is being added to track already ballasted, the good ballast in shoulder should be used in re-surfacing track and poor material used in widening embankments, these being raised to the bottom of good ballast, but not above it. Any good ballast in shoulder should be cast into centre of track before depositing material for widening the embankments is started.

Where there is heaving or wet spots, the wet material must be taken out to such depth and in such manner as to insure good drainage and the space filled with cinders, gravel or other satisfactory material.

368. On fills that are not fully settled the surface of the roadbed shall be brought up with cinders or gravel.

369. Gravel ballast will be used ordinarily. It should be clean, not too coarse, and of uniform character. It should be free from fine sand, loam and clay, which will make dusty

track, cause weeds to grow, and interfere with drainage. It should not contain stone which will readily disintegrate, or large stones, which will cause rough riding track.

370. Gravel pits, from which ballast is to be taken, must be carefully stripped so that clean ballast may be secured free from loam, and care must be exercised in handling, to prevent mixing it with the earth of the roadbed.

371. When stone ballast is to be used, it shall be according to standard specifications.

372. When broken stone ballast is being deposited originally, it shall usually be handled with ballast forks of approved type and not with shovels. The use of shovels for this purpose allows the earth to become mixed with the ballast, which prevents proper drainage, causes dusty track, and encourages vegetation. During certain stages of cleaning stone ballast, shovels may be used, where this can be done to advantage.

373. Track should be thrown to line before ballast is delivered, and it may then be deposited in the middle or on the side of track. When ballasting, open track should be reduced to a minimum and such track carefully watched, loosening bolts if necessary to avoid rail buckling and throwing track out of line.

374. All spikes must be driven down, all worn out ties replaced, and ties properly spaced while track is dug out, and before ballast is distributed.

375. Care must be taken in distributing ballast that surplus material is not deposited, which will have to be carried away later.

376. Avoid wasting ballast down the sides of embankments. Material for raising and

ballasting must not be taken from the slopes of embankments to the reduction of the same below standard.

377. Engineers and track supervisors must exercise careful judgment in deciding the amount of lift necessary, so as to avoid waste of ballast where drainage conditions are good, and where additional ballast under the ties is unnecessary.

378. Where track is to be raised exceeding four inches, the ballast will be first tamped by tamping bar, and after being settled by traffic, in a few days must be re-surfaced, using tamping bar, tamping picks or pneumatic tampers.

In lifts of four inches or less, on broken stone, ballast should always be tamped with picks or bars.

The tamping of ballast shall be done in accordance with the rules for tamping.

379. When making a general raise out of face on ballast, grade stakes set by the engineer must be followed, and level board used continuously.

380. When a good bearing has been obtained on ballast, the general surface must not be raised until a new bed of ballast is needed. Low places should be raised only enough to bring them up to the general surface.

381. The general surface of track should never be raised in tunnels, in front of coal chutes, water columns, station platforms, or where there are overhead structures, to give less than standard clearance, without authority from the division engineer.

382. Ballast must be kept from touching rails where they are bonded for rail circuit and under no circumstances shall cinders be used under rails carrying electric current. A clear

space of at least one inch between ballast and base of rail must be maintained.

383. The standard broken stone ballast section should be used only for clean broken stone.

384. The standard gravel ballast section should be used only for clean, coarse gravel or cinders.

385. The depth of ballast under ties for main tracks and important branches shall follow standard plans so far as possible, and for important sidings must not be less than eight inches and for minor sidings not less than six inches.

386. When ballasting is completed and track in perfect gauge, surface and line according to the stakes furnished by the engineer, the ballast must be trimmed to standard section.

CLEANING STONE BALLAST.

387. The cleaning of stone ballast is a necessary, and at the same time, an expensive operation, which should be done at regular intervals, the frequency depending upon local conditions. As soon as stone ballast is placed in the track it begins to collect cinders and other material in the voids, until these spaces are filled and the drainage greatly impaired, if not altogether cut off. As drainage is essential to well maintained track, the stone must be cleaned to remove this material.

388. Ballast should be cleaned either with ballast forks or screens, usually depending upon the condition of the ballast, the amount to be cleaned, and whether it is in continuous stretches or in spots. If the cleaning is done around ties only, at the time of renewals and

not below the base of ties, it may be preferable to use forks, especially if the ballast is not very dirty.

If the ballast is dirty and compact, and is to be cleaned to the proper depth continuously in stretches of considerable length, the work should preferably be done by a proper organization, using approved screens.

389. On the shoulders, ballast should be cleaned to a depth of 12 inches below bottom of ties or to sub-grade. Between ties it should be cleaned slightly below bottom of same. In centre gauges, between two or more tracks, it should be cleaned to a depth of eight inches below bottom of ties, or to sub-grade. A trench should be cleaned at intervals of 50 feet across the most available track from bottom of centre gauges to shoulder for drainage, and the clean ballast returned in proper order after these operations.

390. The cleaning of ballast is generally deferred longer than is desirable on account of the large expense involved by the methods that have been employed to do this work, and frequently the track is raised and new ballast added to avoid cleaning the old. This practice is both undesirable and expensive, and soon distorts the profile of track to an objectionable degree. Also, it is usually necessary to clean a considerable proportion of the old ballast in any case, to provide for proper drainage.

391. Stone ballast is unfavorably affected to a certain extent by action of the elements and track tools, but its effective length of life is usually determined by the foreign substances which fill up the voids and are permitted to remain there, resulting in a compact mass, which retains moisture and will not hold the

track to proper line or surface without drainage, and which cannot be drained without cleaning.

392. The foreign substances that fill the voids in ballast come from both above and below. When from below, it is usually due to unsuitable material below the sub-grade, into which the ballast gradually settles, and in such cases little can be done except to add new stone to replace that which has settled below the base of standard ballast section. The principal causes of trouble, however, usually come from above, and consist of the droppings of grain, coal, sand and gravel from passing trains, waste from dining and passenger cars, dirt, sand, seed, etc., blown from adjoining banks and fields, and the discharge of ashes and cinders from locomotive ash pans, which fill up the spaces between stones and start vegetation. This can be remedied to a certain extent by encouraging a growth of grass on the right-of-way, and by better regulation of discharge from trains.

393. To clean ballast economically, both the stone and dirt should be disposed of with as little handling as possible.

394. Ballast forks, while satisfactory for handling ballast which does not require cleaning, are expensive, both in time and material, when used for cleaning, on account of the extra handling of the material, and the loss of the smaller stones which fall through the forks and are wasted with the dirt, this waste frequently amounting to a considerable percentage of the available stone.

395. With proper conditions and organization, screens may be used to clean ballast economically, the greatest saving resulting

when the ballast is very dirty, and continuous long stretches are to be cleaned.

396. An efficient organization for work on double track lines, and which can be expanded to cover four or more tracks and repeated as many times as desired, is 12 men, a foreman and waterboy, using three screens, one located on each side and one between tracks, with the men properly distributed, each man having his station and duties and always working to the best advantage without interfering with, or depending upon, any other man.

397. When the full required section of ballast is to be cleaned, one screen is placed between tracks, with the elevated end toward the ballast which is to be cleaned, and moved in that direction as the cleaning advances, by shoveling the dirty ballast over the top of screen, while the clean ballast is deposited behind, in or near its final location.

The other two screens are placed one on each side of the tracks, at the shoulders, and the clean ballast deposited on the shoulders, or between the rails, as desired.

The dirt which is screened out in each case is deposited directly from the screens into boxes, wheelbarrows, or sacks, for removal in the manner which may be most economical, additional men being required for this purpose if the dirt must be moved a considerable distance, out of cuts or otherwise. When desired, two or more screens can be used between different tracks under the same foreman.

398. The ballast around ties shall be cleaned when the ties are being renewed or re-spaced, and when screens are employed for this cleaning, one screen is used by each section gang, being placed at the side of track on double track, and where there are more than two

tracks, it is placed between tracks as may be necessary, never cleaning immediately ahead of tie renewals.

399. The cleaned stone should be deposited to restore the normal ballast section between tracks and on shoulders, leaving any deficiency between the rails, where it can be supplied directly from ballast cars with practically no extra handling.

400. Screens on the outside of tracks are placed in a position to clear trains, and screen between tracks is lowered to a position level with the top of rails while trains are passing. Screens used shall be constructed in accordance with standard plans, or be of other approved design, and special instructions will be issued covering the details of operating them.

401. To obtain the best results, stone ballast should be cleaned in busy terminals at intervals of from one to three years; on heavy traffic lines at intervals from three to five years; and on light traffic lines at intervals of from five to eight years.

The amount of new stone ballast to be supplied when old ballast is cleaned, will usually be from 15 to 25 per cent.

402. The advantages and saving due to keeping stone ballast clean are:

(a) Reduced cost of maintaining line, surface and gauge.

(b) Increased life of rail.

(c) Reduced traction effort.

(d) Removing grass and weeds from track eliminated.

(e) Dust avoided.

(f) Saving in cost of new ballast, widening fills, raising permanent structures, etc., necessary to raise track.

(g) Saving due to eliminating shims, not needed with clean ballast.

Proper records should be kept, in accordance with special instructions, of the various operations, and quantities of material handled in cleaning stone ballast.

TRACK.

403. Track must be kept in safe condition at all times.

404. During the winter and spring, points where there is excessive track heaving should be located and same eliminated, if possible, during the following season. The necessity for shimming is an indication of poor ballast or poor drainage.

405. As the ground thaws, the larger shims should be removed wherever possible without materially disturbing the roadbed. As ground becomes sufficiently dry all shims should be removed and the ties tamped to solid bearing. All rough places due to poor ties, poor surface or poor line shall receive prompt attention, so that the track may be put in proper condition before commencing the work of regular track repairs.

406. The first general attention to be given to the track after removing shims and picking up the worst low spots, should include the checking of gauge, tightening bolts, re-driving spikes where necessary, cleaning up ditches, burning dry grass and stubble on right-of-way, trimming up road crossings and such rough repairs to and straightening up of cattle guards, fences, track signs, etc., as will put them in serviceable condition until systematic and thorough attention is given to the track later in the season. This preliminary atten-

tion should also cover such work as may be required to put side-tracks in order and to clean up from yards and station grounds the accumulated rubbish of winter.

407. As soon as the season will permit, usually about April 1st, the work of renewing ties and removing any remaining shims shall commence. Renewals shall be made by beginning at the end of the section and always working toward headquarters, full spiking track to gauge throughout, maintaining surface and line where track is disturbed in making renewals, and tamping all new ties to a solid bearing. New ties must always be fully spiked as soon as they are put in, and track must not be left over night without being properly filled in and roughly trimmed. At the end of the week any defects in surface and line in the work gone over shall be corrected before proceeding with further renewals.

408. When all tie renewals have been made, general surfacing, lining and other maintenance work should be systematically carried out.

The track level must be used constantly when surfacing track on both tangents and curves, and must be frequently tested to make sure that it is in proper adjustment.

409. Surfacing and lining shall begin at the end of the section and always be continued toward headquarters in the same order as tie renewals, the work being done "out of face" and carried on so that it will be all completed each day for the amount of track covered. The track level and gauge must be used constantly when surfacing track to insure that corrections of surface and gauge are accurately made. No more lift should be given to track in general surfacing than is required to bring the low portions up to a uniform grade between the high

spots. The solidity of the roadbed depends upon how well the ballast has been tamped under the ties, and how little the old ballast in the track has been disturbed.

410. The surface of track on bridges, in tunnels, under overhead structures, at stand-pipes, in paved streets, and opposite platforms or other fixed structures, must not be raised or lowered under any circumstances, without instructions from the division engineer.

411. Before any lifting is done, all spikes should be driven down snug against the rail, so that after lifting it will not be necessary to hold loose ties up against the rails while tamping. Trackmen should never raise the general surface of track unnecessarily. This practice is not only wasteful of ballast but injures the surface and deprives the track of the effectiveness of a full shoulder at the ends of the ties.

412. The rail on one side must first be brought up to a perfect surface and the other rail brought up by the use of track level.

413. Line and gauge are as important as surface, and if not properly maintained the track will soon become unsafe.

Where track is badly out of line over long stretches, centre stakes should be set by the engineer as a guide.

During hot weather track must be watched carefully to detect any tendency of rails to expand and throw it out of line.

414. When track is being gauged, all spike pulling and re-driving should be done along one rail, on the opposite side from the rail used for lining. Before moving the rail, all spike holes must be plugged, and when re-spiking, the gauge must always be laid square across the track, close to the point where spikes are

being driven, and the rail held firmly up to gauge.

415. As the general surfacing, lining and gauging of track progresses, all signs, up to the point where the work for each day ends, shall be straightened up and put in good repair, all crossings, cattle guards, etc., put in proper condition, ballast dressed to a standard section, and the grass line clearly defined at standard distance from the track.

416. After completing general repairs to main tracks, the men shall repair side and yard tracks, then devote as much time as possible until fall in the improvement of drainage, repairs to right-of-way fences, neatness, etc.

417. Important passing sidings, running tracks, switching tracks and leads, and other tracks subject to hard service, shall be laid and maintained same as the corresponding main track, except that new rail, stone ballast, treated and No. 1 ties, or screw spikes will not be used.

418. Ordinary sidings and yard tracks will be laid and maintained as may be required to carry the traffic to which they are subjected.

419. During the fall special attention shall be given to yard and other side-tracks, and general repairs made.

420. In addition to the general repairs made during the season, there is much work in connection with track maintenance that must be done repeatedly during the year. Broken spikes, bolts, angle bars and rails are likely to be found at any time, and must be constantly watched for and promptly replaced.

421. The creeping of rails is a source of much trouble and expense in the maintenance of track and must be carefully watched for and corrected. Spiking joints in the slots of angle

bars retards the creeping tendency and rail anchors secured to the rails and resting firmly against the ties are an additional help.

Rail anchors must not be used on ties supporting signal wires or ties adjacent to signal trunking.

422. Particular attention must be given to the adjustment of switches, and to see that all bolts in switches and frogs are always kept tight. The head blocks of switches must be kept firmly tamped, and switch stand securely fastened to them.

Perfect line and surface must be maintained at switches, gauge kept true, connecting rods and pins in place and secure, switch points working freely and fully bolted, with all nuts tight.

423. In the fall, while the last cleaning up is being given to ditches, etc., low places in the track, low joints, loose ties, etc., should be looked for, and when found, be put in proper condition. If these things are attended to before freezing weather begins, a large amount of shimming will be avoided during the winter.

424. Tracks shall not be laid on land other than that belonging to the railroad company, nor repairs made to private or other foreign tracks until the necessary agreements have been executed.

425. Where main track is to be given a general lift, either for the renewal of ballast or otherwise, except in emergency, grade stakes will be set for the elevation of the top of rail by an engineer.

426. Only a minimum length of track shall be left open at any time, depending upon prevailing conditions.

427. When track is being re-ballasted the ballast must be put under the ties and well

tamped with shovels and later bar tamped. On stone ballast, first tamping shall be done with spade end of tamping bar, and later tamping picks or pneumatic tampers shall be used.

428. When a lift is to be made in the track the lift made by each jack shall be so regulated as to avoid bending the splice bars and straining the joints.

429. Track jacks must be protected at all times when in use. When raised, they must immediately be placed in tripping position, and must always be in the hands of experienced men.

430. Track obstructed when making necessary repairs, may be used until within 15 minutes of the time of passenger trains, and within 10 minutes of the time of freight trains, but never without proper protection.

431. Broken rails in track must be replaced at once, and reports made in proper manner on prescribed form.

432. Track on bridges and approaches must always be kept in good line and surface; neither shall be changed except under the direction of track forces, in conjunction with bridge forces.

433. Track supervisors will, when necessary, arrange for their forces to render assistance to the bridge and building forces in the distribution of material and in repairing bridges, trestles and buildings of the Company.

MAINTENANCE OF TRACK AT INTER-LOCKING AND SIGNAL PLANTS AND CONNECTIONS.

434. When work is to be done which will in any way affect interlocking, signals or crossing bells, or any other signal apparatus, notice

shall be given to the signal supervisor, so that he may co-operate in the work if necessary.

435. The operations of any signal or interlocking apparatus must not be interfered with by trackmen, except for emergency repairs. Repairs which require the removal of any signal apparatus must be made under the direction of the signal maintainer.

436. When possible, section foremen will give signal maintainers at least 24 hours' notice previous to making any rail changes that will affect the working of signal apparatus.

437. In case of extreme emergency, when it is necessary for section foremen to change out a rail which is considered dangerous for a train to pass over, and the maintainer is not present to do the necessary bonding, it will be permissible to use the emergency jumper wire. In cases of this kind the maintainer must be wired for at once, and a man left on the ground, who will make close inspection of the rail that is jumped around, and the connections of the emergency jumper wire, for each train movement, until the maintainer arrives.

438. When necessary to remove a rail, insulation or connecting wires from any bell or signal circuit, signal maintainer must be present to supervise the work, except in case of emergency, when the maintainer and crossing-watchman must be notified before disturbing the bell or signal connections, that they may protect against unsignalled trains. Crossings not in charge of crossing watchmen or gatemen must be protected by placing a man on the crossing to act as crossing watchman until the bell is in working order.

439. In case an electric highway crossing bell is found not to work properly, whether by ringing continuously or otherwise defective,

a flagman must be stationed at the crossing until bell is repaired, and maintainer and track supervisor notified by wire.

440. When necessary to remove or replace any switch or movable point, at an interlocking plant on lines where high speed trains operate, and in suburban territory, the section foreman shall notify the track supervisor and signal supervisor, who shall both be present. The track supervisor shall confer with the chief dispatcher, and if necessary to discontinue traffic over any track it shall not be broken until permission has been received from the chief dispatcher.

441. When rails are to be changed, roadbed raised, or track lined or surfaced at a point where rails are bonded, or wires run from the track to battery or relays, or when the track is to be lined up or raised at switches, switch points adjusted, stock rail spiked in, or any work done on switches or derails that may interfere with the proper working of signal apparatus, notice must be given to signal maintainer in charge of the signals on that territory, so that he may co-operate in the work.

442. When placing or tamping ties around interlocking plants, or where there is trunking, or in working around angle bars, care must be taken not to break bond wires or damage pipe, wire lines, or connections to the track. When any wires or other connections are found damaged or broken so that the trackmen cannot make repairs, the signal maintainer must be notified so that adjustments or repairs may be promptly made.

443. Ballast, cinders, dirt, etc., must be kept at least one inch clear of movable parts of interlocking connections passing under tracks,

and also not less than one inch clear of base of rail where track circuits are in use.

444. Interlocking plants must be kept properly drained at all times, and all switches, interlocking and signal connections free from snow and ice. Burrs must be kept removed from rails where detector bars are in service.

445. Section foremen are responsible for the installation and maintenance of insulated joints, keeping bolts tight and ties well tamped. Signal maintainers are responsible for the fibre parts and will see that they are renewed in ample time to avoid failures. Not more than two end posts shall be placed in any insulated joint. Repairs and renewals of these joints must be made promptly at request of signal maintainer.

Section foremen must see that signal and propulsion bonds are in good condition.

446. Care must be taken while working on tracks where track circuits are in service to avoid short circuiting by iron bars touching both rails, or spikes being driven in ties, the end of which come in contact with bridge girders, etc. Trouble of this nature sometimes occurs in connection with installing guard rails, tie plates, etc.

447. At interlocking plants, during the absence of signal maintainers, section foremen shall give such assistance to signalmen as is possible in repairing any failure affecting the safe working of the plant. If the parts cannot be made to work properly, the switches affected are to be disconnected from the interlocking apparatus and spiked for main track until maintainer arrives, under instructions of signal man. In case of emergency, section foremen shall assist maintainer when called upon.

448. When making regular inspection of interlocking plants, the section foreman and track supervisor shall arrange to have the signal supervisor, signal foreman, or signal maintainer, accompany them so that proper co-operation may be had in any work required, affecting both classes of service.

When instructed by track supervisor, section foremen shall attend to switch or signal lamps which must be taken care of in a manner prescribed by special instructions issued for the purpose.

TIES.

449. Tie renewals require special attention, and there is probably no other item in connection with track maintenance where the supervisor and section foreman can waste or save as much money as in selecting ties which are to be renewed. In determining the necessity for renewals, the condition of tie as to decay, wear, and condition of adjacent ties should be considered. The track supervisors shall personally go over their entire territory, on foot, with the foreman of each section and mark such ties as should be taken out during the coming season, then prepare a statement of the ties required for renewals; this inspection to be made before October 1st of each year.

450. Care shall be taken not to injure good ties when testing for renewals and no ties shall be removed which, in the judgment of the supervisor, and foreman, can safely remain in the track another year, and no ties shall be removed, except those that are marked for removal, or ties that are subsequently broken, unless authorized by the track supervisor.

451. Care shall be taken to avoid renewing ties out of face. No. 1 sound rail cut ties shall

be removed from track if cut one and one-half inches, when they shall be turned over and used in sidings.

452. The work of renewing ties should be started as early in the spring as the frost will permit, and as the renewals progress, the gauge, surface, line and ballast section shall be corrected.

453. All ties must be placed and maintained square to the line of rails. The ends of ties shall be lined with the outside rails on double and four-track sections, and on single track sections, with the east rail running north and south and the north rail running east and west.

454. Ties shall be spaced in accordance with instructions for standard tie spacing, in the various classes of track.

455. Joint ties must be spaced as shown on standard plans and the remaining ties spaced uniformly between the joint ties.

456. When new rails are laid and the position of joints thereby changed, the ties may be spaced to suit the new joints.

457. Good judgment should be used in selecting ties for joints and shoulders. The heart side of ties must be turned down, except where not perfectly true, when the bow must be laid upwards.

458. When new ties are being placed in track, tie hooks or tongs should be used to move them instead of picks, to avoid injuring the ties.

459. Ties must not be damaged by notching. If necessary, they may be adzed to obtain a true and uniform bearing for the base of rail. Any ballast disturbed when putting in main track ties, must be replaced as soon as the ties have been tamped, and always on the same day as disturbed.

460. Where rail braces are used, the seat

for the brace must be adzed level with the base of rail. Ties must not be adzed for plates, except as may be necessary to give them a full bearing. Care must be taken not to adze treated ties unless absolutely necessary. Ties shall be adzed only sufficiently to secure sound wood and true bearing for the rail or tie plate. All adzing shall be kept to an absolute minimum.

461. Twisted or badly hewn ties must not be notched, but shall be adzed to give the rails an even bearing over the entire breadth of the tie.

462. The excessive rail cutting of serviceable ties in the track is often the result of the adjoining renewed ties not furnishing their proportion of rail support, on account of being improperly tamped, which compels the older solidly bedded ties to do double work, and results also in rough riding track. When renewing ties, the old tie bed and adjacent ties should be disturbed as little as possible. The new ties must be solidly tamped and the track left in good line and surface.

463. Tie plugs shall always be kept on hand. The invariable rule must be, "Plug every hole where a spike has been drawn", except when the tie is to be renewed that season, and when possible re-spike into the plug and not weaken the tie by making a new hole.

464. The tamping and ballast trimming for all ties renewed should be completed each day.

465. Dating nails shall be put in on ties renewed at the close of each week's work. Location of nails in tie shall be in accordance with instructions issued.

466. Section foremen shall keep a record of tie renewals in the manner prescribed and report same on forms provided for the purpose.

467. Foremen must not use ties from piles which have not been inspected and marked, except in case of emergency. In such cases they will report promptly to the track supervisor the location from which the uninspected ties were taken, with the number used and the owner's name, if known. Foremen must not use ties from inspected piles which have not been assigned for use on their section, except in case of an emergency or by direction of the supervisor, and report of ties so used must be made at once to him.

468. All old ties removed from track must be gathered up once a week and put in a convenient and safe place for inspection and disposition, those suitable for sidetrack use to be piled separately.

Ties must not be burned until they have been inspected by the supervisor, and any fit for additional service in sidetracks separated from those unfit for further service. The latter will be given to section foremen and section men free of charge, not to exceed 50 per annum for each employee. Other employes to be furnished ties only on the authority of the division engineer. The remainder to be sold by the railroad company or burned. No ties shall be condemned as unfit for further use until they have been examined by the supervisor, or his assistant.

469. Old ties to be burned shall be piled not more than 60 to a pile, not under telegraph or other wires, and as far away from same as possible to avoid injuring them by heat; not less than 200 feet from bridges or other structures, and at least 12 feet from the track.

They should be burned when dry during the

first suitable weather, after instructions to that effect have been received from the track supervisor.

STANDARD TIE SPACING.

470. The spacing of ties will vary with the size of the ties, and traffic conditions.

Special instructions will be issued, classifying the various main lines and branches.

471. Joint ties must be spaced in accordance with standard plans, and the remaining ties spaced uniformly between the joint ties.

Variation from standard spacing, to suit special conditions, may be made by proper authority.

472. Unless otherwise directed, ties shall be spaced as follows:

On main lines (as they may be designated) No. 1 ties, 7 inches by 9 inches, treated or untreated, 20 to each 33-foot rail, and 18 to each 30-foot rail.

In all other important main tracks (as they may be designated) with their running tracks, passing sidings, busy switching leads, or other tracks which are extensively used, whether Company or private track, No. 2 ties, 6 inches by 8 inches, 20 to each 33-foot rail and 18 to each 30-foot rail. This will apply also to the running and passing tracks, busy switching leads and other tracks with heavy traffic, on territory where No. 1 ties are used in main tracks.

In main tracks of unimportant branch lines (as they may be designated) with their running and passing tracks, busy switching leads and other tracks extensively used, whether Company or private tracks, No. 2 ties, 18 to each 33-foot rail and 16 to each 30-foot rail.

In the more important classification, or other

tracks in yards, where the traffic is frequent, on all territory, No. 2 ties 6 inches by 8 inches, 20 to each 33-foot rail and 18 to each 30-foot rail, will be used in the switching tracks, and in all other tracks No. 3 ties, 6 inches by 7 inches, 20 to each 33-foot rail and 18 to each 30-foot rail.

In all other ordinary yard tracks and unimportant side-tracks, No. 3 ties, 18 to each 33-foot rail and 16 to each 30-foot rail.

In repair tracks, No. 3 ties, 14 to each 30-foot rail.

473. A proportionate number of ties will be used so far as practicable, in all cases, with shorter lengths of rail.

SWITCH TIES.

474. Sawed ties must be used for all permanent switch turnouts and crossovers, placed as shown on standard plans.

475. Switch ties must conform to the bill of timber in every case and be laid in proper order.

476. The renewal of switch ties must be made by replacing complete sets, except under special conditions, when renewals will be made by replacing only such timbers as are unfit for service.

477. Only in cases where turnouts are installed for temporary use, should anything but standard switch ties be used.

478. Frog timbers must be used in all cases, even though the installation of turnout is temporary.

PILING NEW TIES.

479. Ties should be distributed as near the exact location required as possible, and lined

up ready for use. If untreated ties, they should be permitted to season, if possible, in which case they should be piled in accordance with standard diagram. They should not be thrown off in piles, except at the end of high fills, where to distribute them would result in their rolling down the embankment.

480. New ties carried in stock, or those delivered along the track for use the following season, must be neatly piled, with one side parallel with the track, and, where practicable, a uniform distance therefrom, according to diagram, as near the point where they are to be used as possible.

481. Piles of ties should be located at least 12 feet from the nearest main track rail, on the most suitable piling ground, and at other points than in yards, have a clear distance of 50 feet, if practicable, between piles, so located as not to obstruct the view or cause snow to drift on track. When piled in yards they must not be less than 10 feet from the nearest side-track rail, with at least four feet between piles. Ties should generally be piled on the opposite side of track from prevailing winds.

482. Whenever available, ground supports of sound material must be used, giving not less than six inches clear space under the bottom of piles, and in any case there must not be more than two ties in contact with the ground. These two ties should be laid square to the track, and the layer next above parallel with the track, then continue as shown on diagram. The roof layers of piles should be laid as close together as possible, and all other layers have at least one inch space between the ties.

483. Treated ties shall be piled solid and piles covered on top with from three inches to six inches of earth for protection.

484. Ties must not be piled where they will be likely to come in contact with water, or where water can stand or run on surface of ground under them. Grass and weeds should be cut or burned where ties are to be piled.

(Note—Standard diagram for piling ties will be found at back of book.)

TIE PLATES.

485. Tie plates are used to provide a larger bearing surface on the tie, prevent the rail from cutting into the tie, or overturning, and to hold the rail to proper line and gauge. They should be applied in all cases where economy in maintenance will result from their use.

486. Shoulder tie plates will be used on every tie in preference to rail braces, except with guard rails and stock rails at switches.

487. Unless otherwise directed, standard tie plates will be used, when properly authorized, as follows:

On all treated ties, on all curves with heavy traffic, instead of braces, on all curves of over three degrees, with medium traffic, on all important switch leads and turnout curves beyond frogs, on important switching tracks and leads, on all bridge ties, through tunnels, ahead of main track switches a sufficient distance to prevent rails spreading, under public and private road crossings, at cattle guards, and for a distance of 50 feet each side of water stations. Also on any track subject to heavy service, where on account of re-spiking, adzing, and by the sawing and cutting action of the rail, ties do not give full life, and at any other points where ties wear out faster than they fail by ordinary decay.

488. If plates are put on after rails are laid,

all spike holes must be plugged, the ties carefully adzed the full length of plates to insure a firm bearing, the rail lifted, and the plates slipped in and track carefully gauged before spiking.

489. Where both flat and beveled tie plates are in use, they must not be mixed, but each kind laid in separate stretches to insure a full bearing for the rail base.

490. Ties shall not be adzed any more than is required to provide a full bearing for plates, and treated ties must not be adzed except when absolutely necessary.

491. The number of spikes used with tie plates shall be in accordance with rules for spiking.

RAIL BRACES.

492. Rail braces shall be used on switches and guard rails, as shown on standard plans, also on curves where tie plates are not provided; on shimmed track and elsewhere as may be necessary to prevent rails from canting or tracks from spreading, or as may be otherwise directed by the division engineer.

493. Braces must be placed on outside of rail, one at each end of the same tie, and ties must be adzed where necessary to bring the seats for braces level with the base of rail, not less than six pairs to each 30-foot or 33-foot rail to be used. Additional braces to be used as authorized by track supervisor. Curves of less than three degrees should not be braced, except in connection with shimming, or for other special reasons which render bracing necessary.

494. Rail braces should extend two rail lengths on the tangent beyond point of curve

and the same number of rail braces used per rail length as on the curve.

495. Where rail braces are required in connection with shims, the latter should be of sufficient length to form a support for the brace.

Where shims are not of sufficient length to support standard braces, old fish-plates, angle bars or other approved device may be used for temporary bracing, until the shims are removed.

ANTI-CREEPERS.

496. To prevent rails from creeping, on steep grades, soft embankments, approaches to important signals, etc., it is necessary that each individual rail shall be anchored to insure freedom from contact with the rails adjoining. Creeping cannot be prevented if a number of consecutive rails are in contact. Special rail anchors or anti-creeppers will be provided for creeping track, and shall be applied in accordance with special instructions.

497. The proper number of anti-creeppers to use is the number which will hold each rail that has a tendency to creep or travel, in its proper position; and no definite instructions can be issued as to the number to be used per 30 or 33-foot rail. Where anti-creeppers are applied, two to each rail shall be the minimum number. If creeping is not prevented by this number, a careful examination should be made to see that the application of anti-creeppers extends over a sufficient stretch of track. In case it does not, additional anti-creeppers per rail shall be applied, first on the quarters, then at intermediate points if necessary, as instructed by the track supervisor.

498. Where anti-creeppers are applied on other than joint ties, they must be placed on each end of a tie to prevent skewing it. There can be no satisfactory results from placing a large number of anti-creeppers on the rails within a few hundred feet of a railroad crossing, or at the foot of a hill when the rail has been "running" for possibly a mile or more before reaching the point where the greatest trouble is experienced. In such cases, the anti-creeppers should have been distributed over the entire distance where the rail has a tendency to move.

499. To obtain the greatest efficiency from anti-creeppers, they should be applied on full size sound ties, in track having standard ballast section. When standard ballast section is not maintained, the track should be well filled with ballast between the ties for at least three or four spaces beyond the anti-creeppers, otherwise they will do little good. The ballast should be sufficient to hold the tie in place against the pressure of anti-creeppers on it. Ballast must not be allowed to come in contact with anti-creeppers, or be close enough to come in contact with them in case of any reverse movement of the rail.

500. On some stretches, movement of the rail is in both directions. In such places anti-creeppers should be used to resist the movement in either direction, and when this occurs it will usually be on single track.

501. Care must be taken when making the original application of anti-creeppers to see that they are correctly applied. Overdriving generally fractures or spreads the material to such an extent that the anchors lose their holding power and prove ineffective in a short time. When anti-creeppers become set away from the ties they should be taken off and re-set against

the tie, but it is desirable to avoid re-setting as much as possible, to maintain the efficiency of the anchors.

502. On branch lines with unimportant traffic, there may be cases where the expense of re-spacing ties would not be justified, so that spiking in the slots of angle bars would be impracticable, and in such cases the application of anti-creepers may be desirable.

RAIL AND RAIL LAYING.

503. The life of rail in main tracks depends to a considerable extent on the care with which it is first laid, and the following instructions should therefore be carefully carried out.

The track supervisor should, so far as possible, supervise the laying of rail personally. Whenever the amount to be laid will justify it, an extra gang foreman will be employed.

GENERAL.

504. Rail is the most expensive portion of the track, defects in which are usually permanent and apparent. It must be handled carefully before being placed in the track, and uniformly supported after placing.

505. The standard length of new rail is 33 feet. Short new rails have ends painted green; second quality rails have ends painted yellow.

506. The position of the brand on rail is immaterial, whether right or left, inside or outside. When new rails are being laid, different brands must not be mixed.

507. Second quality rail shall be laid in turnout leads, except that first quality must be used in the stock rail to form the bend, also first quality rails must be used in turnout leads at end of double track, junction points, and

leads where traffic is fast. Where necessary to use second quality rail in main track it must be laid in accordance with special instructions, usually in freight tracks, and through stations where the track is straight, the speed slow and the service not severe.

508. When relaying or repairing track with second-hand rails, they should be carefully matched, placing together rails that are about equally worn.

509. Any rail that breaks in main track must be removed as soon as another rail is available to replace it. No splicing of rails in main track will be permitted, except temporarily in case of emergency.

The required number of rails must be kept at all times on rail rests.

510. Rails must not be punched or slotted, but when necessary to make holes for bolts, they shall be drilled with proper tools furnished for that purpose.

511. All crooked or bent rails shall be carefully straightened before laying. Particular attention should be given to rails which are slightly bent at the ends, to straighten them so that the two rails at the joint will be in perfect line. Bent rails must not be permitted to remain in the track, but shall either be removed or straightened with a rail bender.

512. General rail renewals must not be made in main or sidetrack without proper authority. In case rail is broken in service, destroyed by wrecks, fire, or under similar conditions, repairs shall be made at once and proper report forwarded to the track supervisor and division engineer.

UNLOADING.

513. Rails must be handled carefully before being placed in track. New or relayer rails

shall not be thrown off cars carelessly, or unloaded while cars are in motion except when an approved unloading device is used.

514. Rails may be distributed either from the ends or sides of cars. If distributed from the sides, both ends of rail must be dropped simultaneously, and great care taken to avoid injury to rails by dropping them on hard substances, or uneven surfaces, or leaving them so unevenly supported on the ground as to cause any bending of rails.

515. When rails are received in high sided gondola cars, some approved device should be used for unloading. If such device is not obtainable, the rails should be transferred to flat cars, from which they may be dropped to the roadbed, always taking care to drop both ends at once and to avoid injury by dropping on hard or uneven surfaces.

Rails placed in piles must be unloaded with skids.

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

In yards and station grounds, if not to be laid at once, rails should be placed in piles, or far enough back to be well out of the way of trainmen, and in convenient location for distributing immediately before laying.

Where two or more rails are unloaded at one point, they should be placed parallel and close together. Rails should not be unloaded where they will interfere with drainage or be dangerous to trainmen.

517. Rails will be loaded by a machine when practicable, but when necessary to load by hand the following precautions must be observed:

(a) Divide the gang equally on the ends of the rail.

(b) Designate one man to call directions and prohibit others from calling.

(c) Do not attempt to throw rail unless an ample force is at hand to throw it clear.

(d) Do not attempt to load where men cannot get away readily should the rail fall back.

CURVING.

518. All rails for curves of four degrees and over shall be curved by a rail bender before laying.

519. Particular care must be given to insure uniform curvature of the rails throughout their length, in accordance with the following table of middle ordinates:

MIDDLE ORDINATES FOR CURVING RAILS.

(In Inches.)

Degree of Curve	LENGTH OF RAILS								
	16'	18'	20'	22'	24'	26'	28'	30'	33'
4	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$
5	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$
6	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$
7	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	2
8	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
9	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{2}$
10	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{2}$
11	$\frac{3}{4}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
12	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
13	$\frac{3}{4}$	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
14	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
15	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
16	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
17	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
18	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
19	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
20	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
21	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
22	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
23	$1\frac{5}{8}$	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$
24	$1\frac{1}{2}$	2	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$

(Ordinates at the quarters are three-quarters of middle ordinates.)

(To find the curvature of track when not known, see directions under "Curvature".)

ADZING.

520. When practicable, the adzing should be done by the regular section force previous to the date rail laying commences. If the rail is canted so that it is impossible to properly adze the ties before the old rail is removed, a sufficient force should be employed at this work to avoid interference with laying the new rail as rapidly as other conditions will permit.

521. Remove ballast or dirt from under rails sufficiently to clear the adzing. Score adze the ties when necessary on both sides of rail a sufficient width to insure a level seat for tie plate, cutting to depth the adzing should be done, and in a straight line across the face of ties, parallel with rail.

522. After the old rail has been removed, drive spike stubs clear of adzing, and fill all spike holes with tie plugs immediately after the removal of the old rail and before the adzing is done. Adze the ties between the score lines perfectly even and straight, all adzed surfaces to be swept with broom before laying new rail; adzing to be done and the rail laid with base parallel with the surface of tie. Where ties are treated, creosote (preferably hot) is to be applied to all adzed surfaces with a brush. Ties should not be adzed more than is absolutely necessary.

FLAGGING.

523. When rail is to be laid the track shall not be obstructed or made unsafe for schedule

speed, until the work has been protected as required by flagging rules.

524. Track supervisor or foreman in charge of the work must notify train dispatcher on what territory he will be laying rail each day, and request slow orders on all trains. They must also notify train dispatcher when slow orders can be removed, either permanently or for the day.

525. Supervisor or foreman must obtain from the train dispatcher the numbers of extra trains and approximate time they will probably reach his work during the day so that the work can be arranged to cause the least interruption of traffic.

LAYING.

526. When new rail is to be laid where main track requires a general throw, track shall be moved to the alignment set by the engineer before laying new rail.

Track centers will be furnished by the engineer every 100 feet on tangents and every 50 feet or less on curves. The track must be laid to conform exactly to the line so established.

527. To maintain proper gauge in relaying rail, three lines of spikes must be drawn. At times it may be found necessary to draw only two lines of spikes, laying one side from the outside and the other from the inside. When old rail is replaced by rail of heavier weight or wider section, three lines of spikes must be drawn. Where shoulder tie plates are in use, both lines of rail will be laid from the inside.

To provide a uniform and level bearing for the new rail, tie plates must be removed where necessary and ties adzed.

All spike holes must be plugged and spikes

driven as nearly in the old locations as gauge will permit.

528. After removing old rail and adzing ties where necessary, the bearing surface of the ties shall be cleaned before new rail is placed on them and dirt or other substances carefully removed from the bottom of the new rail before placing on the ties.

529. Accurate expansion cannot be secured if long stretches of rail are fastened on one side of the track and subsequently thrown into line. When laying new or part worn rails, wherever the traffic will permit, the rails should be laid consecutively, to line and gauge, one at a time, and full bolted, throwing out the old rails from the track ahead as the new rails are laid. When new rails are set up and bolted, outside of the old rails, to be thrown in later, not over 20 rails should be thrown without a break in connection, on curves, and no rail should be thrown in without being full-bolted at each joint.

530. Rails must be laid with broken joints in all tracks.

In main tracks the joints on one side must not vary more than six inches in either direction from the centre of opposite rail.

531. Special rails of less than standard length are furnished for curves to bring the joints in their proper position. When laying up to switches, a combination of rails less than standard length should be used, to avoid cutting, if practicable.

532. Short rails may be used in making temporary closures, connections with switches, and with rails of different sections, or changing from square to broken joints, but such rails shall be used only on tangents or on the inside

of curves, and no rail less than 14 feet long will be allowed in fast running main track.

The difference in length of outer and inner rails in feet for all curves is ascertained by dividing the central angle of the curve in degrees by 12.

533. When laying rails care must be taken to avoid locating joints in important street crossings, in cattle guards or nearer than six feet from ends of bridges or trestles, on the embankment.

Rail 66 feet long will be provided for this purpose, where necessary.

534. Rails must not be driven into position with a hammer, maul or any similar tool, but shall be moved with pinch or lining bars.

535. Standard expansion shims must be used and care exercised in placing them so that the proper opening will be left between the rails, as provided under "Joints".

536. To insure perfect adjustment at rail ends, the rail should be brought squarely together and carefully bolted before spiking.

537. Bolts, spikes, tie plugs, tie plates, etc., should be distributed, as nearly as possible, where they will be used; but they should not be unloaded much in advance of laying the rail, and care should be taken to see that they do not become buried.

538. All joint bars must be properly put on with the full number of bolts, nuts and nut locks, and nuts screwed up tight.

Bolts must be gone over and re-tightened at short intervals until all are tight, with joint bars home.

539. All rail must be left full spiked and full bolted at the close of each day, and this work should be done, so far as practicable, before allowing trains to run over the rail.

Rail laying, at the end of the day, or when the work is completed, should not end on a bridge nor on a curve.

540. When laying rail of heavier section on curves, the heavier rail should extend at least two rail lengths beyond either end of the curve.

Where rail of heavier section is used in main track than in side-track, the main track section should extend on the side-track not less than two rail lengths beyond clearance point.

541. In making temporary connection for passage of trains, a switch point may be used, and must be removed at the completion of each day's work, when old rail is to be cut and drilled for closure, with standard joint fastenings, full bolted and spiked, by the rail-laying gang before leaving for the night.

The best results are obtained by keeping on hand two 12 or 15-foot pieces of heavy rail for these temporary connections.

If it is necessary to make temporary connections by cutting the light rail, a short section of new rail should be laid at the end of last full length of new rail, to avoid damage to the end of the new rail which remains in the track.

Switch points for making temporary connections between old and new rail shall always be of the same section as the higher rail, and be installed facing traffic to prevent the false flange on worn tires from causing a derailment or accident.

When this method of making connection is used, proper caution signals must be displayed, and every requirement to insure safety observed.

542. In connection with laying new rail, all kinks must be taken out with the rail bender and the track accurately gauged. As soon

after laying as conditions will permit, the ties shall be re-spaced, with proper number to each rail, and the track carefully surfaced and lined.

Immediately after rail is laid, shims shall be used to surface the rail until track has been properly tamped.

543. Tie plates must be replaced under the rail as soon as jointing and tie spacing is completed. Particular attention shall be paid to the placing of the tie plates so that their shoulders will have a full bearing along the base of the rail. The track gauge must be used continually so that new rail will be laid accurately to gauge.

544. When laying rails, care must be taken to lay the base of the rail true to the plane of the track, so that the wheels will have a bearing on the full width of the top of rail.

If the rail does not show full bearing on head after a few days, it must be adjusted to give such bearing.

545. After new rail has been laid, the old rail and fastenings which have been relieved, must be picked up as soon as a force is available for that purpose, and taken to the proper storage point, or otherwise disposed of, as may be required. The different classes of rail must be kept separate, as provided for under "Classification".

546. In cutting new rail a saw should be used in preference to cutting the rail with a chisel, except where the extra time involved would result in unreasonable interference to traffic on main track. When cutting with a chisel, the man holding chisel and the man striking should wear non-glass goggles, and the men holding the rail should face away from the cutting.

547. Extra tools, especially adzes, brooms,

mauls and handles, should be provided. Adzes should be sharpened as often as necessary by grindstones to be furnished and kept with rail-laying gang.

548. Where rails are bonded and used for a track circuit, no bond wires are to be broken or rails removed from track, except in case of emergency, unless a signal maintainer is present with facilities to keep the signal apparatus in working order and rebond the new rails put in the track. In case of an emergency, any broken rail, switch or frog may be renewed without waiting for the signal maintainer, but in such cases the joints are to be screwed up tightly to make as good contact as possible between the rails, and the signal maintainer notified that the wires have been broken.

JOINTS.

549. Joints must be provided with the full number of bolts, nuts and nut locks. Bolts must be placed with the nuts alternately on the inside and outside of rails, except where the rails are less than five inches in height, in which case all nuts will be placed on the outside.

550. Rails adjoining others of different section, must be connected by compromise or step joints of approved pattern.

Where it is necessary to use short rail, a full length rail shall be next to compromise joint and the short rail placed back of this full rail.

551. Rails must not be punched or slotted, but when necessary to make holes for bolts, they must be drilled with the proper tools.

552. All rails must be drilled before being put in main track, so that they can be fully bolted. This is especially important at com-

promise joints where different weights of rail are connected, and at insulated joints.

Where insulated joints are installed, special care must be taken to see that joint ties are spaced, and first-class bearings provided at once. Ties must be spaced to give proper support to all rail joints, which should be midway between the joint ties.

553. Insulated joints shall be installed only on perfect rails of the section for which the joint is designed.

554. Care must be exercised when installing insulated joints to prevent damage to the fibre. The fibre bushings will not withstand severe blows on the bolt heads.

555. When uncoupling rails, the nuts should not be knocked off with a hammer, but oiled if necessary and taken off with a wrench.

556. A thermometer must always be used when laying rails, and an allowance made for expansion.

The openings between ends of 33-foot rails should be as shown in the following table:

Temperature (Fahrenheit)		Allowance.
—20 deg. to	0 deg.	5/16 inch.
0 “ “	25 “	1/4 “
25 “ “	50 “	3/16 “
50 “ “	75 “	1/8 “
75 “ “	100 “	1/16 “

With temperature over 100 degrees, rails should be laid close together without bumping.

When laying 30-foot rails omit the shims at every 10th joint.

When laying 28-foot rails, omit the shims at every 7th joint.

The thermometer for determining temperature should be laid on top of the rail in advance of the track laying, and left there long enough

to record the temperature accurately. Shims should be issued to the men laying rail by the man taking the temperature readings who, as the temperature changes sufficiently to warrant, will take up shims in use and issue others.

557. Expansion shims will be made of metal bars of the proper thickness, and in accordance with diagram. Wood shims must not be used. Each shim will be stamped with the temperature for which it is intended to be used, so that by referring to the thermometer readings on the rail, the correct shim can be used to provide the expansion. Shims must be left in place until track is full bolted and spiked for at least ten rail lengths ahead, and then removed.

558. In tunnels above 70 degrees, rails should be laid with close joints, without bumping them together, and for temperature below 70 degrees, an opening one-sixteenth inch for each 25 degrees variation for 30 and 33-foot rails should be provided.

559. At the time rail is laid, all joints must be fully bolted, and bolts tightened, to preserve the expansion, before the joints are spiked.

All rails shall be inspected, and kinks or bends taken out with rail bender, before bolts are tightened.

Nuts shall be tightened the day after rail is laid and thoroughly retightened within the next ten days.

560. No spikes shall be driven in the slots, or at the ends of angle bars, where they will interfere with free movement of the rail, on open deck bridges or trestles.

561. All main track joints must be carefully inspected each day, and cracked or broken angle bars and bolts removed, loose bolts tightened, and any unusual difficulties with bolts,

nuts, locks, etc., reported by foreman to track supervisor.

562. Joint bolts at heel of switch or derail points worked by an interlocking lever must not be so tight as to interfere with the free movement of the point.

SPIKING.

563. Spikes must be started vertically and square, one-half their width from the base of rail, and driven straight, with the face of the spike in contact with the rail, to a full bearing on the base.

564. All rails must be full spiked, four spikes to each tie, and every spike must be driven perpendicularly, as the underside of the head of spike is formed to fit the base of the rail when driven straight and snug up against it. This should be accomplished by careful driving and not by the last blow of the spike maul to bend it over against the rail for the purpose of giving the appearance of a fit. The last few blows should be given lightly so as not to strain or break the head of the spike. Care should be taken not to strike the rail when spiking. Where continuous joints are used, the heads of spikes shall be turned away from the rail.

565. On tangents, only two spikes to a rail should be used on each tie. On curves, or creeping track, three or four spikes should be used, as required, or in accordance with special instructions. Spikes must be driven in the slots of bars at rail joints, except on open deck bridges or trestles, where spiking in the slots or against the ends of angle bars is prohibited.

566. All main track and turnout spikes must be tightened at the same time that the bolts are tightened.

567. The ends of cross ties in track must be lined true, in accordance with rules for placing ties.

568. To avoid splitting the ties and to hold them from skewing, spikes should be staggered, the outside spikes of both rails being placed on one side of the ties and the inside spikes on the other.

The proper position for spikes is shown in diagram at back of book.

569. The track gauge must always be used when spiking track.

570. For the purpose of maintaining standard gauge, three lines of spikes must be drawn, if old rail is being replaced by rail of wider section. All spikes that are being removed from the track must be carefully drawn, so that if found to be of full dimensions they may be straightened and used again, but no throat-worn spikes shall be re-driven in main track. When spikes are drawn from ties that are to remain in track, the holes must be plugged. All spikes must be removed from old ties before they are thrown aside.

571. Spikes in service which are found to be throat-worn, or cut under the head enough to weaken them and create the possibility of shearing or breaking off the heads, must be removed from the track.

Spikes on the outside of main track curves must be removed as soon as they are throat-worn one-eighth of an inch.

All spikes rusted or corroded to such an extent as to weaken them, shall be removed and replaced by spikes of full dimensions.

572. If shims more than one-half inch thick are required, they must be bored, and track spikes of extra length used. When shims are

removed, standard spikes must be substituted for the long ones and the latter preserved in the tool house for future use.

573. Long track spikes of standard lengths, for shimming work, will be furnished on requisition. Reverse pointed spikes must be used at all places where the rail is spiked directly to a stringer.

574. All old spikes, tie plates, bolts, etc., which cannot be used again must be gathered up and taken to scrap bin, convenient for shipping.

GAUGING.

575. The standard gauge of track is four feet eight and one-half inches, and a track gauge of approved type must always be used when spiking track.

All foremen must know that their gauges have been properly tested, and are correct, before using them.

576. The track gauge used should be the standard gauge adopted.

577. Each supervisor of a district shall have a standard gauge, and all gauges in that district must be tested by comparison with this standard as frequently as may be necessary to insure accuracy. The district standards must be checked with the division standard gauge at least once a year, preferably in December. All gauges which have been compared with the standard and adjusted will be painted a new color each year to indicate that they have been inspected and tested.

578. Gauges, to be in satisfactory condition for use, must pass the following tests:

1st. They must be exactly four feet eight and one-half inches between gauge lines.

2nd. The tee ends must be square with the center line of the gauge.

3rd. The heads or ends must be firmly fastened to the rod, and the rod must be straight.

579. Metal track gauges, that are not insulated, must not be used on any track that is bonded. This is to guard against interference with the signal system and the possibility of giving a wrong signal indication.

580. Proper gauge is one of the principal features of good track; gauge kinks on tangents are as detrimental as low joints.

581. Track must be laid to standard gauge on tangents and on curves of eight degrees and under. Gauge should be widened one-eighth inch for each two degrees or fraction thereof over eight degrees to a maximum of four feet nine and one-quarter inches for tracks of standard gauge, as shown in the following table:

Curves of 8 degrees and under to be standard gauge.

Curves of 9 and 10 deg.	widen	$\frac{1}{8}$ "
" " 11 " 12 "	" "	$\frac{1}{4}$ "
" " 13 " 14 "	" "	$\frac{3}{8}$ "
" " 15 " 16 "	" "	$\frac{1}{2}$ "
" " 17 " 18 "	" "	$\frac{5}{8}$ "
" " 19 " 20 "	" "	$\frac{3}{4}$ "

Gauge, including widening due to wear, should never exceed $49\frac{1}{2}$ "

582. The alignment should be maintained on outside rail, and the extra width of gauge given by the inside rail. This should be uniformly decreased on the easement curve, from point of central curve to point of tangent.

583. For curves not having ends eased as above, the full extra width of gauge should extend to the end of the curve and the extra width be gradually decreased on tangent to

tangent gauge, on the low or inner rail in a distance of two rail lengths.

584. Where gauge is widened, metal lugs must be attached to the track gauge, or iron shims used, to insure uniformity.

585. The installation of frogs on the inside of main track curves should be avoided wherever practicable, but where this is unavoidable, the rule for widening gauge on curves should be modified to make the gauge of the track at the frog standard.

586. The clear width of standard flangeway for all frogs and between main rails and guard rails should be one and three-quarter inches, measured at the gauge line, for all tracks of four feet eight and one-half inch gauge.

587. When it is necessary to locate frogs on the outside of main line curves, which require extra width of gauge, the width of flangeway between the guard rail and adjoining main track rail must be increased as much as the extra gauge, that is, if the gauge is four feet nine inches, the flangeway should be increased to two and one-quarter inches.

588. Within proper limits, a slight variation of gauge from standard is not seriously objectionable, provided the variation is uniform and constant over long distances. Under ordinary conditions it is not necessary to re-gauge the track if the increase in gauge has not amounted to more than one-quarter inch, provided such increase is uniform.

589. Wide gauge, due to curve worn rail, within the safe limits of wear, need not be corrected until the excess over the gauge is equal to or exceeds one-half inch, and should then be corrected by closing in, but in no case shall the gauge exceed one inch more than standard gauge.

590. Where track is intended to be spiked to standard gauge, the rail should be held against the gauge with a bar while the spike is being driven.

591. Care must be exercised to gauge correctly at joints, especially where angle-bar projection is liable to catch the lug of the gauge.

592. During the winter months, the gauge of all tracks should be tested, and the rails respiked where necessary to obtain correct gauge. This work, however, shall not be undertaken in extremely cold weather when ties are filled with frost.

593. When snow is on the ground supervisors and foremen must give the matter of spread track special attention, noting the condition of snow or ice around the rail, and if there is any indication of disturbance by rail movement, it must be cleared away and the spiking thoroughly examined.

594. Supervisors and foremen must test the gauge of track frequently if there is any tendency of rails to spread. Any indication of spread track must be corrected at once.

REPLACING DEFECTIVE RAILS IN TRACK.

595. Track supervisors and section foremen must watch the flange wear of the outer rail on sharp curves, on account of the weakening of the rail and the extra width of gauge which this wearing will cause, and remove worn rails from the main track under the following conditions:

1st. When the joint bars are being cut or struck by the wheel flanges.

2nd. When the rail is weakened by the side of the head being worn as much as one-eighth of its original width.

3rd. When the side of the rail head is worn to the slope of the wheel flange and fillet, over which the wheels are liable to climb.

596. Rails having pieces of head or base broken out or those having cracks, splits, pipes or other flaws, must be removed from the main track as soon as discovered, as such rails are liable to break. The discovery and removal of such rails is a most important feature of track inspection and maintenance, and track walkers, section foremen and track supervisors must be constantly vigilant in this respect, particularly inspecting all new rail for a few months after it has been laid.

597. A broken rail, when found in main track or adjacent running tracks, must be immediately protected by a flagman, and no trains shall be allowed to pass over same until it is found that rail is in such condition as will permit train to pass in safety. If it is decided that trains can safely pass over the rail, all trains must be stopped at least 200 feet from the break, and then allowed to proceed at slow speed. If a suitable rail is available the broken rail shall be replaced immediately. If a rail is not available for immediate replacement, the broken ends shall be drilled, a splice bar applied at once, and a slow order of not exceeding ten miles per hour issued. After splicing rail, the section foreman must promptly wire supervisor, who will arrange at once for shipment of rail for replacement. Until repairs have been made the track must be protected by proper signals. Section foremen should promptly fill out the proper form, and send wire report to engineer, maintenance of way, superintendent and division engineer, to be followed by usual form to the supervisor, giving section number, location and weight of broken rail, name of maker, when

rolled and laid, heat number, position in ingot, and time when rail will be replaced. Track supervisor shall personally see that broken and spliced rails are removed from the track promptly and full report made covering delay to trains, etc.

598. On each section there must be on the rail rests, not less than two spare rails per mile of main track and on sections where there are both 30 and 33-foot rails in track, the number of spare rails of each length shall be proportioned to the number of miles of track laid with 30 and 33-foot rails.

These rails should be given a coat of crude or black oil which should be renewed as often as necessary, to prevent rusting.

599. Emergency rails, kept on rail rests, should be occasionally changed with rail in main track, so that all rail will have approximately the same degree of wear.

600. After defective rails have been removed from main track, they will frequently become rusted over to such an extent that all signs of the defect is obliterated, and to avoid the possibility of these rails being used again for main track repairs, they must be placed on the opposite side of track from rail rests. Rails must not be placed on rail rests or on the same side of the track as the rests unless they are suitable for repairing main track.

When so instructed, work trains will pick up defective rails that have been removed from track and take them to proper storage point.

CLASSIFICATION.

601. New rails shall include:

All rails that have not yet been in service.

602. Relieved rail shall be classified as follows:

Rails for repairs in main tracks shall include—

Rails that are sound throughout, and which if curved can be straightened by rail bender when necessary.

The vertical wear on top of head not exceeding: For 100 lb. rail and over, one-eighth inch.

Ends not down more than one-sixteenth inch in two feet or less.

Flange wear of head not exceeding one-sixteenth of original width.

Wear under head not greater than will leave at least one-sixteenth inch between angle bar and web of rail.

Rails not less than 30 feet long.

603. Rails for relaying in branch lines shall include:

Rails that are sound throughout, and which if curved can be straightened by rail bender when necessary.

The vertical wear of top of head not exceeding: For 60 to 80 lb., one-eighth inch; for 100 lb. and over, three-sixteenths inch.

Ends not down more than one-eighth inch in two feet or less.

Flange wear not exceeding one-eighth of original width.

Wear under head not greater than will leave at least one-sixteenth inch between angle bar and web.

Rails not less than 24 feet long.

604. Rails for sidings:

Rails that are unfit for main or branch lines, but which are still serviceable, and shall include—

Rails with badly battered ends.

Rails with broken flange that can be strengthened by angle bars.

Piped rails.

Rails not less than 15 feet long.

605. Scrap rails to include:

Twisted and bent rails that cannot be straightened.

Rails from which a serviceable length cannot be cut.

606. Rail-rest rails:

Shall include all rails distributed on rail rests.

607. Emergency rail:

Shall include all rail loaded on cars for emergency to accompany tool train, or for other purposes.

608. Previous to releasing the old rail it must be classified, and each rail marked on the flange with white paint as follows:

For "Main Line Relay"—four spots; for "Branch Line Relay"—three spots; for "Sidings"—two spots; for "Scrap"—one spot.

609. When the relieved rail is being picked up, the various classes should be kept separate and loaded on separate cars if necessary, all cars to be properly labeled, and class of rail carried by each car specified in the bill of lading.

610. Curve rail, when relaid, should be laid continuously and not mixed with tangent rail.

When taking up curve rail, which is to be relaid in main track, it shall be loaded separately and cars labeled "Curve Rail"; also, bills of lading shall designate cars containing this rail, with the class to which it belongs.

611. When relieved rail is not needed for immediate use, it must be picked up by work train, and not left lying along the track.

In no case shall rail be left between tracks within station limits, or in any locations where trainmen or other employes are required to walk.

LINE AND SURFACE.

612. Track must be laid and maintained to true line and surface. On all tangents, the tops of rails shall be level transversely except on approaches to curves, as provided in Rule 630.

613. When raising or surfacing track, foremen shall not trust to their eye sight, but must keep their level and sighting board in constant use.

614. Vertical curves will be established by the division engineer at all grade intersections where change in grade is more than one-tenth per cent. The length should be determined by the grades to be connected. On first-class lines, rates of change of 0.1 per 100 feet on summits and 0.05 per 100 feet in sags should not be exceeded.

On less important lines 0.2 per 100 feet on summits and 0.1 per 100 feet in sags may be used.

615. When track is badly out of line or surface for long distances, or where for other reasons, it is desirable to have line or grade stakes furnished, this will be done by an engineer.

616. Track levels must be tested by the track supervisor at the beginning of the working season, and the date of the inspection recorded. They must also be frequently tested for accuracy by section foremen during the working season, and all sluggish bubble tubes replaced.

617. When not surfacing out of face, as in case of picking up low joints or other low places, the general level of the track should not be disturbed.

618. The surface of track on bridges, in tunnels, under overhead structures, at stand-

pipes, in paved streets, and opposite platforms, or other fixed structures, must not be raised or lowered under any circumstances, without instructions from the division engineer.

CURVES.

619. Curve easements are transitions from tangent to curve, or from lighter curve to sharper curve, by the introduction of equal chords of increasing degree of curvature.

620. The object of easing curves at their extremities is to turn the trucks gradually, and thus avoid shock to car and rail, to secure a regularly increasing elevation of the outer rail, and a regularly increasing extra width of gauge, which shall be consistent with the increasing degree of curvature. The length of easement curves will vary according to the amount of elevation of the outer rails. Lining this part of the track by eye introduces a flat piece of curve with which the changing elevation of the outer rails seldom accords, and the introduction of these easements can only successfully be made by following the stakes set by an engineer.

621. All curves of two degrees or over should have easement curves at the ends, and all curves of less than two degrees which require two inches or more elevation for the highest permissible speed, should have easement curves. The curve elevation should be run out in the same distance as the length of easement, with no elevation on tangent and full elevation on the circular curve.

Easement curves should be used between curves of different degrees in the same way that they are used between curves and tangents.

Standard easement curves will be laid out by the division engineer where required.

622. In all cases where the track is to be moved, center and grade stakes for curves and easements will be set by an engineer.

623. To determine the degree of curve, stretch a line 62 feet long, with a small knot at the middle, on the gauge side of the outer rail, selecting a well-lined portion of the curve. Measure the distance from the knot to the gauge side of the rail, and every inch of this distance indicates one degree of curvature. Thus, if the distance is two inches, it is a two-degree curve; if four inches, it is a four-degree curve, etc.

The degree of a curve may also be determined by the use of the following table:

TABLE FOR FINDING CURVATURE OF TRACK.

Degree of Curve.	Radius of Centre Line in feet.	No of Rails in Arc		Length of Arc in feet	Length of Chord in feet	Central Angle
		33 feet	30 feet			
1	5730	14	15 - 1/2	463.5	463.4	4°38'
2	2365	10	11	328.6	328.4	6°34'
3	1910	8	9	268.1	267.9	8°02'
4	1433	7	8	232.5	232.2	9°17'
5	1146	6 - 1/3	7	208.0	207.7	10°24'
6	955.4	5 - 3/4	6 - 1/3	190.0	189.7	11°22'
7	819.0	5 - 1/3	5 - 5/6	175.8	175.5	12°16'
8	716.8	5	5 - 1/2	164.8	164.5	13°08'
9	637.3	4 - 7/10	5 - 1/6	155.2	154.8	13°51'
10	573.7	4 - 1/2	4 - 9/10	147.5	147.1	14°40'
11	521.7	4 - 1/4	4 - 2/3	140.5	140.1	15°23'
12	478.3	4	4 - 1/2	134.8	134.3	16°04'
13	441.7	3 - 9/10	4 - 1/3	129.5	129.0	16°42'
14	410.3	3 - 3/4	4 - 1/6	124.8	124.3	17°20'
15	383.1	3 - 2/3	4	120.6	120.1	17°56'
16	359.3	3 - 1/2	3 - 9/10	116.8	116.3	18°30'
17	338.3	3 - 4/10	3 - 8/10	113.3	112.8	19°04'
18	319.6	3 - 3/10	3 - 7/10	110.3	109.8	19°38'
19	302.9	3 - 2/10	3 - 6/10	107.4	106.8	20°10'
20	287.9	3 - 1/10	3 - 5/10	104.7	104.1	20°40'

To find degree of curve, stand at a joint on outside of curve, sight across gauge side of inside rail to where line strikes outer rail and count the joints back, or measure chord or arc. The degree of curve in table opposite either of these distances is the one sought.

CURVE ELEVATION.

624. The inner rail of track must be maintained at grade and the proper curve elevation obtained by raising the outer rail.

625. The maintenance of proper elevation is important, and it shall be maintained at all times.

626. The elevation of outer rail on curves must be adapted to the speed of all classes of trains which pass over them with due regard for comfort, safety and economy in track maintenance.

627. The outer rail on curves should not always be elevated the same amount on curves of the same degree. A four-degree curve at the top of a long grade should not be elevated for the same speed as a four-degree curve at the bottom of a long grade, as the speed of trains is almost invariably faster over the latter than over the former. Foremen should therefore consult the supervisor regarding the elevation of each curve on their sections and get from him the proper speed for which to elevate. The elevation of the outer rail on curves must be the number of inches given in the following table, unless local conditions require a modification:

ELEVATION OF OUTER RAIL IN INCHES.

Degree of Curve	VELOCITY IN MILES PER HOUR										Degree of Curve	
	0	10	15	20	25	30	35	40	45	50	55	60
1	1/8	1/8	1/8	1/4	3/8	5/8	3/4	1 1/8	1 1/8	1 1/2	2	2 3/8
2	1/4	1/4	3/8	1/2	7/8	1 1/8	1 1/2	2 1/8	2 1/8	3 1/4	4	4 3/4
3	3/8	1/2	5/8	3/4	1 1/4	1 3/4	2 1/8	3 1/8	3 1/8	4 1/2	6	7 1/8
4	1/2	3/4	1	1 1/4	1 5/8	2 1/8	3	4 1/8	4 1/8	5 3/8	6 3/8	7 1/2
5	5/8	1	1 1/8	1 1/2	2 1/8	3 1/8	4 1/8	5 1/8	5 1/8	6 3/4	7 3/4	8 1/2
6	3/4	1 1/8	1 1/4	1 5/8	2 1/4	3 1/4	4 1/4	5 1/4	5 1/4	6 3/4	7 3/4	8 3/4
7	1	1 1/4	1 3/4	2 1/8	2 3/4	4 1/8	5 1/8	6 1/8	6 1/8	7 3/4	8 3/4	9 3/4
8	1 1/8	1 3/4	2 1/8	2 3/8	3 1/4	4 3/4	5 3/8	6 1/2	6 1/2	7 3/4	8 3/4	9 3/4
9	1 1/4	2	2 3/8	3 1/8	3 3/4	5 1/8	6 1/8	7 1/8	7 1/8	8 3/4	9 3/4	10 3/4
10	1 1/2	2 1/4	3 1/8	3 3/8	4 1/2	5 3/8	6 3/8	7 3/8	7 3/8	8 3/4	9 3/4	10 3/4
11	1 3/4	2 3/4	3 3/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	8 1/4	9 3/4	10 3/4	11 3/4
12	2	3 1/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	9 1/4	10 3/4	11 3/4	12 3/4
13	2 1/8	3 3/8	4 3/8	5 3/8	6 3/8	7 3/8	8 3/8	9 3/8	9 3/8	10 3/4	11 3/4	12 3/4
14	2 1/4	3 1/2	4 1/2	5 1/2	6 1/2	7 1/2	8 1/2	9 1/2	9 1/2	10 3/4	11 3/4	12 3/4
15	2 1/2	3 3/4	4 3/4	5 3/4	6 3/4	7 3/4	8 3/4	9 3/4	9 3/4	10 3/4	11 3/4	12 3/4
16	2 3/4	4 1/4	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	10 1/4	11 3/4	12 3/4	13 3/4
17	3	4 1/2	5 1/2	6 1/2	7 1/2	8 1/2	9 1/2	10 1/2	10 1/2	11 3/4	12 3/4	13 3/4
18	3 1/4	4 3/4	5 3/4	6 3/4	7 3/4	8 3/4	9 3/4	10 3/4	10 3/4	11 3/4	12 3/4	13 3/4
19	3 1/2	5 1/4	6 1/4	7 1/4	8 1/4	9 1/4	10 1/4	11 1/4	11 1/4	12 3/4	13 3/4	14 3/4
20	3 3/4	5 3/8	6 3/8	7 3/8	8 3/8	9 3/8	10 3/8	11 3/8	11 3/8	12 3/4	13 3/4	14 3/4

The elevation of curves must not exceed 7 1/2 inches without special instructions.

628. If, after having elevated the outer rail according to table, indications show too much or too little elevation, the necessary adjustment in elevation, or speed of trains, will be recommended by the track supervisor.

629. The full elevation of outer rail must not be continued beyond the end of the central curve, but should decrease uniformly along the easement curve to the tangent point where the rails should be level. The division engineer will set stakes and furnish notes for elevation of outer rail for all curves where easement curves have been applied.

630. For curves not having easements, the elevation at the ends shall be one-half the full elevation. From these points the elevation should increase on the curve and decrease on the tangent by changing the elevation of the outer rail one-quarter inch to each rail length, except in cases where conditions will not permit, when it may be necessary to run off at the rate of three-eighths or one-half inch per rail length.

631. For compound curves, full elevation shall extend all the way around sharper curves to the point of compound, unless the difference in curvature is very decided, in which case it is to be governed practically as per Rule No. 630.

632. If the tangent is too short to provide for the length of run-off, the tangent must be divided into two parts in proportion to the degree of the curves which it connects; the greater part being next to the curve of greater degree. Make the track level at this division point and for a rail length in either direction and carry run-off up each way from these points at the rate of one-half inch for each rail length, using as much of the curves as is necessary for that purpose.

633. On reverse curves the rails must be level with each other for one rail length on either side of reversing point. From this point the elevation must be increased in either direction at a uniform rate, depending upon curvature and speed.

634. To ascertain the proper elevation for the outer rail on curves whose degree is unknown or on curve easements for which the engineer has not provided information, use the middle ordinate of the following chord lengths for the various speeds, which is approximately the proper elevation for the outer rail:

Speed 20 miles per hour, chord length 32 ft.
Speed 25 miles per hour, chord length 40 ft.
Speed 30 miles per hour, chord length 48 ft.
Speed 35 miles per hour, chord length 56 ft.
Speed 40 miles per hour, chord length 64 ft.
Speed 45 miles per hour, chord length 72 ft.
Speed 60 miles per hour, chord length 80 ft.

SHIMMING.

635. The necessity for using shims is an indication of poor drainage or poor ballast, and should be remedied as soon as possible.

In case it is necessary to shim the track, it must be done on tops of the ties or tie plates.

The placing of blocking under the ties is forbidden, except in case of emergency, when it must be removed as soon as possible.

636. When shimming, the level board must be used, track carefully gauged and gauge frequently tested.

All shimming must be done in a manner to give track the proper surface gauge, line and strength. The shimming must be carried out far enough each side of the high spots to insure easy grades, and when one side of the

track has heaved more than the other it must be brought to a proper surface, maintaining the correct superelevation on curves and their approaches.

637. Shims of standard dimensions will be furnished, with holes bored through them so that spikes may be driven without splitting the shim. They must be of the same thickness through and not wedge-shaped. Where shimming is required to a height of one-half inch or over, shimming spikes must be used, and the rails thoroughly braced, to prevent them from canting or spreading.

638. As track begins to heave, a "run-off" should be shimmed on each side of the high points, using at the start standard one-eighth inch shim and increasing the depth of shim by eighths of an inch until the surface has been equalized. No attempt should be made to compensate for heaving by adzing the ties, unless conditions render it absolutely necessary, as this practice reduces their strength and rapidly destroys them. Care must be taken to see that the surface of tie, shim, and rail base are entirely free from ice and snow, as track is liable to spread if there is ice between the bearing surfaces.

639. When shimming to the extent of one and one-half inches or more is done, shims must have two additional holes bored in them so that they may be spiked securely to the ties. When it is necessary to shim over two and one-half inches, long shim three inches thick must be used, extending across the track between rails, provided the track is heaved uniformly. It should be bored to receive the rail spikes, and also additional spikes to hold it in place, and if necessary, smaller shims may be used on top of these three-inch shims, the same as if used on

the track tie. In case of but one side heaving two and one-half inches or more, a shim of necessary thickness shall be used on the opposite side, spiked to the tie in the same manner that the longer shim is used.

REMOVING SHIMS.

640. Section foremen should give careful attention to the removal of shims, during thaws, and while the frost is finally leaving the ground. This should be done as nearly as possible in the reverse order in which they were placed, not all at one time, but by successive stages. Instead of raising and tamping the low places caused by the frost leaving the ground, the heavy shims can be successively replaced by smaller ones, thus keeping the track in fair surface, and so gradually restoring it to normal condition.

641. Each time spikes are drawn when changing or removing shims, the old spike holes must be plugged and the spikes re-driven in the plugged holes as often as good holding power can be secured in this way, otherwise ties where much shimming has been done will be destroyed by "spike killing" in a very short time.

Standard spikes should be substituted for long ones, as fast as the thickness of shims has been sufficiently reduced to safely permit this, and the latter preserved with the shims for future use.

Shims must always be removed from the track before surfacing or ballasting.

642. As soon as all frost is out of the ground, and surface water removed from the roadbed, all remaining shims should be removed from the track.

Where track does not return to its original level after the frost is all out of the roadbed and shims are still necessary to keep it in surface, the high points must be dug down to proper level, the shims removed and a good surface secured in this way, rather than by attempting to raise the long intervening sections to the level of these high points. All ties that may have been disturbed in resurfacing these places in the track must be solidly tamped to furnish a firm support for the rails.

Places where extreme heaving has taken place, should be carefully watched, as broken rails are liable to occur at such points.

643. Section foremen should always bear in mind that constant attention to, and improvement of, drainage is the only way to remove the necessity for shims and that time spent in improving drainage will save a great deal more time in shimming track.

TAMPING.

644. Satisfactory surface cannot be maintained with any kind of ballast except by properly tamping the material under the ties with tamping bars, tamping picks, or pneumatic tampers.

645. Broken stone ballast must always be tamped with tamping picks or pneumatic tampers, except where it is being renewed in such quantities as to require more than one raise; in such cases bar tamping will be allowed for the first raise only.

646. Gravel ballast must be tamped with tamping bars or tamping picks, except when it is being renewed in such quantities as to require more than one raise; in such cases shovel tamping will be allowed for the first raise.

647. On stone ballast, ties must be thoroughly tamped from the end to about 16 inches inside of each rail, and the center tamped lightly to prevent the track from becoming center bound.

At joints, tie at receiving end of rail should be tamped first. This primarily to lessen liability of cracking angle bars. Tamp the receiving side of tie at ends first and leaving side last and hardest. The middles, leaving side first and receiving side last and hardest. This will apply to all track where it is given a general surface. The tie on the receiving end of the rail will be given a second and last tamping. In raising low joints, ties shall be tamped toward the joint, the receiving joint tie being tamped last.

648. On gravel ballast, the entire length of tie should be tamped on new track, and on old track from the end of tie to about 16 inches inside of each rail, with center filled and tamped lightly, taking care not to disturb the old bed. If practicable, tamp the end of tie outside of the rail first and allow train to pass over before tamping inside of rail. Ties should be tamped solidly from the end, using tamping pick or bar.

After train has passed, the center of tie should be loosely tamped with the blade of shovel, and ballast dressed to correspond with standard section.

649. Joint and shoulder ties should be thoroughly tamped. Joint ties should be tamped last and especially hard, on any kind of ballast.

650. When ties are being renewed they must be tamped at once to give as solid a bearing as that of the ties immediately adjoining, to preserve the surface of the rail.

651. When track is being re-ballasted the ballast must be put under the ties and well tamped with shovel blade, and before ballast is trimmed it must be thoroughly tamped with tamping bars.

652. When a good bearing has been obtained on ballast, the general surface must not be raised until a new bed of ballast is needed. Low places should be raised only enough to bring them up to the general surface.

653. The surface of track on bridges, in tunnels, under overhead structures, at stand-pipes, in paved streets, and opposite platforms, or other fixed structures, must not be raised or lowered under any circumstances, without instructions from the division engineer.

GUARD RAILS.

654. Guard rails are used to prevent derailments at frogs, switches and on sharp curves, and to prevent derailed cars from wrecking bridges or from leaving the ties at derailing switches.

655. Guard rails on curves should usually be given two and one-half inches space, with ends curved away from the track rail, increasing the flangeway to six inches in a distance of six feet. They shall be full spiked, and preferably held in position by the use of guard rail clamps placed at such intervals as conditions require. Other guard rails, including those on bridges, at derails and at frogs and switches, will be laid in accordance with standard plans. For guard rails at frogs and switches, see also rules under "Turnouts, Switches and Frogs".

TURNOUTS, SWITCHES AND FROGS.

656. All switches and frogs must be placed in accordance with standard plans. Switch ties shall conform to the bills of timber in each case, and be laid in proper order. The point of frog must always be located where directed by the engineer.

657. When rail of a heavier section is used in main track than in side track, the main track section shall extend at least two rail lengths beyond clearance point.

658. The location of all frogs with reference to the character and direction of traffic, should be carefully considered and the proper type of frogs selected.

Unless otherwise directed frogs should be used in the main track as follows:

(a) Where the turnout traffic is considerably less than the main track traffic, use spring frogs.

(b) Where the turnout traffic and main track traffic are about equal and not especially heavy, standard rigid frogs should ordinarily be used.

(c) At important junctions, and at the ends of important main tracks, and the entrance to terminal yards, or other points where the track is subjected to exceptional wear, rigid frogs with manganese centers should be used. In yards the standard frog is No. 8, which is to be used so far as practicable, on lead tracks having an angle with other yard tracks, equal to that of a No. 7 frog.

659. Guard rails for frogs must conform to standard plans.

660. When necessary to locate frogs on outside of main track curves, which require extra width of gauge, the width of flangeway be-

tween guard rail and adjoining main track rail must be increased as much as the extra width of gauge, that is, if the gauge is four feet nine inches, the flangeway should be increased to two and one-quarter inches. When frogs are placed on the inside of main line curves, the gauge of the main track must be exactly four feet eight and one-half inches through the lead.

661. The main track through switches should be tangent wherever practicable.

662. Three-way switches must not be used in main tracks, nor in any yards if it can be avoided.

663. All frogs, switches and guard rails must be properly equipped with standard foot guards, and foremen must see that these are maintained in good condition.

664. All turnouts should have the same elevation as the main track to the end of the switch ties, unless otherwise instructed.

665. Standard shoulder tie plates, including special tie plates back of the heel of switch, guard rail plates and frog plates, should be used throughout all important switch leads where the life of ties will be governed by mechanical wear. Tie plates should also extend ahead of main track switches a sufficient distance to prevent rails spreading.

666. Second quality rail may be laid in turnout leads, except that first quality must be used in the stock rail to form the bend, also in turnout leads at end of double track, junction points, and leads where traffic is fast.

667. Care shall be taken to see that the stock rail is bent the proper amount, and at a sufficient distance ahead of the switch point to insure an accurate fit of the point, with perfect line and gauge, through the switch.

The full number of slides and braces must be

used, and the ties tamped up until the rail has a full bearing on the slides.

668. The connections between main rails and frogs and switches must be made with standard angle bars wherever practicable.

669. The main track must be protected by approved derailing devices in sidings, so located that derailed cars will clear the main track. They must be kept set and locked for derailment at all times, except when in use. Failure to leave them locked and in proper position should be reported by wire to the superintendent and track supervisor, giving, if possible, number of train and engine last using the siding.

670. Derails in main track and at the foot of coaling plant inclines, and at other dangerous places, shall consist of a split point, with a throw of at least five inches. On slow speed switching track and sidings derails may be of some other approved type.

671. Switch stands used will be of approved types, which shall generally conform to the following requirements:

- (a) There should be no lost motion in parts.
- (b) Stands should have an adjustable crank on the foot.
- (c) The operating lever of ground stands should work parallel with the track.
- (e) The stand should be snowproof.
- (f) The connection between the throwing rod and the stand should be so arranged that it will be impossible to separate the throwing rod from the stand when the stand is set up in working position.
- (g) The stand should be so arranged that it can be easily inspected.

(h) The target should not show clear signal for main track movements unless the points are up snug against the stock rail.

(i) The targets should conform to specifications.

672. Main track switch stands, so far as possible, shall be placed on the right hand side of track as viewed from a position facing the switch points. Exceptions to this rule shall be made as follows:

(a) On double track, switch stands shall in no case be placed between the main tracks without authority from the division engineer.

(b) If the location of a side track interferes with placing the switch stand on the right hand side, and it is impracticable to move the side track sufficiently to provide proper clearance for a stand between the tracks, a parallel ground throw type of stand may be used.

673. Switch stands for turnouts on other than main track, shall be placed as follows:

(a) Where track turned out of is adjacent to main track, switch stand shall, if possible, be placed on side of secondary track farthest from main line, except as noted in (b) below.

(b) Switch stands for right hand turnouts leading out of ladder tracks shall be placed on left hand side of ladder as viewed from a position facing the switch point of turnout, and if turnout is a left hand, the switch stand shall be placed on right hand side of ladder tracks. This rule shall, in case of turnouts from ladder tracks, take precedence over (a), but, if necessary to place switch stand between ladder track and main track, there shall be no switch lamps used on switch stands for such turnouts.

(c) Switch stands for live rail tracks for scales shall be placed on the same side of track as the scale box or scale house.

(d) Except as noted in (a), (b) and (c), all switch stands on other than main track turnouts shall, wherever possible, be placed on the right hand side of track as viewed from a position facing the switch points.

674. Switch stands must, so far as practicable, be placed the standard distance from track, to provide proper clearance for trainmen, and no stand shall be placed less than the standard distance, without authority from the division engineer.

675. In case two or more switches are so located that their targets or switch lamps might be confused, special arrangements shall be made to meet the requirements such as using different heights of switch stands, or setting one stand farther from track than standard, by the use of longer connecting rod.

676. The signal indications given by lamps and targets on all switch stands shall be in accordance with special instructions.

677. Cotter pins must be used in all switch bolts and connecting rod bolts and must always be inserted with the nut on top of the rod, for convenient inspection of the nut.

678. When temporary sidings are put in, the main track rails must not be cut, but short closure rails provided to fill the space between the frog and adjoining rail.

679. Switches not in service in main tracks at gravel pits and other points must have the frogs, switch points and lead rails taken up and main track restored to good condition.

680. Foremen must notify superintendent, division engineer and track supervisor by wire, when switches are spiked and when switches that have been spiked are restored to service. They must also report promptly when new switches are ready for use, or old ones removed.

681. The lead of a split switch is the distance from the switch point to the frog point, measured along the straight track.

682. To obtain the number of a frog, divide the total length in inches by the sum of the spread between gauge line in inches at the heel and toe.

683. The proper way to put in a turnout is as follows:

Locate the frog and switch point, and, if found necessary to change the main line rail on the unbroken side, this will be done so that the joints will be kept clear of switch and guard rail, if practicable.

Then put in the turnout ties, spacing them not only to conform to the joints in track on the unbroken side, but also to other proposed joints in the lead, including those at heel of switch and ends of frog, also to avoid switch rods.

Put slides and braces on the unbroken side of main track, placing switch slides in their proper position under rail, on the opposite ends of ties.

Line and full spike the rail to new ties on unbroken side, placing and fastening the main track guard rail and switch slides and braces in their proper positions.

Couple up, on the new ties, on turnout side, the frog and lead rails, to the main track switch point, also short rail, or rails at heel of frog, if same are found necessary.

Having done such cutting and drilling as may be required to complete the main track, including the bending of stock rail, changing such rails ahead as may be necessary to avoid having a joint in the switch, and after properly protecting the work, main track may be broken, throwing out the old rail and replacing with frog, lead rail, switch, etc., previously coupled

together; spiking all to proper gauge. Curve the lead rail separately with the rail bender, if necessary, before laying. Couple up the lead rails and switch point to the toe of frog. Connect up the switch point for siding with main track switch point by means of the proper rods. Spike the siding lead to the proper line for turnout curve. Complete the work of laying turnout rail and doing the necessary spiking, gauging and adjustment of switch stand and placing and fastening the turnout guard rail.

684. Section foremen shall be responsible for the condition of the rails, ties, switches, frogs and derails connected to and operated by interlocking machines.

685. They shall, so far as practicable, keep on hand sufficient frog and switch material to make repairs at the time any defect is noted and if unable to make repairs with material on hand, shall notify the supervisor by wire.

686. Any unusual wear of switch points should be investigated with a view to learning the cause and suggesting the remedy.

687. The most careful attention must be given to switches, frogs, stands and connections by section foremen and track walkers, to make sure that everything is kept in proper adjustment and safe condition. All switches and stock rails must be carefully watched and necessary action taken to prevent creeping track from pushing them out of proper position, and all rods and connections at switches must be kept clear of ties or other obstructions. Switches must work easily and have no lost motion, must not rattle when trains pass over them and must be kept lined up and in perfect gauge at all times.

688. Section foremen must see that switches are full bolted with nuts tight, that all bolts

are in switch stands and connecting rods, with nuts tight and cotter pins in place, and that switch points are not worn beyond a safe limit. All broken or damaged parts must be renewed promptly.

In emergencies, when cotter pins are not used in connection with rod bolts, the bolts must be nicked with a chisel to prevent nuts turning off.

689. Frogs and switches must be maintained in perfect line and surface at all times. Switch and frog ties must be tamped thoroughly and solidly their entire length. Special attention must be given to joints at the heels of switches and ends of frogs.

690. Track supervisors must thoroughly test all new facing point main track switches before they are put into service. The section foreman or his representative must daily inspect all main track switches.

691. The working parts of spring rail frogs must be frequently examined to see that they are in proper order. Stop braces for spring rail must be kept securely spiked in their proper position.

692. Switches must be kept free from obstructions at all times and from ice and snow in winter. The slide plates, journal boxes, levers and geared parts must be kept well oiled.

693. Switch stands must be kept firmly spiked to the head ties, standing plumb, with the target at right angles to the track. All head ties must be kept firmly tamped throughout their entire length.

694. The moving parts of automatic switch stands must be frequently oiled. Throw the switch several times after oiling, to insure a uniform lubrication. Test for lost motion or weak springs by putting a track spike between

the point rail and the head of the stock rail at the point. If, when the point is thus blocked, the switch lever can be easily thrown and locked, examine all connections between the stand and connecting and No. 1 rods and readjust connections to take up lost motion. If, with no lost motion in the connections, the switch can be thrown and locked with points blocked, and the points remain open when the obstruction is removed, the spring is too weak and must be adjusted or renewed.

695. The adjustment of all main track switches for proper contact with the stock rail shall be tested periodically and reports made in accordance with special instructions.

696. Test must be made weekly by the section foremen of all main track switches. To make sure that a switch is in good working order, it must be thrown and returned to place promptly and locked. Main track switches must be kept locked at all times except when in actual use by train passing over them, in going to and from another track, or when being examined by section foremen. Where switch indicators are installed in automatic territory, switches should not be thrown under any circumstances, unless the switch indicator shows there is no train in the section.

697. When an automatic switch has been run through, it must be considered defective until readjusted.

698. When switches have been run through or rendered unsafe, section foreman must make track safe at once for main track movements and report by wire to superintendent and track supervisor, time of discovery. If repairs cannot be made so switch can be used immediately for sidetrack movement, facts shall be wired to superintendent and track supervisor.

699. If a main track switch stand is found to have a defective lock, it must be properly secured and report made at once to the superintendent and track supervisor.

700. The use of salt at switches and frogs at seasons of uniformly low temperature is prohibited. It must be used only when snow melts during the day and freezes at night.

701. Section foremen will have charge of and attend to the cleaning, trimming, filling and lighting of switch lamps on their section, when so instructed by the track supervisors.

702. Switch targets must be kept bright and in good order, and shall be painted as often as is necessary to preserve proper appearance.

703. In districts where switch lamps are used, a lamp must be maintained at every main track switch, even though switch may be spiked, unless otherwise ordered, and at such sidetrack switches as are necessary. If for any reason a lamp cannot be maintained at a switch, the foreman must notify the track supervisor and superintendent by wire.

704. Switch lamps, except the long burning type, must be thoroughly cleaned and filled with oil every day. A supply of clean waste shall be kept for this purpose. Lamps must be lighted before "sundown" and not put out until after "sunrise". On foggy and cloudy days they must be lighted earlier, and left burning later on such mornings, but this must be watched carefully and no oil consumed unnecessarily.

705. When lamps are placed on switches they must be watched until the lampman is satisfied that the wicks are in good condition and at proper height to give the best possible light. Wicks should not be trimmed by cutting but by rubbing the finger over them and

removing the crust. In filling lamps, care must be taken not to fill them quite full, as when lighted the oil expands and if lamp is full the oil will run down on the switch target. Lampmen must be careful not to put greasy hands on switch targets and discolor them.

SIDINGS.

706. All sidings shall be kept in as good condition as practicable, using for this purpose, so far as available, partly worn material taken from main track. General repairs shall be made to side tracks in the fall.

707. An approved derailing device must be used on all sidings where required.

708. Important passing or running tracks, adjoining the main tracks, switching leads, and other tracks in yards, where the service is severe, should be ballasted with gravel. Other sidings and yard tracks may be ballasted with gravel, cinders or sand, as may be found most practicable or economical. See also rules for maintenance of sidetracks, under "Track".

709. Owners of private sidings must be required to keep their tracks in safe condition for use at all times. See also rules under "Joint Property, Private Tracks, Etc., Not Maintained by the Company".

STANDARD DISTANCES BETWEEN TRACKS.

710. All new main tracks shall be laid and maintained 13 feet between centers.

All present main tracks, moved to new position on account of revisions, etc., shall be spaced and maintained 13 feet between centers, when practicable, unless otherwise instructed.

All side tracks next to main tracks shall be laid and maintained 13 feet between centers. Other side tracks shall be laid and maintained 12 feet between centers, unless otherwise instructed.

All main tracks now spaced less than 12 feet between centers, shall be moved to provide at least that distance, and 13 feet if practicable, as soon as conditions will permit.

All side tracks now spaced less than 12 feet between centers, shall be moved to provide that distance, as soon as practicable.

All main tracks, and side tracks next to them, now spaced 12 feet or more between centers, shall be so maintained except on sharp curves, where there is not proper clearance, or where revisions are made, when they shall be moved to standard width, as above.

CARE OF RIGHT OF WAY.

711. Section foremen shall keep their sections in a neat and orderly condition, and devote sufficient time each week, with their gangs, to cleaning and putting things in order around section tool houses, station grounds, yards, sidings, highway and farm crossings, and the right of way generally, removing all loose papers, straw, leaves, or other combustible material to a safe place, where same shall be burned.

A few hours devoted to this work each week will give an appearance of neatness to the section which will be appreciated and complimented both by officers of the company and travelers.

712. All grass and weeds, whether dry or not, and all brush, wood and other inflammable material must be kept cleared away from

wooden bridges and trestles, culverts and buildings, from under passenger and freight platforms, and from all piles of cross ties, crossing plank and other material liable to burn.

713. All brush and other obstructions that tend to obscure the view of a crossing or sign from an approaching train or vehicle, must be removed, and no material shall be piled near a road crossing, in such a position as to obstruct the view of approaching trains by parties using the road.

714. All grass, weeds and brush on the right of way must be cut at least once a year and preferably twice a year. This should be done in the months which are most suitable, but must in any case be done before the seeding time of the plants. After grubbing, cutting or mowing, the material should be raked into heaps and burned as soon as it is dry enough, care being taken that the fire does not extend to fences, poles, posts or on adjoining lands. Where fire by-laws, or laws for the suppression of noxious weeds, are in force, they must be strictly observed.

715. At all times, as fast as any portion of the right of way becomes sufficiently dry, it must be burned off to avoid the risk of fires started by engines. Special care must be taken in the vicinity of buildings, etc., and where adjoining land is in grass or grain.

716. On all main tracks and sidings, weeds and grass shall be removed to a true line at the edge of the ballast section twice each season, or as often as directed.

717. Briers and undergrowth on the right of way must be cut close to the ground. An effort should be made to destroy all weeds and to get a good growth of hardy grass everywhere on the right of way.

718. Cut all trees within the right of way that are in danger of falling across the track and those on private property, first obtaining permission from the owner; also, those which obscure the view of enginemen or are liable to touch telegraph wires.

719. No fires should be made under telegraph wires, or near the ends of bridges or other structures, and under no circumstances shall any fire be left burning after working hours.

720. Rubbish and waste that cannot be burned should be buried. Dead animals found on the right of way, unless otherwise disposed of, must be buried.

721. Loose stones on the right of way rejected from ballast, must be gathered and placed around telegraph poles or sign posts to keep down grass and weeds and protect the poles from fire; the piles should be of such size as to give the protection desired, but not so large as to be conspicuous. All surplus stones should be buried in shoulder of embankments, or placed where they can be used to advantage.

722. All material dropped from engines or cars, such as draw bars, car doors, brake beams, nuts and car scrap, must be picked up as soon as practicable after being discovered, and taken to the section tool house for shipment, as may be directed.

723. All other scrap that may be found along the tracks should be gathered up promptly, and piled neatly in a scrap bin at the section tool house, convenient for loading, when its disposition has been arranged for.

724. All old rails, fastenings, etc., must be gathered up at frequent intervals and piled neatly at proper points to be disposed of as instructed by the supervisor. New material, not

intended for immediate use, and stored on the right of way or station grounds, must be neatly piled.

725. In electrified territory, the track and roadbed must be kept clear of scrap, loose bond and telegraph wires, and all material which would in any way cause a short circuit.

726. Freight found upon the right of way must be delivered to the nearest station agent as soon as practicable and receipt taken therefor. Freight too heavy to be delivered should be placed a safe distance from the track, reporting the fact to the nearest station agent and track supervisor, stating, if known, from what train freight was lost.

727. Station platforms, fences, tool houses, overhead footbridges and subways, and grounds at stations and yards, must be kept clean and in good order. Defective platforms, which might cause injury to persons, must be promptly repaired or protected, and the supervisor concerned notified. Open culverts, ditches or drains near stations or where switching is done, must be protected to prevent passengers or employes from falling into them. Trench openings and piles of material for construction work in the vicinity of station platforms or points where passengers or employes must pass, shall not be left over night by the foreman in charge, without proper protection, so that injury to persons may be avoided.

728. Ballast, ties, tools, ladders, refuse or other material of any kind must not be permitted to lie within the clearance lines of any track in service.

729. Unless otherwise instructed, company driveways must be kept clean by the section men.

OPERATION OF MOTOR, HAND AND PUSH CARS AND VELOCIPEDES.

730. Motor, hand and push cars and velocipedes, when used in company service, must not be run beyond the section or other limits to which car is assigned, except in case of emergency or under special arrangement, and when run off its home section must be operated with extra caution and prepared to find obstructions or cars operated in other sections.

Where cars are loaned or rented they shall be operated only when accompanied by a qualified flagman, and then only with the approval of the superintendent; the above to hold good whether cars are used on main track or sidings.

731. On lines of more than one track, motor, hand and push cars must be moved only in the current of traffic. On lines of more than one track, velocipedes must be moved only in the opposite direction to traffic, except that they may be operated with the current of traffic when closely following trains on an ascending grade.

732. The rules governing the operation and protection of all cars shall apply to passing sidings as on the main tracks.

733. Before occupying main track, if at a telegraph or telephone station, foreman must ascertain from the operator the location of any extra trains or of delayed regular trains, and on a special or long run, ascertain from the train dispatcher relative to trains over the territory the run is to be made. This information does not confer any right to track or relieve the foreman from taking all necessary precaution for the safe operation of car. Trains may be run at any time without notice. Close watch should be kept of passing trains for signals in-

dicating following sections and cars must not be operated between sections except under full flag protection.

734. Motor and hand cars must be run with great caution, keeping a lookout for all trains and when necessary fully protect themselves in both directions. Push cars when used are never to be so loaded as to prevent prompt removal on approach of trains and they must be fully protected at all times.

In case flagman hears approaching train, he must place two torpedoes on top of rail two rail lengths apart on the engineman's side, place fuses and flag train. When car is removed from track, flagmen shall be called in and any torpedoes or fuses placed by them taken up.

735. A motor car must be operated by the foreman or man in charge of the gang, and must not be put in motion without this man in position on the car to control its movement. Brakes must be tested immediately after starting to insure that they are in working condition. This rule must be strictly enforced to prevent the possibility of a car getting away from control.

736. Cars must not be run faster than 20 miles per hour and then only where view is unobstructed and the way is known to be clear. Over grade crossings, frogs, switches and interlocking, a speed of five miles per hour must not be exceeded, and through yards and passing trains or stations cars must be run at a moderate rate of speed and under full control, prepared to make a quick stop. Cars must not be run between a station and a train discharging or receiving passengers. At highway grade crossings where there are gatemen and gates are not closed, or where there are flagmen and

no flag is displayed, a man shall be sent ahead of the car to protect movement over crossing.

737. When car is in motion, a man must be detailed to keep sharp lookout ahead and another to keep sharp lookout in the rear. At night or when weather conditions require, a white light must be secured on the forward end of the car and a red light on the rear end of the car in such position that the light is not obscured from the front or rear by men or material on the car. Close watch must be kept, and car stopped and lantern relighted if, for any reason, light should go out.

738. When not in actual use, cars must be taken off track and placed at least six feet clear of the nearest rail and secured by lock.

Car must not be placed at highway crossings except to allow trains to pass, and when clear of tracks the lights must be put out or obscured so they cannot be seen from approaching trains.

739. Motor cars and hand cars must be kept a sufficient distance apart, and from trains, to insure absolute protection to employes using them. When two or more hand cars are running in the same direction on the same track, a distance of at least 400 feet must be maintained between them. Two motor cars running in same direction, or a motor car following a hand car, should maintain a distance of not less than 1000 feet.

740. Cars must not be pushed ahead of a motor car. When necessary to move cars they must be coupled behind, and a man ride on trailer to stop it in case of becoming detached. Cars must never be attached to moving trains.

741. Torpedoes placed on the track should not be run over if it can be avoided. Any torpedoes which are exploded must be immediately replaced by others. Torpedoes must not be

placed near stations or road crossings where persons are liable to be injured by them.

742. Except for motor cars, or loaded push cars, main track switches must not be thrown to pass to and from the main track.

743. The men riding on hand cars should be properly distributed to prevent cars from jumping the track. The use of seats on ends of hand cars is prohibited.

744. Track jacks or other tools liable to fall off must not be carried on the forward end of cars. Rails must never be carried on hand or motor cars, except in case of emergency. Other materials may be carried on hand and motor cars only when they have been properly secured in a manner to prevent any possibility of their falling from the car. (See also Rules under "Precautions".)

745. Foremen must not ship their hand cars to the shop for repairs until the track supervisor has inspected them and decided that shop work is needed. No foreman, however, shall use a car, either before or after advising the track supervisor of its bad condition, when to do so involves risk of accident.

TRACK SECTIONS.

746. Track sections will, so far as possible, be of such length and so arranged, as to enable the track forces to work with the least loss of time and energy.

Sections will be numbered as the division engineer may direct.

747. The dividing line between sections should not be located on a curve or on the run-off from elevation, if this can be avoided. It is desirable to assign the maintenance of a curve, including the run-off, to one foreman.

SECTION TOOL HOUSES.

748. Section tool houses will be erected in accordance with standard plans, and shall, so far as practicable, be located where most convenient of access from the section as a whole. This should take into consideration the necessity of being as near as possible to station or telegraph office, so that prompt communication may be had with division headquarters.

749. Tool houses should be located so that the track in front of them will not be occupied by standing trains or cars.

750. Tools must be kept in a neat and orderly manner, in accordance with standard arrangement.

The supervisor will see that a list of the tools allowed is posted in each tool house and that proper allowance is on hand.

Tool boxes, hand and push cars must be kept neat and orderly.

751. All tools and small material, old and new, except scrap, must so far as possible be kept locked up in the tool house, or where it can be carefully watched. Spikes, bolts, washers, rivets, etc., should be properly sorted and kept in readiness for use.

752. Scrap bins, constructed in accordance with standard diagram, will be located near each tool house and all small scrap must be deposited in the bins and held there for shipment, as directed.

753. Tool houses and surroundings must be kept clean and neat and all inflammable material kept away from the vicinity.

754. The occupation of tool houses as dwellings by section men is undesirable and should be avoided so far as possible.

755. Supervisors must inspect their tool houses at least once every three months.

MATERIAL, EQUIPMENT AND TOOLS.

Material.

756. Proper judgment and caution must be exercised by supervisors and foremen in all departments, to avoid extravagance or waste of material intrusted to their care, and for which they will be held strictly responsible. Economy in use of materials must be practiced at all times, and they must not be loaned or disposed of in any manner, except as required in the work, without proper authority.

757. Supervisors shall determine from the record of material charged to foremen, whether it is being used to best advantage, and foremen must report promptly to the supervisor any loss of material, by theft or otherwise.

758. Precautions must be taken against theft, and foremen or others in charge shall chalk upon each pile of ties, plank or other material which might be stolen, the number of pieces in the pile, so that check may be had as to whether any material has been stolen since the former count.

759. The amount of material carried in stock must always be kept at a minimum, consistent with safety and economical management of labor. Any surplus material carried over that required for immediate use or emergency, represents capital from which no interest is received.

760. No employe is allowed to sell old or new material belonging to the company, or to purchase on its account any supplies or material, except upon authority from the head of the department. Second-hand material will be used in repair work, so far as practicable. Scrap must be picked up at stated periods and held at tool or store houses for disposition.

Drawheads found along track must be picked up promptly, and disposed of in accordance with special instructions.

761. When any considerable quantity of rails and fastenings, interlocking, signal or other material, is being removed from the track or interlocking plants, and replaced by new material, all the old material, unless otherwise ordered, must be carefully collected and taken to the proper storage point, instead of being left lying along the track where it may be covered by ballast, or thrown to one side on the right of way where it cannot be found.

762. Employes should bear in mind, at all times, that no material is to be wasted. Old and new material shall not be mixed, but must be carefully sorted and kept separately piled, or when stored, in separate compartments. Economy must be practiced in the use of all material as far as consistent with securing the best results. Many spikes are carelessly drawn, and often thrown in the scrap heap, where, if a little more care was used, or a moment given to straightening them, they could be used again. Serviceable bolts, spikes, tie plates and fastenings of every description must be removed from old material before piling it. Old ties removed from track shall be neatly piled for burning once each week.

763. All small supplies, when not required at the site of the work, must, so far as practicable, be kept locked up in the tool house, or placed where they can be carefully watched.

764. Section foremen have the care of and are responsible for all loose property of the company on their sections, including wood, ties, lumber, scrap iron, etc., and will see that it is neatly piled at the proper distance from track.

765. All bridge material will be handled so as to avoid injury and will be placed on skids above the ground to keep it clean; girders and floor members placed upright to prevent the collection of water; heavier members placed below and the material arranged so as to be readily inspected and loaded.

766. Section foremen and heads of departments must inspect all material when received. Any material which is defective or not up to specifications, as far as known, must be laid aside and a report of the facts made through the proper channel to the engineer, maintenance of way.

Equipment.

767. Supervisors of track and supervisors of bridges and buildings shall see that maintenance of way equipment, including steam shovels, ballast cars, tool train equipment, snow plows, flangers, pile drivers, etc., are maintained in proper condition and ready at all times for use. Heavy running equipment shall be tested frequently on the road to see that the journals are in good condition so they will not run hot. Steam derricks, cranes, track pile drivers, etc., shall at all times be equipped with fuel and appliances for service on short notice.

768. In freezing weather, all water must be drawn from a boiler at night, unless provision is made to keep it hot, and when equipment is to be stored, water must be drawn from boilers regardless of weather conditions.

769. After each storm every appliance should be carefully examined to discover necessity for repairs, and in case of long continued disuse frequent examinations should be made to see that parts are not lost or stolen. Run-

ning gears shall be carefully examined periodically by the men in the maintenance of way department in charge, and by the car inspectors.

770. All employes must know that the equipment and tools they use are in good condition. Foremen must personally inspect all tools, chains, ropes, guys, derrick fittings, etc., before using them and be sure that they are safe for the work proposed.

771. Arrangements will be made through the division engineer, or by the supervisor of track direct, in emergency, with the division superintendent for prompt service for snow plows and flangers, and it is expected that efficient locomotives will be provided for this purpose.

Tools.

772. All employes must know that the tools they are using are in proper condition. Those needing repairs which cannot be made by foremen must be properly tagged and sent to the shop for repairs, with necessary directions for returning. Tools must be kept locked in tool houses when not in use, and must be carried to work as required and returned each night to the tool house, or stored where they can be carefully watched. When a tool wears out or is broken, foreman must make requisition for a new one, if required.

773. Supervisors must make frequent personal examination of the condition of tools in charge of foremen and will see that all surplus, damaged and worn out tools are promptly returned to headquarters.

774. Surplus tools represent money and any unnecessary accumulation is money lying idle. Foremen must understand the necessity of ordering only what is needed for immediate re-

quirements, and return to division storekeepers any surplus that may accumulate other than what is needed for repairs, whether new or second hand.

775. Requirements should be anticipated, as far ahead as possible, so that tools can be transported in an economical manner, and with as little delay as practicable. Orders to ship by passenger train should be avoided except in case of emergency.

776. Supervisors and foremen must carefully examine the quality of all tools, watching the efficiency of same in service and keeping a record as to wear and effectiveness.

777. All tools must be plainly stamped N. Y., N. H. & H. R. R.

778. Each track section will be provided with a full equipment of standard tools, sufficient to supply every man in the gang, and several extra tools for the purpose of replacing any that may be sent to the shop for sharpening and repair. Foremen must see that all tools are kept in first-class condition, ready for service.

779. The kind of tools will vary according to the ballast and other conditions. The following list is authorized for the various sections and foremen and track supervisors must see that each section is fully equipped.

LIST OF TOOLS FOR TRACK SECTIONS.

.....Division.

Section No..... Location.....

TOOLS	Number Authorized	TOOLS	Number Authorized
Adzes, with handles	The allotment of tools for each section will be made by the track supervisor, subject to the approval of the division engineer and engineer maintenance of way. The authorized list for each section shall be posted in the tool house	Flags, green	The allotment of tools for each section will be made by the track supervisor, subject to the approval of the division engineer and engineer maintenance of way. The authorized list for each section shall be posted in the tool house
Axes, chopping, with handles		Forks, ballast	
Bars, claw (ordinary)		Forks, hay	
Bars, goose-neck claw		Forks, rail	
Bars, lining		Fuses	
Bars, raising		Funnel for oil cups	
Bars, tamping		Gauges, track	
Bars, pinch		Gauges, track center	
Bars, Tommy at interlocking plants		Grinders, carborundum	
Barrows, hand		Grindstones	
Baskets, coal		Hammers, claw	
Bit stocks		Hammers, spike maul	
Bits, wood		Hammers, striking, 8 lb.	
Blocks, elevation		Hammers, sledge, 16 lb.	
Boards, sighting		Hatchets	
Bobs, sighting		Handles, adze	
Brooms, winter		Handles, axe	
Brooms, summer		Handles, spike maul	
Brushes, whitewash		Handles, pick	
Cans, oil, 1/2 gallon		Handles, hammer	
Cans, oil, 1 gallon		Handles, hatchet	
Cans, oil, 2 gallon		Hoes	
Cans, oil, 5 gallon		Hooks, bush	
Cans, ash or waste		Jacks, track (Barrett) 7 ton	
Cars, hand		Jacks, track (Barrett) 10 ton	
Cars, motor		Jacks, track (other)	
Cars, velocipede		Lines for ditching and ballasting	
Cars, push		Lanterns, tubular, white	
Chisels, track		Lanterns, tubular, red	
Chisels, cold		Lanterns, tubular, green	
Chisels, wood		Lanterns, tubular, yellow	
Chisels, broom		Lantern globes, white	
Cups, tin		Lantern globes, red	
Dippers		Lantern globes, green	
Draw knives		Lantern globes, yellow	
Drills, track, flat		Level boards, track	
Drills, twisted		Locks, pad and chain	
Drills, machine		Oilers, squirt can	
Drills, ratchet frame		Pails, water	
Drilling machines		Pails, whitewash	
Files, 10 inch		Picks, clay	
Flags, red; double staff		Picks, stone tamping	
Flags, red; single staff		Pins, drift	
Flags, yellow			

List of Tools for Track Sections—Continued

TOOLS	Number Authorized	TOOLS	Number Authorized
Punches, track	The allotment of tools for each section will be made by the track supervisor, subject to the approval of division engineer, and engineer maintenance of way. The authorized list for each section shall be posted in the tool house.	Shovels, long handle, round point	The allotment of tools for each section will be made by the track supervisor, subject to the approval of division engineer and engineer maintenance of way. The authorized list for each section shall be posted in the tool house.
Rail bender (Samson)		Shovels, scoop	
Rail bender (Jim Crow)		Shovels, snow	
Rail bender (Sherburne)		Spike pullers	
Rail curving machines		Squares, tie	
Rail tongs		Squares, steel	
Rail trucks, dolly		Tapes, 50 ft. metallic	
Rakes, iron		Tie tongs	
Rakes, wooden		Torches	
Reamers, burr		Torpedoes	
Saws, cross cut		Templates, standard road-bed	
Saws, hand		Tool boxes	
Saws, hack, frame		Trays, oil	
Saws, hack, blades		Wheelbarrows	
Screw drivers		Whistles, warning	
Scythes, brush		Wire stretchers	
Scythes, grass		Wrenches, monkey	
Scythe snaths		Wrenches, track	
Scythe stones		Wrenches, frog	
Scythe, rifles		Wrenches, screw, spike	
Shovels, square point			
Shovels, round point			

SPECIAL AND EXTRA TOOLS REQUIRED ON SECTIONS, IN YARDS AND FOR EXTRA GANGS.

Rail benders, special fence tools, augers, track drills and bits, expansion shims, track thermometers, hack saw frames and blades, track jacks, rail tongs, rail forks, clay picks, wheelbarrows, cross cut saws, scoop shovels, grubbing hoes, mattocks, hand and jumper stone drills, ice tools, pulley blocks, ladders, and other tools used by extra gangs, and occasionally by section gangs, will be furnished to each track supervisor, to be sent out as required, and returned to the track supervisor's headquarters when work is completed.

Tools in need of repair must be shipped by foremen to the Company's repair shops, with

tag attached to each article, stating to whom it is to be returned, and a requisition sent to cover repairs.

USE OF CARS.

780. All cars should be loaded and unloaded as promptly as possible and disposition given agents for prompt movement of same.

781. In loading cars, care must be taken not to exceed their capacity. Piles, timber and structural material must be loaded in such a manner as to insure safe passage through bridges and tunnels. Foremen must be conversant with Master Car Builders' Rules governing loading and comply therewith. Rails, stone or other heavy material must be distributed on the cars uniformly.

782. Avoid loading Rodger ballast cars or cars of similar design all on one side, as otherwise they are likely to turn over.

783. The shipment of heavy material by passenger train should be avoided except in cases of emergency.

784. When loading or unloading material a record must be kept and a report made daily of the kind and quality of material contained in each car, where loaded or unloaded, and the disposition made of cars.

785. Foremen must see that care is exercised in unloading material. Rails must not be unloaded while cars are in motion unless an approved unloading device is used.

786. Loading material must be discontinued while trains or cars are passing on adjoining tracks.

787. When unloading material a man must be detailed as watchman to warn persons passing the car.

788. When handling rails or similar material on flat cars, it must be secured with good stakes.

789. Foremen will inspect all material to be used for standards or stakes, and will see that they are securely applied.

Properly braced end boards must be used where rails or similar material is loaded on flat cars.

790. In unloading cars on a curve with a plow and cable, no one shall be allowed to stand on the inside of the curve, either on the cars or on the ground.

791. Men should not be permitted to remain in cars when material is being dragged out of hopper bottom cars, nor to remain in any car while it is being switched.

792. Side dump, hopper and other similar cars should have the doors closed as soon as they are unloaded. Such cars must not be hauled with the doors open.

793. Drop-bottom cars used for gravel, cinders, etc., should have the pockets properly cleaned out when the cars are unloaded.

794. Floors of all cars used in maintenance work shall be thoroughly cleaned before being stored.

795. Cars not needed for handling material must not be taken in work trains, except for shelter of men in stormy weather, without proper authority. Defective equipment in work trains must at once be reported to the supervisor and superintendent.

796. When camp cars are in use, foreman in charge must see that they are kept in a clean and sanitary condition, and are at all times safe for transportation over the road. Foremen of extra gangs and others must not keep women or children in their boarding cars.

797. While camp cars are occupied, foremen must see that steps, hand holds, ladders, etc., are maintained in safe condition.

798. All movable articles in camp cars must be fastened down or otherwise prevented from moving when cars are to be handled.

799. Heavy tools or material shall not be suspended, but must be placed on the floor or otherwise prevented from moving.

RAIL RESTS.

800. Rail rests for extra rails, erected in accordance with standard diagram, shall be maintained at designated points.

HAND AND MOTOR CAR RESTS.

801. Hand and motor car rests shall be constructed in accordance with standard plan, and maintained at convenient points, generally about half a mile apart, with grade descending from track.

When practicable, they should be located where the surface of ground is approximately level with the roadbed.

On single track lines, for the sake of uniformity, they should all be on the same side of track.

RIGHT OF WAY FENCES AND CATTLE GUARDS.

802. The boundary fences, gates and cattle guards, will usually be erected and maintained by roadway forces, in accordance with standard plans and specifications, except such fences as require the services of carpenters, which will be maintained by the bridge and building

department, or as may be otherwise directed. Special authority must be obtained for erecting fences elsewhere than on the line of railroad ownership.

803. Fences shall be erected and maintained only where needed to prevent trespassing on the right of way, or where required by law, or by the provisions of deeds or agreements. Where fences are not maintained, the line of railroad ownership should be marked at proper intervals by monuments, so that encroachments may be avoided.

804. All farm gates shall be erected and maintained according to standards.

805. Fences maintained by the railroad company must be frequently inspected, wire kept tight and properly secured to posts, and repairs made immediately where required.

806. Section foremen will make all ordinary repairs to right of way fences, but where extensive repairs are needed, involving the rebuilding of long stretches, a fence gang and foreman, with proper tools and material, will usually do the work. So far as practicable, extensive repairs should be made between April 1 and December 1 of each year.

807. A break in the fence must not be neglected, and when it cannot be repaired for lack of material, foreman must notify the supervisor promptly, specifying materials needed. When fences are taken down for any purpose, either by sectionmen, bridgemen or contractors, they must be replaced as soon as practicable.

808. Gates must be closed when found open, and when adjoining owners persist in leaving gates open, the supervisor must be notified by letter.

809. Wing fences shall be erected and cat-

the guards installed and maintained, in accordance with standard plans, or otherwise, as may be properly authorized.

810. Standard surface cattle guards will be used where instructed, and in localities where surface guards will not furnish necessary protection, a report shall be made to the supervisor, who will request authority for a special guard.

811. Cattle guards and wing fences must be kept clean and in good order. In case of necessary repairs which the trackmen cannot make, prompt notice must be given to the supervisor.

812. All vegetation, dirt and rubbish must be kept removed from the surface guards to a depth of four inches below the tops of ties. The cross fences at cattle guards must be white-washed, preferably in the latter part of April and September of each year. (See formula.)

813. When cattle guards are temporarily removed they must be replaced as soon as possible, and when so removed, they must not be left out during the night.

HIGHWAY, PRIVATE ROAD AND FARM CROSSINGS.

814. Public crossings shall conform in width and construction to local laws regulating same. In the absence of local laws, they shall be not less than 16 feet wide at right angles to the road, and constructed in accordance with standard plans.

815. Private crossings shall be 12 feet wide, measured at right angles to the road, and constructed in accordance with standard plans, unless width and construction is specified by local laws, in which case they shall conform to these laws.

816. For special conditions of heavy traffic, such as important city street crossings, the space between rails of each track, and between tracks, may be planked solid, or a combination of planking and paving used.

Other street crossings will usually have one plank on each side of rails, in accordance with standard plans, with the center filled level with top of plank, with broken stone, gravel, or other suitable material, providing this will not conflict with ordinances regulating crossings.

817. Crossing plank must be of uniform lengths and laid evenly, except where streets or roads cross diagonally, when the angles of crossing should be followed. All planks must be firmly secured by use of standard crossing spikes. Track spikes must not be used in any case.

818. Top of crossing plank shall be flush with top of rails. The outside plank should be placed against the rail and the outer edge adzed when necessary to meet the slope of approach to crossing.

The plank next to rail on inside must be set so that there will be a uniform space of two and one-half inches between gauge side of rail and plank, and the outer ends of all crossing planks must be adzed to a bevel. When renewing the plank in crossings, all unsound ties shall be replaced with good ties.

819. At road crossings where an opening is needed to provide drainage for the roadbed, approved pipe, of the proper size, shall be used, and when necessary, the ends shall be protected by a wall. The pipe should be of sufficient length for two teams to pass on the approach to crossing. When the drainage of a highway is toward the track, care must be

taken to divert the water away from the road-bed.

820. Special attention must be given to the line and surface of track through road crossings, and cattle guards, as otherwise it will usually be rough and unsatisfactory. When practicable, crossings should be underdrained by tile or stone drains laid about three feet deep, parallel to the track at the edge of ballast, and a good bed of clean ballast maintained under the crossing, to provide proper drainage and avoid heaving.

821. All highway and farm crossings, and approaches, so far as the railroad company is responsible for the maintenance, must be kept in the best condition practicable, and not obstructed by material that would interfere with travel. All plank must be kept securely spiked down to avoid danger of becoming torn loose by passing trains, and all defective planks, which might cause injury to persons or animals, must be repaired or replaced promptly.

822. Flangeways must be kept clear of rubbish, snow and ice, and particular attention must be given in freezing weather to see that planks are not forced above the top of rails in track.

823. Where it is necessary to run snow plows or flangers, planks may be removed at farm crossings during the winter months, providing the consent of the owner is obtained, these planks to be replaced at his request.

824. All brush, piles of material, embankments, or other obstructions on the right of way or outlying railroad land, that tend to obscure the view of a crossing, as seen from an approaching train or vehicle, must be removed, when practicable. Where brush or other obstructions to view at crossings are located on

land not owned by the railroad company, and removal is feasible, track supervisor should endeavor to obtain permission from the owner to remove the obstructions.

825. Work on public streets, roadway crossings and highway bridges shall be made with the least inconvenience possible to the public. Care must be taken to protect such work in compliance with the law, and, if necessary to construct temporary foot or driveways, they should be left in a safe condition.

826. All public road crossings must be provided with standard road crossing signs, so placed as to be readily seen by persons approaching from either direction, and whistling posts must be placed in both directions as required by law.

827. Great care must be used in the maintenance of track circuits for bells and signals. Any necessary interruption of the circuit must be made as short as possible. An accumulation of dirt and cinders must not be allowed under the rails or around the connecting wires.

828. Electric highway crossing alarm bells must be inspected and tested when territory is covered by maintainer. In case of accident at a highway crossing which is protected by an electric crossing alarm bell, maintainer will immediately make thorough inspection and render report to signal supervisor.

829. Where highway crossings are protected by bells only, the section foremen or track walker must visit each bell not inspected by other employes, each day at the time train is passing over the crossing, for a train in each direction, and ascertain whether the bell rings when the train is approaching and stops ringing after the rear of the train has passed the crossing, and must note in inspection book, on

the date he inspects the bell, the time, train number and the condition and sign for a train in each direction. When bell is found out of order, whether by ringing continuously, or otherwise defective, a flagman must be stationed at crossing to protect same until bell is repaired, and maintainer or signal supervisor and track supervisor notified by wire.

830. If flagman, or crossing watchman, is known or found to be absent from duty, section foreman shall place a man to protect the crossing and notify the track supervisor.

TRESPASSING ON RIGHT OF WAY.

831. Section foremen shall, so far as practicable, inform themselves regarding the boundary lines of the Company's right of way, station grounds and other land on their respective sections.

832. Any attempt on the part of adjoining land owners or others to trespass on right of way by building structures, altering ditches, obstructing culverts, interfering with or occupying the company's property for wagon roads, or in any other manner, must be prevented at once, or if foremen are unable to prevent such trespass, a report must be made to the track supervisor.

833. Trespass by live stock, teams or persons will be prevented so far as possible by section foremen and track walkers, who shall see that right of way fences and cattle guards are in good repair, and gates kept closed. A break in the fence must be immediately repaired, and when fences are taken down for any purpose, they must be replaced as soon as practicable. Any animals found on the right of way must be driven off at once.

834. Private or farm crossing gates must be kept closed when not in actual use. Any conditions affecting the safety of trains, such as refusal to keep gates closed, and the continual trespassing of stock, must be promptly reported to the supervisor, and efforts should always be made to induce the owner to remedy the trouble. Standard trespass signs shall be erected where necessary.

835. Section foremen must prevent encroachments of any kind within the limits of the Company's property, and no person shall be permitted to erect telegraph, or other poles, string wires, ropes or anything else over the track or buildings, construct road crossings, lay drain, sewer or water pipes under the track, whether in roads, streets, or otherwise, unless provided with proper authority. When in doubt, foremen shall demand the production of a permit for the use of right of way or property. Any such encroachments must be reported at once to the supervisor, giving the name and address of the party, with full particulars as to the locality and nature of the encroachment.

836. Attaching signs, other than those of the Company, notices and advertising cards or posters, or painting signs of any kind on the Company's fences, telegraph poles, buildings or structures, on the right of way, station grounds or other land, except by proper authority, is prohibited, and section foremen and track walkers must prevent this so far as possible. Unauthorized signs, posters, cards, etc., must be detached or obliterated from fences or buildings as soon as discovered, if this should be necessary after making proper effort to get them removed by the parties who placed them.

837. All encroachments must be covered by lease or agreement. Application must be made to the superintendent for location for pipe crossings, overhead and underneath wires, private road crossings, lease of land, and all other industries and encroachments, and must be approved by the proper officers before parties desiring such locations or leases are allowed to occupy same.

838. All persons are forbidden to deposit rubbish of any kind upon the tracks, or right of way, of this railroad, and foremen will use proper means to prevent such abuse and report cases which they cannot control.

ROADWAY SIGNS AND POSTS.

839. Roadway signs and posts must be provided and placed in accordance with standard plans and special instructions.

840. Standard railway crossing, junction and drawbridge signs,
Highway crossing signs,
Whistle posts,
Stop signs,
Slow and resume speed signs,
Section posts,
Yard limit signs,
Mile posts,
Derail posts,
Plow and flanger signs,
Bridge warnings,
Bridge and culvert number signs,
Trespass signs,
Danger signs,
Keep-off signs,
State line posts,
Division posts,
Etc.,

must be placed and maintained in accordance with instructions on standard plans.

841. Section foremen must see that all roadway signs and posts above enumerated, and any others that may be required, are in their proper position, in good condition and standing plumb. Should new ones be required, foremen will so report to the supervisor.

842. Roadway signs shall be painted as often as is necessary to preserve proper appearance.

The standard location of any signs must not be changed without proper authority.

SNOW AND ICE.

843. Track supervisors shall see that all snow equipment is in first class condition, as directed under "Equipment"; assign men to operate plows and flangers, and be fully prepared for handling snow storms.

844. During the progress of a storm, they shall keep in touch with the division engineer and train dispatchers, inform themselves as to the conditions on their districts, and prevent snow from obstructing tracks.

845. Arrangements will be made through the division engineer, or by the track supervisor direct in emergency, with the division superintendent for prompt service for flangers and plows.

846. In case of doubt as to which part of the road should be cleared first, supervisors shall consult with the division engineer, division superintendent and train dispatchers.

847. Track supervisors may increase their forces for handling snow, as, in their judgment, is required, reporting such action to the division engineer.

848. They shall detail sufficient men during the day and at night to keep switches and interlocking clear during snow storms.

849. All employes of the maintenance of way department are subject to call for duty in handling snow and must perform the duty assigned to them. In severe storms the forces of the supervisor of bridges and buildings and others may be called upon for assistance.

850. During long continued storms men will be worked in relays, so that one gang can be resting while the other is working.

851. Ample arrangements shall be made for feeding the men during storms so that they can work to their full efficiency.

852. Unless otherwise directed, section foremen will attend to the removal of snow and ice from switches and frogs, interlocking and signal pipe and wire lines, sidewalks, overhead foot-bridges, flangeways at crossings, water stations, track scales, the sides, roof and bottom of tunnels, rock cuts, etc., and give all necessary assistance to remove snow and ice from station platforms, subways, buildings, turntable pits, ash pits, etc.

853. During thaws, they shall also cut ice from around abutments, piers, piles, etc., where movement might cause damage.

854. Surface ditches and ends of all culverts must be cleared of snow where it is liable to interfere with the free passage of water during the spring thaw.

855. Section foremen must see that all snow fences are kept in repair, and that all portable snow fences are taken down in the spring, properly piled to prevent loss by fire, and put up again before winter begins.

856. During the winter season, points should be located where trouble with snow

might be avoided by the use of snow fences or other means. Culverts liable to be hidden by snow should be plainly marked.

857. During extremely cold weather accidents are liable to result from ice forming on the track at water stations, on account of overflows, leaks, etc. Where such conditions exist, foremen on whose sections water tanks are located, shall place a watchman at each tank day and night, whose duty it will be to keep the ice below the top of rail and properly flanged out. At tanks where pumpers are regularly stationed, foremen will notify them to attend to this duty.

858. The use of salt in connection with the clearing of switches during winter months must be handled with good judgment. The proper purpose of salt at switches is to remove or prevent the formation of ice in the working parts at times of sudden change from thawing to freezing and it must never be used when the temperature is uniformly low. Before salt is applied the switch and frog and their connections must all be cleared of snow and ice, and proper drainage channels cut so that any water formed by thaw, etc., will run off quickly.

859. Where the burning of hydro-carbon or similar fluid is employed to remove snow and ice from switches and their connections, it must be handled with great care.

Tanks containing hydro-carbon should be carefully inspected to see that there is no leak, and during the summer all filled tanks should be placed with the plug hole at the top. At the close of winter months, tanks should be placed with outlet up, the self-closing faucet removed and plug inserted. Safety cans should be tested with air or steam, and at the end of season, cocks and strainers should be removed

from cans and air blown through them, with cans reversed so that any sediment which may have collected will be blown out.

When using hydro-carbon from cans during storms, the strainers must always be in place and the cap properly fastened on the end of spout. Cap should not be removed except when necessary to clean out spout when it has become clogged with dirt or refuse. For filling the can a drawing gauge is used which has a spring and an indicator to show by the weight of the can when it is nearly full, and thus avoid the possibility of overflowing the liquid and consequent danger of fire.

It is very important that the hydro-carbon be shut off when indicator reaches the proper mark on drawing gauge, thus preventing overflow, and when the can is filled the cork should be replaced promptly.

When the can is taken to a switch which is to be cleared of snow, the outlet cock should be opened and a few spoonfuls of the liquid turned upon the snow. This may be ignited with a match, and the asbestos torch at the outlet of can, which became saturated when the liquid was turned out, swung into the flame and ignited. The can is then ready for use and the burning liquid may be turned into the snow where desired, to clear it away.

The operator should always stand with his back to the wind while using hydro-carbon, to prevent the flame from being driven toward the can, or burning his clothes.

No liquid should be drawn or safety cans filled in any other manner than by the use of safety faucets, which must be held open and will automatically close on being released by the operator, as otherwise there is danger of accidental ignition. No flame should be al-

lowed near the liquid at any time when it is exposed to the atmosphere.

Cans and other equipment, when not in use, should be left empty and stored in ventilated tool boxes provided for the purpose.

The gas from hydro-carbon is inflammable, and with a certain mixture of air becomes explosive, therefore care should be constantly exercised in handling it.

During the summer, shelter should be erected over all tanks that contain hydro-carbon, to prevent the sun from shining directly on the tanks.

Signs should be erected at all points where hydro-carbon is stored, reading as follows:

**DANGEROUS.
HYDRO-CARBON.
VERY INFLAMMABLE.
KEEP LIGHTS AND FIRE AWAY.**

For additional information on this subject, see special instructions.

**JOINT PROPERTY, PRIVATE TRACKS,
ETC., NOT MAINTAINED BY
THIS COMPANY.**

860. Private tracks or structures, or those of other corporations, located on the right of way or involved in the operation of this Company's trains, but not maintained by the Company, are subject to the same regulations, unless otherwise ordered, and shall receive the same inspection as tracks or structures of this Company.

861. Owners of private sidetracks shall be required to keep their tracks in safe condition for use at all times, and prompt report shall

be made to the track supervisor when such tracks need repairs. No work shall be done, however, on private tracks, joint tracks, and others not maintained by the Company, without special instructions from the division engineer, except in case of emergency, when the necessary action shall be taken promptly to insure the safety of trains, and proper report made of same.

862. After attention of the owners, or those in charge of private tracks, has been called to the necessity for repairs to their tracks, and proper action is not taken within a reasonable time, to have repairs made, and if in the meantime track has become unsafe, foreman shall spike the switch and notify superintendent, division engineer and track supervisor.

863. Foremen must make frequent inspection of such track crossings, wye tracks, and joint tracks as are used in common with other railroad companies, but not maintained by this Company, and report promptly to the track supervisor any defects in such tracks or track appliances.

Foremen will be held responsible in the same degree for reports of the unsafe condition of such joint or private tracks as they are for the safe condition of this Company's tracks. Responsibility of foremen in the matter of tracks maintained by other railroads, however, will extend over such tracks only as are laid within station grounds.

DON'TS FOR SECTION FOREMEN, EXTRA GANG FOREMEN, WORK TRAIN FOREMEN AND TRACK WALKERS.

864. Don't forget that safety is first.

865. Don't obstruct track in the face of passenger trains.

866. Don't use track jack unless properly protected at all times.

867. Don't allow incompetent men to handle track jacks. Assign the most competent men in the gang to this work.

868. Don't allow rail bender to be used in track without proper protection.

869. Don't leave a switch point that does not fit up perfectly.

870. Don't allow the stock rail to be higher than the switch point.

871. Don't change rails, frogs or switches, except in case of emergency, without getting permission from superintendent and track supervisor.

872. Don't allow your men to repair main track frogs or switches, except in emergency, unless you are there to supervise the work. They are liable to throw switch in the face of a train, or leave it in wrong position.

873. Don't call your flags in after changing rails, frogs or switches, or making other repairs, without making a personal inspection of the work and finding everything O. K.

874. Don't leave your tools out on the section for tramps and train wreckers.

875. Don't leave dangerous trees standing near the track, or limbs projecting that may injure trainmen.

876. Don't leave overhanging rocks in cuts or tunnels that you know should be removed.

877. Don't leave crossing plank projecting above the rail.
878. Don't leave broken angle bars in the track.
879. Don't let new ties roll down the bank when distributing them.
880. Don't take out ties that are serviceable.
881. Don't leave broken ties in the track.
882. Don't take out too many ties at once and allow the track to kink in hot weather.
883. Don't take out two or more consecutive ties at the same time. Passing trains may bend or spread the rails.
884. Don't leave ties unspiked.
885. Don't try to draw a rail with a spike—hold it to gauge with the bar and drive the spikes straight.
886. Don't burn your ties in the evening and leave the fire when you go home at night.
887. Don't burn old ties under telegraph or other wires.
888. Don't leave your shims under the rails after the frost is out. Take them to the tool house for next year.
889. Don't use tie plates or angle bars for permanent rail braces.
890. Don't allow unbolted joints in the track. When necessary to cut a rail, see that it is properly drilled and bolted.
891. Don't break wires bonding the track. It may cause a wrong signal indication and result in a serious accident.
892. Don't allow culverts to become stopped up. It may result in a washout.
893. Don't allow unconnected rails to lie on bridges or trestles unless they are temporarily spiked to prevent the rail from springing up or moving toward the running rail.
894. Don't haul dump cars with doors open.

895. Don't allow your men to ride on, or stand close to, a plough or cable when unloading ballast; or to sit on brake wheels of cars at any time.

896. Don't be in a hurry in getting on the track after a train has passed until you see that the way is clear.

897. Don't put motor car, hand car or push car on main track unless you know that all regular trains due have passed.

898. Don't run hand or motor cars at a high rate of speed, or too close together. It is liable to result in an accident.

899. Don't apply brakes on hand or motor cars without warning other men on the car.

900. Don't allow your men to get on or off hand or motor cars in motion, except when it is necessary, to start them.

901. Don't run over interlocked switches without an understanding with the towerman.

902. Don't raise your track more than necessary at a summit of grades.

903. Don't raise track any more than is necessary to make a good surface, where drainage conditions are good. It is a waste of ballast and labor.

904. Don't surface your track down hill if you can avoid it.

905. Don't make the run-off too short, when surfacing track out of face; make it two rail lengths for each inch the track is raised and keep the rails in cross level or proper elevation.

906. Don't dress the track and forget to line it. Poor line will jar a train worse than low joints.

907. Don't dig a ditch and then throw the dirt where it will wash back into it when it rains.

908. Don't waste in a cut, dirt that you know should be put on the adjoining fill.

909. Don't allow ballast to roll down the bank or lie in ditches.

910. Don't leave dirt or foul ballast where it will hold water under the ties.

911. Don't fill in with ballast when the ties rest on dirt.

912. Don't make ballast margin, when you haven't enough material to fill in between the ties and thoroughly tamp them.

913. Don't send one man over the track to tighten up joints; he won't do it. Take the whole gang and get it done.

914. Don't throw steel rails off cars.

915. Don't lift rails and drop them to make a break when cutting, if rail bender is available.

916. Don't curve rails with a sledge hammer—use rail bender.

917. Don't nick, dent or slot steel rails.

918. Don't carry rails without tongs, except in emergency cases, or permit the men to be inattentive or careless while handling rails.

919. Don't hang your clothes on the roadway signs.

920. Don't leave your signs heaved out of plumb. Straighten them as soon as the frost is out of the ground.

921. Don't keep section house and tool box in a disorderly condition.

922. Don't allow the right of way and station grounds to remain in an untidy condition. The company's reputation, as well as your own, depends upon neatness and order.

923. Don't use a grass scythe where you should use an axe or bush-hook.

924. Don't use spike mauls for striking chisels.

925. Don't use rail chisels, spike mauls or any tools with badly battered or split heads. Pieces are liable to fly off.

926. Don't hold a spike maul on the head of a spike and strike it with another maul. The steel is brittle and liable to break.

927. Don't drive a claw bar under the spike head by striking it with a maul. The spike head or pieces of the bar are liable to fly off.

928. Don't put your hand or foot between stock rail and switch points that are connected with tower unless switch is blocked or spiked.

929. Don't put your hand under rail to clean out while rail is being held up with a bar.

930. Don't allow cinders and dirt to collect on bridge seats. They injure the ends of bridges.

931. Don't work on track between cars in yards unless permission has first been obtained from yardmaster.

932. Don't work on the end of any track, repairing track or bumping posts, without first notifying yardmaster and displaying red flag.

933. Don't fail to inspect private side tracks and report defects.

DON'TS FOR SIGNAL DEPARTMENT MEN.

934. Don't fail to have proper protection while you are working on interlocking.

935. Don't put your finger through pin or bolt holes to see if they match. Towerman may move lever.

936. Don't put your hand between the points of interlocking switches and stock rails to replace lug bolts or make other repairs without first blocking the point so that it cannot be moved.

937. Don't disconnect switch or signal apparatus without first notifying towerman.

938. Don't work on the locking of an interlocking machine without first having an understanding with the leverman; he might raise the latch of the lever on which you are working and injure your hands by getting them caught in the locking.

939. Don't work with your head or body over tail levers of interlocking machine, unless you have a man guarding the levers.

940. Don't work on a switch where it is necessary for you to crouch near the ground without knowing that there is no train approaching or about due.

941. Don't climb a telegraph pole unless you know it is sound and safe to carry your weight.

942. Don't use rope or tackle without inspecting it to see if it is in proper condition and of sufficient strength to withstand the strain.

943. Don't climb signal ladders unless you know they are properly fastened.

944. Don't leave doors of signal mechanism cases or relay boxes open when signals are located between main tracks.

945. Don't remove capping from trunking and allow it to lie on the ground with the nails sticking up.

946. Don't come in contact with high voltage wires unless you know definitely that they have been killed and made safe to work upon.

947. Don't clean or wipe motor generators while they are running.

948. Don't imagine all wires hanging down are dead; they may be very much alive.

949. Don't consider any wires dead unless you have positive information that they have been killed and are safe to work upon. All wires should be regarded as alive unless known to be dead.

950. Don't allow your hands or feet to be

too close to cranks and compensators connected to levers. Levermen may pull them and cause personal injury.

951. Don't work on any high tension transformers without first pulling the fuse.

952. Don't worm over an electric switch and lock movement by hand without first pulling the brush or fuse.

953. Don't put your hand back of a switch point operated by motor before first pulling the brush or putting a block between the point and stock rail.

954. Don't work around switches without having a red flag or lantern with you in case of necessity.

DON'TS FOR ALL FOREMEN AND OTHER MAINTENANCE OF WAY EMPLOYES.

955. Don't forget that safety is first.

956. Don't allow any one, not authorized, to use your switch key.

957. Don't stand, walk or work on tracks, or too near them, while trains are passing on adjacent tracks, or allow your men to do so. Something might drop off and cause serious injury.

958. Don't allow your men to jump on or off trains in motion, or ride with their feet hanging over the sides of cars.

959. Don't allow your men to crawl under cars, to climb over cars in yards, to pass between cars standing close together, to take shelter from rain under cars, or to sit under cars when eating lunch. The cars are liable to start unexpectedly.

960. Don't leave your men unprotected in any exposed position.

961. Don't linger until enginemen have to blow for you to get off the track.

962. Don't throw articles from moving trains.

963. Don't throw anything before you look where it is going; it may strike somebody.

964. Don't cross the tracks without looking both ways.

965. Don't walk on tracks unless facing traffic.

966. Don't depend upon some one else to look out for your safety while working on the track or elsewhere. Protect yourself.

967. Don't encourage people to walk on the railroad. Use your influence to have them take the highway.

968. Don't pile material too close to tracks or allow any one else to do so.

969. Don't leave holes uncovered along the right of way when work is stopped temporarily. Some one is liable to fall in and be injured.

970. Don't leave old lumber with projecting nails or spikes in such a position that some one may step on them.

971. Don't use defective tools of any kind or allow your men to do so.

972. Don't allow the men to talk while on dangerous work. The danger is increased by dividing the attention.

973. Don't cut off bolts or rivets without using proper precautions so that heads will not fly and hit some one.

974. Don't swing your shoulder load of long material horizontally when passing other persons. Raise the rear end of load sufficiently to be above them.

975. Don't use dull tools it pays to keep them sharp.

976. Don't use wrenches which do not fit properly on the object to be turned.

977. Don't leave tools or other appliances where you get through with them. Place them where they belong.

978. Don't leave bolts in the rain, where they will get rusty.

979. Don't leave scrap scattered around on the right of way and in yards.

980. Don't leave excess material lying around after you have completed repairs. Replace it where it belongs. By so doing your services will be considered more valuable.

981. Don't be wasteful. Save all the material that can be used again.

982. Don't load cars on one side. They are liable to turn over.

983. Don't hold cars with maintenance material under load longer than necessary.

984. Don't call for work trains unless it is absolutely necessary. They are too expensive to use unless conditions are favorable.

985. Don't allow your men to loaf when there is work in the vicinity that can be done.

986. Don't keep slow orders in force longer than necessary.

987. Don't knock one another. Work together; more will be accomplished.

988. Don't fail to help other departments when necessary. You are working for the same company.

989. Don't shirk, keep your end up.

990. Don't do your work as well as others; do it better.

991. Don't fail to protect the Company's property in an emergency. You are thus protecting your own interests.

992. Don't handle gasoline carelessly, whether in cans, storage or fire pots.

993. Don't carry lighted cigars, cigarettes or pipes in or about places where gasoline or other inflammable material is stored.

994. Don't walk or stand under ladders or staging where men are working. They may accidentally drop tools on you.

995. Don't mount a ladder or scaffold until you are sure it is safe to work upon.

996. Don't leave tools or materials lying around loosely on bridges, station platforms or elsewhere. See that they are put in a safe place.

997. Don't scatter packed lumber to procure a choice piece, and leave it in that condition for some one else to replace. Be considerate of others, and replace the material properly.

998. Don't be disrespectful to owners of land adjoining the right of way. Remember they are your neighbors.

999. Don't throw switches for trainmen, or allow your men to do so, except to prevent an accident.

1000. Don't fail to advise your foreman of any personal injury no matter how slight. They often result seriously.

1001. Don't fail to notify your foreman of any change in your residence. It may sometime result to your advantage.

1002. Don't wait until you need report blanks before ordering them; always keep blanks on hand.

1003. Don't fail to report violation of the rules.

1004. Don't allow your men to follow dangerous practices when doing construction or repair work and in handling tools. Always do it the safe way.

1005. Don't be careless or take anything for granted.

1006. Don't let your pipe interfere with your work.

1007. Don't fail to exercise good judgment.

1008. Don't take any chances. Take more time if necessary.

1009. Don't imagine the foregoing applies to the other fellow, it is intended for you personally.

SUPERVISORS OF BRIDGES AND BUILDINGS.

1010. Supervisors of bridges and buildings report to and receive instructions from division engineer. They are responsible for the safe condition and proper maintenance of structures, including bridges, trestles, culverts, masonry, docks, wharves, buildings, sheds, platforms, stock pens, water stations, pipe lines, track scales, ash pits, engine houses, coaling stations, turntables, transfer tables, abutments, retaining walls, tunnels, cranes, intertrack fences, special boundary fences, crossing gates, planking of track in vicinity of stations, etc. They also have charge of all roofing, plumbing and painting, including switch stands, and such construction work as may be assigned to them, unless relieved of some of these items by the division engineer.

They must make temporary repairs of such defects as may endanger or delay the movement of trains, and promptly report defective conditions to the division engineer and such other officers as may be directed.

1011. They must make frequent inspection of structures and have necessary repairs made as promptly as conditions require. They are responsible for the neat and tidy appearance

of all property under their supervision, and ordinary repairs must be kept up without special instructions.

1012. They shall conform to prescribed standards and plans in the execution of work under their charge. All renewals or extensive repairs shall be made in accordance with standard plans, or plans and specifications prepared specially for same.

1013. Before any additions, changes, extensive repairs or renewals are made to bridges, buildings, plumbing, lighting, heating or other work, the plans and methods of execution shall be examined and approved by the engineer, maintenance of way, to insure that they conform to the prescribed standards and specifications, or that any plans or specifications, not standard, prepared specially for the work, are satisfactory in all respects.

1014. On completion of any bridge or building work, a report shall be made to division engineer, copy to engineer of structures, giving necessary data. If any change is made from approved plans a revised plan shall be submitted with the report.

1015. Supervisors shall, as necessary for the execution of work under their charge, employ such assistants, inspectors, foremen, bridge-men, masons, pile driver crews, carpenters, mechanics, painters, plumbers, helpers, laborers, and other forces as may be authorized by the division engineer.

1016. They shall have charge of all forces engaged on repairs, renewals and authorized construction, and must see that they perform their duties properly.

They are authorized to discharge or suspend foremen or other employes for intoxication while on duty.

In the matter of other offences by foremen, they will report the case to the division engineer and await instructions. When reporting the discharge of a foreman they will give the circumstances, so that a record of the man's standing may be kept for future reference.

1017. They will, so far as practicable, use ordinary labor for handling material, scraping bridges, excavating for foundations, or piping, concreting, etc.

1018. They must see that the time of their men is kept and reported in the manner prescribed, and that the monthly expenses for labor do not exceed the appropriation. They shall prepare all reports that may be required, in detail, of all maintenance and construction work under their charge, in accordance with the classification of the Interstate Commerce Commission, and forward this information to the division engineer.

1019. They have supervision of all work-train service for the maintenance of structures on their districts, and shall employ such service only when authorized by the division engineer.

1020. They must see that boarding and tool cars of all gangs under their charge are kept in a clean, sanitary condition, and that these cars are at all times safe for transportation over the road.

1021. They will appoint foremen subject to the approval of the division engineer. Before placing foremen in charge of work they shall personally examine them as to qualifications and understanding of the rules applying to their work, and know that they have passed the required examinations.

1022. They must examine foremen on the book of rules and instructions for maintenance

of way and structures, especially the operating rules in regard to train signals and flagging, and know that they fully understand and comply with the rules.

1023. They must see that foremen are provided with copies of the current time-table before it goes into effect, also with the rules, circulars, forms, special instructions, safety regulations, etc., pertaining to their duties, and that they fully understand and comply with these.

1024. They shall caution all foremen to be constantly looking out for the safety of their men, especially those just entering the service, and if unable to do this personally, appoint a man for that purpose.

Painters and others working near high tension power wires of overhead construction, must be especially cautioned not to come in contact with these wires.

1025. They must give necessary assistance in case of accident in any department.

1026. In case any structure in their charge is threatened by high water, or otherwise, they must use all necessary and available means to protect it and take every precaution to prevent accidents to trains.

1027. They must, in case of damage to structures, promptly assemble forces, tools and materials and make necessary repairs.

1028. They shall take personal charge of more important repairs to bridges, buildings or other structures when damaged by wrecks, storms or fire.

1029 (*1311). They must investigate damage to structures resulting from train accidents or other causes and make proper report to the division engineer and such other officers as may be directed.

1030 (*1313). They must investigate and report on proper form accidents which may be attributed to defects in, or result in damage to, structures.

1031. They must make careful and prompt inquiry and report fully, on the prescribed forms, all accidents that may occur to employes or structures under their charge.

1032. They must personally inspect all bridge and building work being done by contractors on the division, and report to the division engineer any neglect or improper work that comes under their observation.

1033. They shall keep themselves informed in regard to all work performed on bridges and structures in their districts by contractors, or others who do not come under their charge, see that nothing is done by them that will interfere with the safety of structures, or safe passage of trains, and report promptly to the division engineer if the work is not done in accordance with the prescribed standards.

1034. They shall inspect all work in which their men are engaged as often as is necessary to know that it is being properly and economically performed.

1035. They must know that all regular and special watchmen who are to have charge of bridges or other roadway structures are familiar with the rules for bridge watchmen, the use of signals, and flagging rules and that they understand and comply with the same.

1036. They must know that foremen are supplied with tools and material necessary for the efficient performance of their duties, and see that these are properly used and cared for.

1037. They must know that all material received and used in their department is in ac-

cordance with the standard specifications, as far as known.

1038. They must co-operate with the track supervisors in regard to distribution of material, and call upon them whenever assistance is desired.

1039. They must see that materials are safely kept and economically used, and that all defective tools and material are reported on the proper forms. Requisitions for material and tools shall be made through the division engineer, as additional supplies become necessary.

1040. They shall see that all material taken out of bridges is gathered and neatly piled at a safe distance from the track, and at the first opportunity removed to a proper place for storage and that no rubbish is allowed to remain where repairs have been made.

1041. They must see that all good second-hand material is kept and used as far as practicable for repair work, that the most economical methods are used, consistent with safety, and that foremen are not only instructed how to do work, but that they follow instructions. They will converse with foremen relative to their work, calling attention to bad and inefficient practices. They should, by personal contact and conversation with foremen, avoid the unnecessary issuance of written instructions.

1042. Before a water tank, stand pipe, coal chute, or anything else closely connected with the operation of trains is taken out of service, either temporarily or permanently, the superintendent and division engineer must be notified and authority obtained before proceeding with the work. When restored to service, the superintendent must be notified by wire.

1043. They shall keep a record relative to the base of rail, of high water marks at the

time of floods, or extraordinary freshets, at all bridges, culverts and openings, where streams pass under the track, and report this information to the division engineer, calling special attention to any case where the opening seems insufficient.

1044. They shall see that water barrel rests at all bridges and trestles, and at shops and other buildings occupied by their men, are in repair and supplied with barrels and buckets.

1045. They shall maintain bridge guards at all overhead bridges or other obstructions having a clearance of less than 22 feet above the top of rail, unless otherwise instructed by the division engineer.

1046. They shall see that all bridges are marked with their proper numbers.

1047. They shall see that all inspections of structures are made as prescribed, and that full reports of same are rendered, as required.

1048. They shall be conversant with all local laws and regulations governing the construction and maintenance of buildings, docks, piers, etc.

1049. All work in connection with buildings shall be done in accordance with the building laws of the city or town in which the work is performed, and they must see that foremen in charge have the necessary permits.

1050. Where local building laws do not conflict, or where there are no building regulations, the work shall be done in accordance with the standard building specifications.

1051. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1052. They must keep the division engineer

and train dispatcher advised daily of their movements.

1053 (*1314). They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

DIVISION AND DISTRICT BRIDGE AND BUILDING FOREMEN.

1054. Division and district bridge and building foremen report to and receive instructions from the supervisor of bridges and buildings, and have charge of renewals and repairs and are responsible for the proper inspection and safe condition of all structures on their territory, also of such construction work as may be assigned to them, unless relieved of some of these items by the supervisor of bridges and buildings. They shall do no work that will interfere with the safe passage of trains, except under proper protection.

1055. They must make such inspections of the structures on their territory as the supervisor of bridges and buildings may direct, and report their condition on the proper form.

1056. They have general supervision of all mechanics and laborers engaged on work under their charge, and will employ men as the supervisor of bridges and buildings directs. They must see that the men properly perform their duties, and discharge those who are incompetent or neglect their duties, but in no case shall they discharge men without sufficient cause.

1057. They will, so far as practicable, use ordinary labor for handling material, scraping bridges, excavating for foundations, piping, concreting, etc.

1058. They shall caution all foremen to be

constantly looking out for the safety of their men, especially those just entering the service, and if unable to do this personally, appoint a man for that purpose.

Painters and others working near high tension power wires of overhead construction, must be especially cautioned not to come in contact with these wires.

1059. They must see that the time of their men is kept and reported in the manner prescribed; that rates paid are correctly reported and properly classified, and that the number of men shown on the time book agrees with the number of men actually at work.

1060. They must each have a copy of the current time-table, and be thoroughly familiar with the rules and regulations therein, and with the time of trains over their districts. They must carefully observe signals displayed by all trains, and assure themselves, before obstructing track, that all trains and sections due have passed. No notice will be given of extra trains, and employes must protect themselves as prescribed by the rules.

1061. They must be familiar with the book of rules of the operating department and the book of rules and instructions for the maintenance of way and structures, and see that these are understood and complied with by all foremen and others under their charge.

1062 (*1326). They must know that foremen are provided with rules, circulars, forms and special instructions pertaining to their duties and that they fully understand and comply with them.

1063. They must see that foremen are supplied with tools and materials necessary for the economical performance of their duties, and know that same are properly used and

cared for. They shall see that defective or worn out tools are reported on the proper forms, and make requisition through the supervisor of bridges and buildings, from time to time as additional supplies of material and tools become necessary.

1064. They shall see that the tool and boarding cars for their men are kept sanitary, neat in appearance and in good repair.

1065. They have immediate supervision of work-train service required for maintenance of structures in their districts, and shall employ such service only when authorized by the supervisor of bridges and buildings and division engineer.

1066. They must supervise any work being done on or about structures by contractors or others which will affect the safety or regularity of trains, and see that the tracks over or under same are safe for trains and that proper signals are displayed.

1067. They must not do work which will interfere with the safe passage of trains at the usual speed without first displaying the proper signals.

1068. In the zone of electrical operation they will see that bridges supporting catenary are in good condition and properly maintained.

1069. They shall conform to the prescribed standards and plans in the execution of work under their charge.

1070. They shall see that all renewals and extensive repairs are made in accordance with standard plans, or plan especially prepared for them.

1071 (*1329). Repairs to bridges and structures must, except in case of emergency, be made at such time and in such manner as will avoid delay to trains. Tracks must not be ob-

structed for any length of time without due notice having been given to the chief train dispatcher and his acknowledgment received. Tracks must never be obstructed without having proper Stop signal displayed, in both directions, on all tracks affected.

1072 (*1330). When work is to be done upon bridges which in any way affects interlocking or signal apparatus, notice must be given to the signal supervisor so that he may co-operate in the work if necessary.

1073. They shall see that water barrel rests on all timber bridges and trestles are in repair and supplied with barrels and buckets, and that stations and other structures, where there is no agent or other person in charge, are equipped with the necessary water barrels, buckets and other appliances.

1074. They shall in period of flood observe and record the flow of water of various streams passing under the track, and report to the supervisor of bridges and buildings any case in which the opening seems insufficient.

1075 (*1327). They must, in case of damage to structures in their districts, promptly proceed to the place with men, tools and materials at their command, and do all in their power to make necessary repairs.

1076. In case the bridge and building forces belonging to two or more districts are called to repair a damaged structure, the foreman on whose district the work is being done will have general charge of the work, in the absence of the supervisor, unless instructions are given to the contrary. This rule will apply to the supervisor also.

1077. They shall take personal charge of all important repairs to structures when damaged by wrecks, storms or fire.

1078. They shall give necessary assistance in case of accident in any department.

1079 (*1328). They must, in case of accident coming under their observation, report facts to the supervisor of bridges and buildings.

1080. All work in connection with buildings shall be done in accordance with the building laws of the city or town in which the work is performed, and the foreman in charge must see that all necessary permits are obtained and kept on the work.

1081. Where local building laws do not conflict, or when there are no building regulations, the work shall be done in accordance with the standard building specifications.

1082. They shall, so far as they are familiar with instructions issued for the government of trains, report to the supervisor of bridges and buildings any neglect of duty or violation of rules that comes under their notice.

1083. They must keep the supervisor of bridges and buildings advised daily of their movements.

1084 (*1331). They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

BRIDGE AND BUILDING FOREMEN.

1085. Bridge and building foremen report to and receive instructions from district bridge and building foremen. They are responsible for the safe condition of the structures under their charge, and must do no work thereon that will interfere with the safe passage of trains, except under proper protection.

1086. They are responsible for the proper

care and use of tools and materials necessary for the safe and efficient performance of their duties. They must make requisition through the proper officer from time to time, as additional supply becomes necessary.

1087. They have direct supervision of all mechanics and laborers engaged on work under their charge and will employ men as authorized.

They must see that the men properly perform their duties, and must discharge those who are incompetent, or neglect their duties, but in no case shall they discharge men without sufficient cause.

1088. They will, so far as practicable, use ordinary labor for handling material, scraping bridges, excavating for foundations, piping, concreting, etc.

1089. They must make such inspections of the structures on their territory as required, and report their condition on the prescribed forms, in the manner required.

1090. They must keep and report on the prescribed forms, the time of their men and of labor expended on each class of work, and a record of material received and used, or otherwise disposed of.

1091. They must exercise special care under all conditions to guard against personal injury to themselves and their men. They are responsible for the safety of their men and must not leave them in any exposed position without having some one to give warning in case they cannot do so personally on account of attention to other duties. They must expect trains to run in either direction on all tracks at any time, and protect themselves accordingly. All foremen must provide themselves with a whistle and use it whenever necessary to warn their

men of approaching trains. Painters and others working near high tension power wires of overhead construction, must be especially cautioned not to come in contact with these wires.

1092 (*1337). They must, if practicable, make repairs to bridges or other structures at such times and in such manner as will avoid delay to trains.

Tracks must not be obstructed for any length of time without due notice having been given to the chief train dispatcher, and his acknowledgment received, and tracks must never be obstructed without having proper Stop signals displayed in both directions on all tracks affected.

1093. They must have with them a copy of the current time-table, and book of rules and instructions for the maintenance of way and structures, be familiar with the rules and regulations therein, know the time of all regular trains at any point where they may be working, and so far as practicable arrange the work to avoid interference with the passage of trains.

1094. They must keep themselves informed, as far as possible, how schedule trains are running, carefully observe signals displayed by all trains, and assure themselves before obstructing track that all trains and sections due have passed.

No notice will be given of extra trains, or of movements of trains against the current of traffic, and employes must protect themselves as prescribed by the rules.

1095. They must keep themselves supplied with the necessary flags, lanterns, torpedoes and fuses; be conversant with and pass the requisite examination on the rules pertaining to the use of signals, train signals and flagging;

keep signal appliances in condition for immediate use and be prepared to display Stop or Caution signals in accordance with the rules as may be required.

1096 (*1339). They must report at once to the supervisor of bridges and buildings, by telegraph, all accidents involving personal injury, however slight, to themselves or their men and follow this by written report on prescribed form.

1097. They must, in case of any accident, coming under their observation, report the facts to the supervisor of bridges and buildings.

1098. They shall conform to the prescribed standards and plans in the execution of work under their charge.

1099. They will personally engage in all work except when such labor would interfere with their duties of supervision.

1100 (*1340). They must devote themselves exclusively to the Company's service during such hours as may be required.

They must not absent themselves from duty without first obtaining permission from the division or district bridge and building foreman, except in case of sickness, when notice must be promptly sent to the division or district foreman and supervisor of bridges and buildings.

1101 (*1341). They must watch all trains that pass them, and if anything is seen to be wrong which, in their opinion, endangers trains or track, they must attract the attention of trainmen, if possible, and notify the superintendent at once by wire from the nearest station, giving train number.

In any case where track, bridge, building, culvert or other structure is unsafe for maximum speed of trains, foremen must display Stop signals in both directions on all tracks

affected, and do everything possible to make repairs, notifying the superintendent and division engineer.

1102. During severe storms, or extraordinary freshets, bridge foremen must be on duty, and shall, where possible, place themselves in communication with telegraph stations, ready to go at once with their men to repair any damaged structures. They must assure themselves that the structures on their respective districts are not being damaged and must take all necessary precautions for the safety of trains. In case of damage by storm or fire which may endanger or prevent the passage of trains, they must promptly notify the superintendent, division engineer and supervisor concerned, and will at once take measures to stop trains, if necessary, and to repair the damage.

1103. In case two or more bridge and building gangs are called to repair a damaged structure, the foreman on whose territory the work is being done will have general charge in the absence of the division or district foreman, unless instructions are given to the contrary.

1104. In making ordinary repairs to structures, they shall do only such work as is ordered by the division or district foreman. If any defect is discovered that would endanger a structure, they must make temporary repairs and call the attention of the division or district bridge and building foreman and supervisor of bridges and buildings to such defects at once.

1105. When work on a structure has been completed, all chips and worthless material must either be burned at a sufficient distance from the structure to insure safety (all fire being extinguished before work is left) or placed on the down stream side of the opening. Sound material, together with surplus bolts, washers,

etc., must be piled convenient for shipment, standard clearance being maintained, and at the first opportunity loaded and shipped for use elsewhere, or to the proper storage point.

1106. Each piece of work must be completed before going to another, except in case of emergency, and when work is left unfinished, it must always be maintained safe for the passage of trains.

1107. At times of extreme high water, foremen will take measurements at bridges or culverts, from the top of tie to the surface of the water, or high water mark. This information, with the number of the bridge or culvert and the date of the taking of measurement, should be sent to the supervisor of bridges and buildings.

1108. Foremen are forbidden to change the surface or line of track on bridges or approaches, except when authorized by the supervisor of bridges and buildings or the district foreman of bridges and buildings.

1109. When making repairs on highway bridges, they must do so with as little interruption to travel as possible, and if temporary driveways or footways are provided, they must be properly protected day and night and maintained in a safe condition.

1110. When raising derricks, care shall be used in handling guy ropes, so as not to interfere with telegraph or telephone wires, etc., and foremen must see that guy ropes clear the top of rails at least 25 feet when rope is slack.

1111. When derricks are used to handle material through a bridge floor, or between bridges on double track or anywhere, over or across a track, or near enough to the track to constitute an obstruction, danger signals must first be displayed.

1112. Excavations must be carefully made, using shoring or sheet piling, if necessary, to avoid disturbing neighboring structures and track, or possibility of slides.

1113. When work is to be done on bridges, which will in any way affect interlocking or block signal apparatus, notice must be given signal maintainers in charge of signals in that district, that the signal department may co-operate in the work if necessary.

1114. Before a water tank, stand pipe, coal chute or other appliance affecting the coal or water supply, is taken out of service, either temporarily or permanently, the foreman in charge must notify the supervisor of bridges and buildings and not proceed with the work until authority is obtained. When restored to service a report should be made by wire.

1115. When making repairs to turntables, foremen shall see that the circular track is kept level and the table raised so that its end wheels will just clear the circular rails when turning the heaviest engines. The height at ends must be adjusted so that when engine is moving on or off the table, the rails on the table are level with the rails on the approach. Turntables and truss bridges must be adjusted by men who have been properly instructed and who thoroughly understand the work.

1116. They must carefully inspect and check all tools and materials received, and make report of same to the supervisor of bridges and buildings. Material or tools not in accordance with the standard specifications as far as known, or otherwise defective, must not be used without special instructions.

1117. They must see that the boarding and tool cars for their gangs are kept sanitary, neat in appearance, and in good repair, and that all

refuse from these cars is properly disposed of and not thrown on the right of way.

1118. They must be familiar with all rules relating to their duties, particularly those in regard to watching, signals, slow orders, tie plates, spiking, elevation of the outer rail, gauging, shimming, standard plans, explosives, accidents, reports, hand and push cars, etc., and be governed by them in performing their duties.

1119. They must report in writing, all accidents, or the failure of any structure under their charge, giving the date and cause. In case of detention to trains on account of repairs under their charge, they must report the day and hour when traffic was stopped, and also when it was resumed, giving cause of detention.

1120. They must study carefully and be thoroughly familiar with the special instructions relative to fire protection, and see that everything possible is done to prevent any structures on their territory from being destroyed by fire.

1121. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1122. They must observe rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

FOREMEN OF MASONS.

1123. Foremen of bridge and building masons will report to and receive instructions from the supervisor of bridges and buildings, or as may be otherwise directed.

1124. They have charge of such masonry

construction, renewals and repairs, as may be assigned to them, and shall be governed by the rules for other bridge and building foremen, so far as they apply.

1125. They shall personally supervise the work in their charge and see that workmen faithfully perform their duties.

1126. They shall see that all materials are safely kept and properly and economically used, that all tools are in proper condition and that boarding and tool cars are sanitary and have a neat appearance.

1127. They shall make requisitions through the proper official for necessary tools, material and supplies.

1128. They shall perform all work in accordance with standard plans and specifications, or plans and specifications specially prepared for it, and see that lines and levels furnished by the engineer are closely followed.

1129. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1130. They must observe rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

FOREMEN OF PLUMBERS AND TINSMITHS.

1131. Foremen of plumbers and tinsmiths will report to and receive instructions from the supervisor of bridges and buildings, or as may be otherwise directed.

1132. They have charge of the construction, renewals and repairs of such plumbing, heating, roofing and other work as may be assigned to them, and shall be governed by the rules for

other bridge and building foremen, so far as they apply.

1133. They shall personally supervise the work in their charge and see that workmen faithfully perform their duties.

1134. They shall see that all materials are safely kept and properly and economically used, and that all tools are in good condition.

1135. They shall make requisitions through the proper officials for necessary tools, materials and supplies.

1136. They shall perform all work in accordance with standard plans and specifications, or plans and specifications specially prepared for it.

1137. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1138. They must observe rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

WATCHMEN.

1139. Watchmen shall be detailed, when necessary, to watch bridges, patrol unsafe or imperfect track, or to perform other duties regarding the safety of track and structures. They will report to and receive instructions from their respective supervisors or section foremen, who shall frequently inspect their performances.

1140. They must be vigilant, energetic and prompt in the discharge of the duties assigned to them.

1141. Their special duty is to see that the structures under their charge are safe for the passage of trains and to prevent them from be-

ing damaged by freshet or fire. They must be familiar with the rules, particularly those relative to track walking and inspection, signals, and slow orders.

1142. They must report promptly any accident or liability of same or occurrence not consistent with safety or good order.

1143. When day and night watchmen are employed, they are forbidden to leave their posts until relieved.

1144. Night watchmen, before going off duty, must notify the relieving watchmen of the trains due which have not passed, or of any other matters requiring attention.

1145. They must keep lamps, flags, torpedoes and matches on hand ready for immediate use, and in case of necessity or obstruction, display Stop signals in both directions and immediately notify the superintendent, supervisor concerned and section foreman.

1146. Bridge watchmen shall remove combustible matter from near the bridges and prevent driftwood from accumulating, frequently examine the wood and iron work and promptly report any decay or defect to the supervisor of bridges and buildings. They must keep water barrels filled, and the bridge seats of abutments and piers clean, on the structures under their charge, relieving section foremen of that work.

1147. They shall report enginemen who allow fire to escape while crossing bridges or who are careless in observing signals or speed requirements, giving the number of train or engine and all facts pertaining to the case.

1148. When the time of watchmen is not wholly occupied, they shall perform such other duties as may be assigned them.

1149. They must, so far as they are familiar with the instructions issued for the government

of trains, report any neglect of duty or violation of rules that comes under their notice.

1150. They must observe the rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

(For other rules applying specially to watchmen, see rules under "Track Walkers".)

GENERAL BRIDGE RULES.

1151. The line or surface of track on bridges or approaches must not be changed except under the direction of the track supervisor. While erecting or replacing bridges, if the track cannot be kept in condition for full speed, slow orders must be provided for, according to the rules.

1152. Ties and guard timbers on all bridges must be maintained in safe condition.

1153. The supervisor of bridges and buildings will provide necessary barrels with lids and buckets for bridges and trestles, where required. The track forces will see that the barrels are maintained in proper condition, and filled with water, containing the required amount of calcium chloride or salt, to prevent freezing.

1154. Bridge foremen will be furnished by supervisor with the schedule of authorized work and repairs for the various structures and the general employment of their forces. They should examine all structures upon which they are employed for signs of weakening or crushing of stringers, chords, caps, posts, or piles, and other defects that might endanger the structure or make it unsafe for the passage of trains. Such defects must be corrected even though they may not be included in the schedule of repairs.

1155. In reporting work done on bridges or other structures, the same language and order of wording as on the schedule should be used to facilitate the checking of reports. When work called for on the schedule is changed in any manner, the reasons should be given for such change. If any work is performed not called for in the schedule, it must be reported with the reason for such extra work. If schedule work on a structure is completed, the report should so state.

1156. In replacing decayed piles with posts, never more than one post is to be placed in a bent. The outside piles must never be replaced with posts, except for temporary purposes, until a pile driver can be moved upon the ground and a new pile driven. When necessary to replace an outside pile with a post, the fact should be immediately reported to the supervisor so that arrangements can be made at once to put the bridge in its normal condition. Shim- ming between piles and caps to be done only in temporary cases. Shims should not be used between the rails and the ties on bridges.

1157. When posts are used to replace piling, dig down until sound timber is found in the old pile. Each post must be properly fastened to pile and capped. Use second-hand pile heads for posts where practicable. Care must be exercised in sawing off the old pile to insure a good bearing for the post.

1158. When piling is renewed, old piles must not be mixed with new, oak piles with cedar or other soft wood piles, or treated with untreated piles in the same bent. Except in case of emergency, old piles will not be mixed with new piles in new bridges, nor will treated be mixed with untreated piles in the same structure.

1159. Material and rubbish left over from construction or repairs of bridges must be cleaned up as soon as the work is completed. Material of a usable character must be piled at a convenient point for loading at a distance of at least ten feet from the nearest rail. At the first opportunity it must be loaded and shipped to the storage point designated by the supervisor.

1160. Work on public streets, roadway crossings and highway bridges shall be done under permit where necessary, with the least inconvenience possible to the public. Care must be taken to protect such work in compliance with the law, and if necessary to construct temporary foot or driveways, they shall be maintained in safe condition, and properly protected day and night.

1161. Private structures over which the rolling stock of the railroad company is operated shall be constructed in accordance with standard or approved plans, maintained in safe condition, and shall be inspected in the same manner as Company structures.

1162. No permanent structure shall be started until the foundations have been approved by the division engineer. Points for elevation and lines shall be given by the engineer. These shall be checked—1st: when foundations are excavated and before footing is put in; 2nd: when footings are completed and before neat work commences; 3rd: when neat work is completed and before copings and bridge seats are placed. Similar care shall be taken with other structures.

1163. The bottom of all footing courses shall extend below frost line, be of sufficient depth to insure solid foundation and thoroughly protected from all danger of scour and un-

dermining. Where the foundations are doubtful, special instructions will be furnished by the division engineer.

1164. In dismantling old structures which can be used again, care must be exercised to avoid injury to the parts, particular attention being given to avoid bending eye-bars, rods, connection plates and the flange angles of girders. All old bridges will be marked for re-erection before dismantling. Pilot and driving nuts must be used in erection and dismantling of pin connected bridges. All unpainted surfaces of old bridge material which is not to be immediately scrapped shall be coated with white lead paint, or standard paint.

1165. All bridge material will be handled so as to avoid injury and will be placed on skids above the ground to keep it clean; girders and floor members placed upright to prevent the collection of water; heavier members placed below and the material arranged so as to be readily inspected and loaded.

1166. No structure shall be supported upon false work until same has been approved by the supervisor of bridges and buildings. The quality of timber; number and position of posts; length of spans; strength of stringers; bracing of bents; foundations of bents, blocking and wedges; size, spacing and bearing of ties; must all be given careful consideration and safe limits not exceeded. Ties must not be left loose laterally on wooden stringers or smooth girder flanges. They must at least be drift-bolted, to prevent lateral movement, and when timber guards are removed, heavy nailing strips strongly spiked to every tie, shall be put on to prevent bunching of ties.

1167. In erection of truss bridges the floor system shall be lined and camber elevations

given by instruments. Roller beds must be set with care to see that they are in proper position for the existing temperature and square with the bridge. No straightening of main members by heating will be allowed and any injury must be reported to the supervisor of bridges and buildings.

1168. In riveted truss bridge erection, if lower chords line up properly on camber blocking the splices in these chords shall be fully riveted before spans are swung. Top chord splices and other main field connections shall generally be riveted after camber blocking has been removed and spans swung with dead load only. Before swinging, one-fourth of the field connection holes in each top chord splice shall be filled with tightly driven drift pins and tightly drawn bolts, there being at least as many drift pins as bolts and always sufficient bolts to hold members together. After swinging any span it shall be immediately blocked to take all live load. If lower chords do not line properly they should not be riveted until after bridge is swung, and before swinging at least one-half the holes shall be filled with drift pins and bolts in the manner specified.

Floor systems shall not be riveted until spans are swung.

1169. If falsework is removed by accident or otherwise before field riveting is completed, no live loads shall be permitted upon any span unless at least one-third of the holes in each main field connection are filled with driven rivets, or until two-thirds of the holes are filled with tightly driven drift pins and tightly drawn bolts, there being at least as many drift pins as bolts, and sufficient bolts to hold members together. In case of stringers resting on shelf angles, each shelf angle rivet may be con-

sidered equal to one drift pin and one bolt in the main connection, or to one driven rivet.

1170. When spans or floor systems must carry trains before riveting is completed, the speed of trains must not exceed five miles per hour and riveting must be completed as soon as possible.

1171. Rules 1168, 1169 and 1170 apply to riveted work in pin-connected and girder bridges.

1172. Drift pinning shall be permitted only for the purpose of drawing parts together and not for making mismatched holes come to a fit. All holes that do not coincide perfectly shall be reamed out.

1173. The threads of bolts used in permanent field connections shall be checked so that nuts cannot turn after they are placed.

1174. Eye-bar heads shall be drawn together tightly and pin nuts must come on the pins equally at both ends. All members must be straight and true and not sprung to get them into place.

1175. In driving rivets with pneumatic hammers, care must be taken so that the metal around rivet heads is not cut. All field rivets must be tested, and if found loose, cut out and re-driven.

1176. Rivets shall be carefully heated so that the heads are hotter than the points and when ready for driving shall be clean and free from slag, scale and cinders. When driven they shall completely fill the holes and shall have concentric heads of standard dimensions.

1177. All culverts or other openings in roadway for the passage of water, must, at all times, be kept free from driftwood or obstructions, and all trestles, bridges, culverts, cattle guards or other structures which would be in-

jured by fire, kept free from accumulation of weeds, etc.; also dirt and cinders must be kept away from the ends of steel bridges and from top of all piers and abutments and not allowed to be in contact with the steel. On trestle bridges, caps and bents should be kept free from dirt; also sills, when set in concrete pedestals.

1178. In rivers of swift current, subject to flood conditions, and where driftwood accumulates against structures, it shall be the duty of bridge and building foremen to assist the section gangs, if necessary, to clear the drift. In many cases drift can be best removed by pulling with derrick cars or locomotives, as section gangs are neither large enough or properly equipped to handle this kind of work. Whenever work is being done on a bridge spanning a river with either deep or swift water, a boat must be kept at all times on the down stream side of the bridge, where it will be available at once, to rescue workmen who may fall from the structure.

1179. Drawbridges will be maintained by the supervisor of bridges and buildings, including all structural parts, and the locks, where these are operated by hand. Where electric power is used for operating or locking the bridge, the electric apparatus will be maintained by the signal supervisor, and the shafting, gearing, etc., by the division master mechanic. Where power is furnished by steam or gasoline engines, these, together with all gearing, shafting, etc., will be maintained by the division master mechanic.

In case of failure to the operating machinery, or other emergency, all departments concerned shall render prompt assistance and do every-

thing possible to make repairs, and avoid delay to train service or navigation.

1180. The supervisor of bridges and buildings, or his representative, with the master mechanic, or his representative, and the signal supervisor, or his representative, shall make an examination of all drawbridges at least every thirty days.

1181. A supply of duplicate parts must be kept on hand by the mechanical department.

1182. If the drawbridge is operated day and night, the day operator is in charge of the bridge and will be responsible for proper condition, and reports of defects or breakages.

GENERAL INSTRUCTIONS FOR THE INSPECTION OF BRIDGES.

1183. The object of bridge inspection is to discover and report defects so that prompt steps may be taken to remedy or remove such defects before they endanger the structure or unduly diminish its capacity.

1184. Some bridges, under certain unusual conditions, may require careful daily or weekly inspection, while others will require inspection not oftener than once in a period of one to three months. There shall be three classes of inspection, as follows:

(a) Inspection by the regular section forces daily, or as often as they inspect the track under their supervision. In case of any damage to the bridge by fire, flood, derailments or other accidents from traffic, or any displacement in the structure, in whole or in part, the section foreman shall immediately notify the track supervisor, who shall at once notify the supervisor of bridges and buildings. No reports of

such inspections need be made unless adverse conditions are discovered.

(b) All bridges built previous to 1896 shall be inspected once in three months by a competent bridge foreman, or a special inspector selected from the bridge supervisor's forces, whose duty it shall be to make a careful examination of the masonry and superstructure.

The division inspector shall fill out the proper form at the bridge site, when making examination, and, at the end of each day's inspection, forward same to supervisor for transmission to the division engineer.

(c) During September and October each year a thorough inspection of every bridge on each division shall be made by the division engineer or his assistant, in company with the supervisor of bridges and buildings and inspector. The condition of each structure shall be noted and special attention shall be given to bridges likely to require repair or renewal.

This inspection must be made with special reference to obtaining data for estimating the costs for renewals and repairs and for the material required for the ensuing year.

The division engineer shall make up a report of this inspection with recommendations for renewals or repairs for the ensuing year, and forward one copy each to the engineer maintenance of way and the engineer of structures.

Following this inspection, estimates of the cost of repairs, renewals and replacements recommended for the ensuing year will be prepared by the division engineer, passed to the engineer maintenance of way, who, after checking, will forward to the general manager for approval. The character and extent of renewals and improvements will be determined from this report. Descriptions and estimates

will be given for permanent structures wherever same appear desirable or economical.

1185. When making the regular inspection, the inspectors will note particularly whether repairs previously recommended have been fully carried out, and whether the work is in accordance with standard plans.

1186. The division engineer shall furnish the engineer maintenance of way (copies to engineer of structures) with monthly reports of all repairs and renewals of bridges and trestles, also culverts. The engineer of structures will check these reports against the inspection requirements for the purpose of insuring compliance with such requirements.

1187. For the final record, at the completion of the work, the division engineer will forward report to the engineer maintenance of way (copy to engineer of structures) showing the nature of the work done and the labor and material expended.

1188. In addition to the above classes of inspection, there will be a special inspection made by two district bridge inspectors, reporting directly either to the engineer of structures or to the general supervisor bridges and buildings, as may be directed. It shall be the duty of a district bridge inspector to make a complete examination of the condition and strength of each bridge in his district once in six months and to make special inspection of such bridges as may be reported as needing immediate or extensive repairs or renewals. The results of these inspections shall be recorded at the time of making the inspection, and the results at once forwarded to the engineer of structures or general supervisor for file or for such attention as may be necessary in case repairs or adjustments are needed. If conditions are

found requiring immediate attention, the division engineer and general supervisor shall be notified at once.

The general supervisor will keep complete records on the proper forms.

1189. The various inspections prescribed shall, so far as practicable, be utilized as substitutes for those required by Public Commissions.

INSTRUCTIONS TO INSPECTORS OF BRIDGES.

General.

1190.

(a) Bridge inspectors will report to, and receive instructions from, the engineer of structures, general supervisor of bridges and buildings, or the supervisor of bridges and buildings, as may be directed.

(b) Safety is the first consideration, then economy. Great care must be taken by inspectors to make their inspections so thorough and the records thereof so complete as to convey definite and precise knowledge of the condition of each and every structure at the time of the last inspection.

(c) In case they find conditions which are considered dangerous or demanding immediate attention, they shall at once report to the supervisor of bridges and buildings by letter or telegram, as seems advisable, and may call on any employe in the maintenance of way department, who is at hand, for necessary assistance. If the defect is of such a nature as to render it unsafe to operate trains over the bridge, the superintendent shall be notified by wire.

(d) Notes of inspectors must be recorded at the structure when the examination is made.

(e) Number bents, spans or panels in each bridge in the direction of the bridge numbers. Number piling in all bents and piers from left to right, designating trusses as left or right when facing away from the initial point of the road.

(f) Note if the waterway requires straightening, cleaning out or enlarging above or below structure; if structure affords ample waterway; if rip-rap is needed to maintain channel or protect roadway.

(g) Note line and surface, also condition of rails, joints and fastenings on bridges and approaches. See that rails are braced or tie plates used on curves when necessary and that track on approaches is firmly bedded, to avoid shock or jolt to train as it passes on or off bridge.

(h) Note any decayed, split or otherwise defective bridge ties, giving number, size and kind. See if there are tie plates on bridges and if same are drawn tight so they will not rattle.

(i) Note if wooden guard rails are in sound condition, fastened properly and in correct line. See if inside guard rails have been provided where necessary and if they are full spiked, bolted and in correct line.

(j) See that attachments to bridges and structures are properly secured and afford standard clearance and that electrical attachments are properly insulated and maintained.

(k) Note whether necessary ladders are provided, and if in good condition.

(l) Note condition of paint on all structures.

(m) When making the regular inspections, the inspector will take a statement of the results of the last examination relative to such

structures, as required attention at that time, and in reporting on these structures, special notes shall be made as to whether the repairs and recommendations of the previous examinations have been carried out or not, and whether the work is in accordance with the standard plans.

(n) Report any work not done in a workmanlike manner and any neglect or inattention to duty of any employe in the Bridge and Building Department. Also report cases of improper use of material.

Superstructures (Steel).

1191.

(a) Bed plates should be level and in proper position, and have uniform bearing.

(b) Sole plates and pedestals should be free from flaws and cracks and shall be firmly attached to main members.

(c) See if bed plates and rollers are clean, and if the latter stand so as to move freely back and forth with the axle at right angles to the line of the truss. See if pedestal takes an even bearing on rollers. Examine anchor bolts.

(d) Particular attention shall be given to the action of the structures or parts thereof under passing trains. Excessive deflection, swaying, twisting or rattling of parts is evidence that attention is needed. Unusual deflections shall be accurately measured.

(e) Main trusses should have the tension members (eye-bars, rods and bottom chords) free from slackness and in perfect adjustment, so that they will be equally strained in any panel. Compression members (top chords and posts) should be straight, free from bulges, twists or bends, with joints bearing firmly against each other.

(f) Test equality of tension in tie bars by springing them. Look for any signs of distortion or crookedness in bars of end panels of bottom chords. Howe truss rods, counter, lateral, and vibration rods, must never be allowed to hang loose. They must not be adjusted while a load is on the bridge. They should be tightened enough to give close and even bearings, but must not be overstrained, as unnecessary strains are put on compression members if too much power is used in adjusting tension members. See that the center line of all tension members is the same as the line of strain.

(g) Examine all tension members carefully, especially at the joints.

(h) Lateral systems (sway-bracing and lateral-bracing) of trusses, girders and viaducts should be in proper adjustment. Examine bracing in iron trestles.

(i) Note pins which indicate the movement of any of the members coupling on them, or that give evidence of bending, wear or loose nuts. All pins and nuts shall have a streak of white paint across nut and pin end, to indicate any movement.

(j) Make particular examinations of all hangers, testing each nut to see that it is tight. These nuts should be screwed up tight and secured by burring the thread of the bolt and nut at two or three points with a center punch or chisel.

(k) Hangers supporting floor-beams require careful inspection. Where they consist of round or square section their bearing around the pins should always be equal and uniform over half the circumference, and they shall be critically inspected at the semi-circle for flaws or fractures. The nuts on the ends of the hangers should never be loose and shall have

jamb-nuts to prevent their movement. Plate hangers shall be examined for loose rivets and for any indication of cracking or shearing.

(l) Notice particularly the connection between stringers and floor beams, see that connecting angles are not split, neither in the angle nor through in the line of the rivet holes; also that there are no loose, defective, or missing rivets, due to shearing and crushing of webs and flanges at points of connection with each other, and where floor beams connect with hangers or posts.

(m) Notice particularly the connection between floor beams and trusses, for evidence of imperfect bearing, or splitting of connecting angles. If suspended, notice if they are up tight against the post feet, or free to move.

(n) Shelf angles supporting ties on through plate girders should be closely examined for loose, missing or defective rivets and for cracks at the root of angles. Special attention should be given to ends of wooden ties bearing on angles.

(o) All rivets in lower-chord and floor connections shall be inspected to detect loose rivets, and loose or missing rivets shall be marked and replaced.

(p) All castings on bridges shall be examined for cracks, breaks or flaws.

(q) Overhead bridges exposed to locomotive gases shall be frequently examined. Planking must be removed, or other means taken to determine the conditions at inaccessible places. All parts deteriorated shall be immediately reported.

(r) Detailed sketch must accompany report on each truss bridge, with the panel points on this sketch lettered, and these letters must be

referred to in reporting on each of the following items:

1. Rail surface and alignment of track on bridges and approaches, connections at floor beams, laterals, stringers, and at all panel points of trusses, noting and reporting on any defective connection which cannot be properly taken care of and adjusted.

2. Report on all loose rivets in floor beams, stringers and truss connections, and on failure of bottom of posts to abut floor beams. Also in regard to loose hangers and nuts where the same cannot be adjusted at the time. At all floor beam and stringer connecting angles, report in regard to any indications of fracture at the root of the angle.

3. See that all adjustable members are so adjusted that they carry their share of the strain. In Pratt trusses the counters are generally subjected to more strain per square inch than the main diagonals, and should be adjusted to carry as little strain as possible, but should not sag or rattle. Report any part so tight that it is carrying more than its share of the load, so that proper adjustment may be made.

4. See that all trusses and lateral pin nuts are in place and tight, with the threads properly checked up, particularly at hip joints where there is no check plate. Examine the camber of all trusses, carefully, also the alignment of trusses and of individual compression members, particularly end posts, which are riveted to shoes or top chords, noting and reporting any indications of buckling in the posts or struts. Report also on all loose rivets, or indication of motion of abutting joints of compression members.

5. See that all hanger bolts and nuts are in place with threads properly checked up and tight, and that all bridge seats are clean and have good drainage. See that rollers are in proper position, clean and free to move. Where rollers are jammed, or there is not sufficient room for proper expansion, note and report on any indications to buckle in end panel or bottom chord.

1192.

Superstructures (Wood).

(a) Observe particularly the condition of wall plates where bolster rests upon them. Note any appearance of crushing or decay.

(b) Note condition of bolster and corbels. See if holes are bored through them where they cover the spaces between chord sticks, and prevent the collection of water, and if there is any indication of decay where they are in contact with chord.

(c) Angle blocks and all cast-iron members, such as chord boxes, post shoes, etc., must be examined for cracks and for any indications of displacement by reason of caps splitting or timber crushing. A hole one-fourth inch in diameter, if bored at the end of a crack, will frequently stop its extending farther.

(d) Note particularly any appearance of opening of bottom chord joints. Wooden bridges over four years old should have gauge blocks at all joints in the middle half of the span, made by fastening two planed and squared blocks, two inches by one inch, six inches long, to the chord sticks with screws, and scribing a fine line across both. Any movement of joints should be noted, giving location and amount, scribing a new line from

the old one on the outside block across the inside block. See if clamp daps are shearing.

(e) See that all chord and packing bolts are tight. Nuts on all bolts through guard rails, ties, stringers, and floor beams must be secure in place by burring the thread of the bolt at two or three places with a center punch or chisel.

(f) Note any signs of decay or crushing in packing blocks and see that clamps and keys are in proper condition.

(g) See if gib plates are distorted, or crushing into the chords; if they are, give their location and dimensions, number, size and spacing of rods passing through them. Give size of rods over threads.

(h) Note condition of sides and roof of covered bridges, or of chord and end post covering.

(i) Wooden members in bridges will be inspected by sounding and if necessary by boring, especially at points where they bear against each other, all such holes to be not larger than three-eighths of an inch in diameter, to be bored in such places that the members will not be weakened and to be plugged so as not to hold water. Examine all parts of trusses for defective clamps or evidence of pulling apart. See if braces are up in place, taking a square bearing at ends, and note if any warping is evident. Note their condition as to soundness.

(j) Examine the general condition of painting, tie floor, spiking, etc. In combination or wooden truss bridges, see if tension members are so tight as to cause crushing of timber at the connections, and also note any indications of counters to buckle on account of being too small, or main ties in the same panel being too tight.

(k) In Howe truss bridges, examine all timbers carefully, especially the lower chord, near the center panel points, boring the same with a small auger, in such a position and direction as not to reduce the net section of the lower chord any more than necessary to enable you to state percentage of good timber left in the wooden members at these critical points. Do the same thing at the top chords near the center; also where the compression members of the trusses join the chords, and have auger holes, which it is necessary to bore in top chord sections and struts, plugged, after the examination is made. Examine all floor beams and stringers carefully, and note where the same are 20 to 25 per cent decayed, and which should be replaced. Furnish sketch which shows clearly the percentage of good material remaining at each of the critical points examined, so that the necessity of renewing the timber or temporarily supporting the bridge may be intelligently passed upon.

(l) Where any members of wooden structures, on account of their age, appearance or position, are liable to be decayed, they shall be tested by boring and the holes are to be plugged as soon as the inspection is completed.

(m) See if water barrels or buckets are provided or are necessary. State condition of such barrels as may be in position. See if they are kept filled with water and have sufficient calcium chloride or salt in them to prevent freezing in winter.

Timber and Pile Trestles.

1193.

(a) Note condition of caps, sills and stringers particularly at points where they bear

against other members. Sills should be kept free from dirt.

(b) Note if tower posts, trestle posts, or piles are decayed, split or crooked and if bents stand plumb, without settlement or lateral motion under traffic. Examine piles particularly for decay at the point where they enter the ground or water. Remember that points of worst decay in piles may be covered by loose dirt, water or snow. In waters where teredo or limnorea are found, make special examination at frequent intervals of the piles at and near the mud line to ascertain whether the worms are boring in the interior of the piles.

(c) Posts of viaducts and those supporting girders or trusses should be free from bends or bulges and all points should bear firmly and closely against each other.

(d) Examine all tower braces, longitudinal braces and sway braces on timber trestles. See if timber is sound, bolts tight and bracing sufficient and properly applied, with necessary fastenings. Observe action of trestle under movement of train to determine this if possible.

(e) Test timber for decay by sounding with a sledge, prodding with a steel bar or boring as may be necessary. Care must be taken not to disfigure or injure the timber by doing this, and all bored holes must be plugged.

(f) In condemnation of piles in a bridge, conform to the following as closely as possible:

In four-pile bents where a pile has six inches or less diameter of sound timber, replace with a post at once. Piles of seven inches in diameter of sound timber must be replaced with a post during the coming season. If all piles in the bent are seven inches or less diameter of sound timber, replace bridge with a new structure during the following season. Pile bents

of more than four piles must be kept up to the average condition of timber equal to the above for four-pile bents.

Abutments, Piers, Retaining Walls, Etc.

1194.

(a) Examine each abutment, pier, retaining wall, culvert, or other masonry structure, for undermining, settlement, scouring, tipping over, bulging, cracks, opening at joints, crushing, imperfect stones, defective concrete, or other indications of failure.

(b) Take soundings and compare with former records to note scourings around piles, abutments and foundations.

(c) Note condition of retaining walls. See if they are yielding by settlement or bulging from the pressure of the embankment.

(d) Note if masonry needs pointing, and if any cracks have been opened since last inspection. Make such measurements as will locate position of cracks.

(e) Note condition of paving and rip-rap, if any; and whether same is placed so that it cannot be undermined by washing; also if rip-rap is needed to prevent undermining, and if so, how much.

(f) Note whether bridge seats are level, well bedded and free from cracks or evidence of crushing.

(g) See that bridge seats and roller rests are clean, free from rubbish and cinders, and that water is drained off.

Examine pedestal stones for crushing or splitting.

Culverts and Drain Pipes.

1195.

(a) Note condition of culverts. In metal or

masonry culverts, examine for cracks or settlement. Where new culverts are required, or where old culverts need renewal, give size of opening, and distance from bottom of stream to base of rail.

(b) Note condition of ring or covering stones, of box or arch culverts.

(c) See if culverts have end walls; if not, note where end walls are required. See if flow line of culvert is at proper elevation and if culvert drains itself.

(d) Note condition of pipe drains. Does pipe need head or tail wall to protect embankment from washing, and does it clean itself of water?

(e) Does timber box need to be replaced with masonry or culvert pipe? If so, give dimensions required to provide ample waterway, and give height from bottom of stream to rail.

BRIDGE NUMBERING.

1196. Bridges, trestles and culverts will be numbered consecutively, with regard to their mileage on the various lines, as may be directed by the engineer of structures.

1197. The numbers shall be provided and placed in accordance with standard plans and specifications, prefixing the words "Bridge" or "Culvert", as the case may be, in records and reports.

1198. The supervisor of bridges and buildings shall see that all bridges are marked with their proper numbers.

GENERAL BUILDING RULES.

1199. Buildings, wherever practicable, shall be located on the outside of curves and far

enough from road crossings to avoid obstructing the view either of trainmen or travelers on the highway or street.

1200. All work in connection with buildings shall be done in accordance with the building laws of the city or town in which the work is performed.

1201. Where local building laws do not conflict, or when there are no building regulations, the work shall be done in accordance with the railroad company's standard building specifications.

1202. Careful attention must be given to all portions of structures, including those hidden from view, such as under-support of platforms and buildings, truss rods and other members subject to corrosive action of locomotive gases, engine house smoke stacks, roof cornices, water tank hoops, etc. All platforms used by passengers or employes shall be frequently examined and any defect that might cause injury repaired promptly. See that shop roof trusses are not overloaded.

1203. Foremen in charge of work which requires scaffolding will personally inspect all material to be used in the scaffold and satisfy themselves that such material is entirely safe for use.

1204. They will personally supervise the construction of scaffolding and see that it is made safe. Also that the scaffolds are not overloaded while in service.

1205. The occupying of scaffolds by employes, or others whose duties do not require it, is prohibited.

1206. Runways or ladders must not be located under scaffolds, or at other points where tools or material are likely to fall, and where a considerable amount of work is to be done

temporary barricades must be erected to prevent persons going beneath them.

1207. Rope and tackle scaffolds which have been stored or shipped must be thoroughly tested for deterioration or injury before being used.

1208. All buildings shall be neatly painted and properly maintained, especially those used by the public. Small defects such as broken glass, locks, woodwork, etc., shall receive prompt attention. Toilet facilities shall be maintained in good order.

1209. Buildings shall be repaired before they are repainted.

1210. The date of erection and painting of all buildings shall be plainly indicated on the structure in an inconspicuous place.

1211. Bulletin boards shall be provided for time-tables, advertising notices, etc., in stations. Placards should not be placed on the walls of the building. Signs must be distinct and neatly painted.

1212. All new main line passenger and freight platforms shall be located with reference to the track in accordance with standard plans, and old platforms changed or renewed shall be brought to standard. Before constructing new, or altering old, platforms, the supervisor of bridges and buildings shall ascertain from the division engineer whether a change in elevation of track is contemplated.

1213. All new buildings and other structures shall have standard clearance, unless special authority is obtained to vary from this.

1214. On side tracks used for special purposes, such as elevators, coal chutes, etc., the demand must, to a certain extent, establish the clearance distance; but no building or other structure shall be placed nearer than the stand-

ard distance from the center of any track, and that only by special permission of the division engineer.

1215. All raised platforms other than concrete shall be enclosed beneath, preferably by vertical slats, to prevent deposits of scrap iron, paper, rubbish, etc.

1216. Ice houses shall be placed in condition not later than November, to receive the season's supply of ice.

1217. All buildings shall be inspected at least once each year by the supervisor of bridges and buildings, or the division or district bridge and building foremen, and report made on proper form, one copy to be furnished to the division supervisor and one to the general supervisor of bridges and buildings.

PAINTING.

1218. Foremen of painters will report to and receive instructions from the supervisor of bridges and buildings, or as otherwise directed. They will have charge of all painting, kalsomining, paper hanging and lettering in their respective districts.

1219. It shall be their duty to personally supervise all work and see that their men faithfully perform the duties assigned to them, discharge any one for neglect, incompetence or misconduct, and report same to the supervisor of bridges and buildings. They must exercise great care in the erection of scaffolds and know they are safe before being used.

1220. They shall have charge of all material and must see that it is safely kept and properly and economically used. They shall make requisition through the supervisor of bridges and buildings for necessary tools and

material, and must see that all tools are in good condition, and that their tool cars are clean and have a neat appearance.

1221. They shall see that all painting in their charge is done in standard colors, and in accordance with standard plans, specifications and instructions furnished, unless otherwise directed.

1222. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

1223. All buildings shall be neatly painted. Exterior painting should be started as early as possible in the spring and completed before the beginning of summer travel. The interior of buildings may be painted during the winter months. Signs must be distinct and neatly painted.

1224. New buildings must have all knots and pitch streaks covered with thin shellac before priming. After being primed, all punched nail holes are to be stopped with putty. New work is to be primed and have two coats of color.

For new work, roof shingles shall be dipped in fire-proof material and side shingles in stain, and the roof painted with fire-proof paint.

1225. Old buildings shall be repaired before they are repainted.

1226. In painting old buildings, the outside surface must be cleared of all dirt and grease by scraping or burning and using dusting brush. Inside should be washed with soap and warm water. Blisters or cracks must be removed before applying the new paint. When old buildings have been patched with new woodwork, these new portions must be primed separately and allowed to dry before a full surface coat is applied.

1227. All exposed structural steel in new bridges, buildings, etc., shall receive a full priming coat and two full coats of approved paint. All bolts and nuts shall have a white streak of paint across them to indicate any movement of the nut.

1228. Rivets driven in the field, and all parts of bridges where paint has been rubbed off, shall be well coated with priming coat before painting.

1229. In structures not new, the steel shall be cleaned of all rust and scale by means of steel scrapers, steel brushes or sand blast, before painting.

1230. The first coat shall be put on as soon after the cleaning process as practicable, and, to carry this out, the work must be done in sections and not all cleaned at one time.

1231. At least once every year, when practicable, all exposed structural steel should be carefully gone over and all signs of scaling paint and rust removed by steel brushes and steel scrapers.

The cleaned portions then to receive the same treatment as new work.

If the spots requiring cleaning are found to be so close together as to render it impracticable to repaint these without repainting the whole exposed surface, the latter should be done.

1232. Paint must dry out with a uniform gloss, must be uniform in color and of sufficient thickness to protect material.

Brushes must be clean and have such size of bristles or hair as will spread the paint or varnish uniformly.

1233. Blistering of painted surfaces is due to the following causes, which should be avoided so far as practicable.

(a) Too much oil in the paint on surfaces exposed to heat.

(b) The surface being damp when paint is applied.

(c) Too little time being allowed for one coat to harden before the next is applied, when resinous portions of the wood are not properly prepared.

Cracking is caused by using too little oil in top coat and too much in under coats.

1234. In all cases the cleaning of steel and placing of first coat of paint shall be carried on under rigid inspection.

1235. When bridges, buildings, or other structures are painted, the date showing month and year when painting was completed must be stenciled on each structure in two protected and inconspicuous places.

1236. The bottom of troughs, or deck plates of other solid floor bridges shall be protected as required by plans and specifications.

1237. The ends of ballasted solid floor bridges shall be waterproofed to prevent the roadbed drainage, either on or off the bridge, from passing down beneath the ends of the superstructure and the bridge seats.

1238. All steel which is exposed to engine gases, etc., must receive frequent and careful attention and be cleaned and painted when necessary to protect the steel from corrosion.

Where special paint or other coating can be used to advantage for protecting steel, a report should be made and proper authority requested.

1239. When dismantling old bridge superstructures, which may be used again, all parts will be marked for re-erection before dismantling. All unpainted surfaces of old bridge

material which is not to be immediately scrapped shall be coated with white lead or standard paint.

LOCOMOTIVE WATER SUPPLY.

1240. Supervisors of bridges and buildings are in charge of the locomotive water supply, and responsible for its proper maintenance. They shall see that proper inspection of and necessary repairs and renewals are made to all tanks, water columns, pipe lines, windmills, reservoirs, intake wells, etc.

1241. All tanks shall be inspected in the spring and fall by the supervisor or his representative, and a report made to the division engineer and general supervisor of bridges and buildings, showing condition of tanks, supports, hoops, etc. Reservoirs, drains, intake wells, etc., shall be inspected, cleaned and repaired as often as may be necessary to keep them in satisfactory condition for service, and report should state the approximate quantity of water stored in reservoirs or available in running streams.

1242. They shall give particular attention to the cost of water where supplied to the railroad by municipalities and see that it is properly metered.

They shall note the results obtained from the pumping machinery at the various water stations and where changes in the character of pumping plant can be made to secure greater efficiency, they shall so report and make recommendations.

1243. Foremen of locomotive water supply will report to the supervisor of bridges and buildings, or to district or other foremen, as the supervisor may direct.

1244. They shall have charge of and be responsible for the condition of all pumps, pipe lines, water columns, etc., and for repairs to same, and will be furnished such assistance as is necessary to keep these structures in satisfactory condition.

1245. Where power for pumping is furnished by gasoline or steam engines, the division master mechanic will be responsible for the maintenance of boilers and connections to a point agreed upon.

1246. Where pumps are driven by electric power the signal supervisor or a representative of the electrical department will be responsible for the maintenance of the motor and power transmission lines.

1247. Where windmills furnish power for pumping, the supervisor of bridges and buildings or district foremen will assign men to maintain them.

1248. Foremen of water supply shall keep an accurate record of the type, condition and all minor details of each pump and plant, and have a general knowledge of water supply, including the amount furnished and consumed at each plant so far as practicable.

1249. They have charge of such tools and material as are necessary for the efficient performance of their duties and must see that these are properly cared for and economically used, and that duplicates of such parts of the plant as are subject to exceptional wear or frequent breakage, are promptly available.

1250. In case of necessary repairs which they are unable to make without assistance, prompt report shall be made to the supervisor of bridges and buildings, by wire if necessary, giving full particulars as to the nature of repairs required, description of parts, etc.

They shall take every precaution to prevent failure of the plant to serve the purpose for which it is operated.

1251. Before a tank or water column is taken out of service, either temporarily or permanently, the foreman shall notify the supervisor and not proceed with work until authority is obtained. When restored to service, notify superintendent and supervisor by wire.

1252. During extremely cold weather accidents are liable to result from ice forming at water stations. Foremen on whose sections water stations are located shall see that the ice is kept below the top of rails and properly flanged out. At water stations where pumpers are regularly stationed, foremen will notify them to attend to this duty.

1253. Foremen shall report all cases of leaky tank valves to the supervisor of bridges and buildings, the district bridge and building foreman, or other foreman, and where there is danger of freezing, the pipes and pumps shall be thoroughly drained before leaving them.

1254. They must report their movements daily to the proper official, as may be directed.

1255. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

CROSSING GATES.

1256. Supervisors of bridges and buildings have charge of and are responsible for the proper maintenance of crossing gates.

Foremen in charge of the maintenance of these gates will report to and receive instructions from the supervisor or district foreman, as the supervisor may direct.

1257. They are responsible for the proper maintenance of all crossing gates and will be furnished such assistance as is necessary to maintain the gates in good working order.

1258. They shall, so far as possible, keep a sufficient supply of repair parts on hand for emergency work.

1259. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

TRACK AND OTHER SCALES.

1260. All scales shall be installed in accordance with the railroad company's standard plans or in accordance with plans approved by the engineer maintenance of way.

1261. Report of all new scales installed or scales re-located or removed should be made to the superintendent, superintendent of station service, division engineer, and general supervisor of bridges and buildings, and a statement giving full data with cost, etc., shall be made on prescribed form and sent to the general supervisor as soon as the information is available.

1262. The supervisor of bridges and buildings is responsible for the maintenance of track scales, and will assign one man on the division to make all inspections and tests, and supervise repairs to scales. When any repairs are made, scale shall be inspected and proper report made to cover.

1263. In case of any trouble which the division scale man cannot remedy, the general supervisor of bridges and buildings shall be notified and an inspector will be sent to make an examination, and report.

1264. Rails on scale and on approaches

must be kept in good alignment and surface, and the space between end of scale rail and end of track rail shall be not more than one inch or less than one-half inch.

1265. Under supervision of the division scale inspector, section foremen must frequently examine track scales to see that they are well drained, free from dirt, snow and ice, and clean out the pit when necessary.

1266. The division scale man shall make a monthly inspection of all track, wagon and dial scales; these inspections to be made on the first of each month and reports on prescribed form sent to the supervisor of bridges and buildings, who will forward report to division engineer, who will in turn report to the general manager, general supervisor of bridges and buildings and superintendent of station service.

1267. A weekly inspection of all freight house scales shall be made by the agent or some competent representative to see if scales are kept clean, in balance, and general good condition, reporting any defect to the superintendent and superintendent of station service.

1268. A test of all track scales will be made by the general supervisor of bridges and buildings semi-annually, or oftener if considered necessary, in accordance with rules of the Interstate Commerce Commission. Report on prescribed form should be sent to the general manager, engineer maintenance of way, superintendent, and superintendent of station service.

1269. The general supervisor will make such additional inspections and tests as may be considered necessary on any scale, report being forwarded in the usual manner. Any repairs which are found necessary will be

called to the attention of the division scale man.

Other tests with car of freight, or loaded push car, may be made when desired and be reported the same as regular tests.

1270. The following rules shall be posted in each track scale house or box, and division scale man will note whether they are being observed.

1271. Engines shall not run over track scales, nor shall switching be done over them.

1272. Scale switches shall at all times be set for the dead rail track unless the scale is in actual use.

1273. Engines shall not stand over track scales, nor shall sand or injectors be used while engines are passing over dead rail of scale track.

1274. Equipment shall not be allowed to stand on scales except when being weighed.

1275. The weighing beam shall be balanced before the scales are used, and when not in use shall be locked with beam catch.

1276. Beam box or house shall be kept locked when not in use.

1277. Scale beams shall be kept clean by weighmaster where such person is employed; otherwise by the division force.

1278. Weights shall not be taken while cars are in motion except on scales in hump yards and which are equipped with automatic weighing device.

1279. If ice obstructs the levers, salt shall not be used to melt it; artificial heat shall be used wherever practicable.

1280. Deck of track and wagon scales shall be cleared of ice and snow as soon as practicable after storm is over, and particular atten-

tion shall be given to scale levers to see that they are free from ice before any weighing is done.

MAINTENANCE OF SIGNALS AND INTER-LOCKING.

General.

1281. No changes in location of signals or in the locking of interlocking machines or electric circuits shall be made without the approval of the signal engineer.

(a) All installations must conform to the signal engineer's standard plans and specifications.

1282. Apparatus or material of any kind must not be placed within standard clearance lines.

1283. When any part of the signal apparatus or circuits affecting the operation of a switch, movable point frog, derail, or signal is disconnected or disarranged, the foreman or man in charge must give the signalman on duty an "Out of Service" notice in duplicate, explaining what operating units are affected.

The notice must be signed by each signalman on duty, and one copy held by foreman or man in charge.

1284. Any man permitting the possibility of a false signal indication being given in order to avoid train detention, or for any other reason, will justify his immediate dismissal.

1285. When a switch, movable point frog or derail is disconnected, it must be secured in proper position, and when possible to do so, locked with lock plunger. In addition, if power operated, motor brushes and control fuses must be removed.

(a) Switch movement motor brushes and control fuses must not be replaced while a train

is moving over a switch or route affected, and must be kept removed from switch movements connected with switches that are out of service except during the time tests are being made, or until such time as switch is again ready for service.

(b) Motor brushes and control fuses must be removed before power operated switch movements are cranked by hand.

(c) When a crossover is disconnected, both ends must be properly secured in the corresponding positions.

(d) A signal must not be operated to the position indicating Proceed, except by means regularly provided for that purpose.

(e) When a signal or any apparatus or circuits affecting the operation of same is disconnected, the signal must be secured so as to give its most restrictive indication.

(f) If a signal is removed for any purpose, the use of which has not been discontinued by bulletin, trains affected must be stopped and be governed by the most restrictive indication that the signal can give before proceeding.

1286. When interlocking apparatus is disarranged, all switches, movable point frogs and derails in the route affected must be secured in proper position. In addition, if power operated, motor brushes and control fuses must be removed, and all signals for same route secured in the most restrictive indication.

(a) Whenever possible, a competent man must be stationed on the ground to see that routes are properly lined up, and know that switches, movable point frogs or derails are secured and in proper condition for movements to be made over same.

1287. Interlocked switch points must be so adjusted that they cannot be locked when a

gauge one-eighth ($\frac{1}{8}$) of an inch in thickness is placed between stock rail and switch point six (6) inches back of point of switch, and hand thrown switches so that they cannot be locked when a gauge one-quarter ($\frac{1}{4}$) of an inch in thickness is placed in the same position.

(a) Any switch that does not meet the required adjustment must be immediately brought up to standard. If this cannot be done without the assistance of the trackmen, they shall be called upon to fasten the rail firmly, as required.

1288. The mechanical locking of interlocking machines must be tested at frequent intervals to detect any irregularities that may develop, and the result of such tests must be recorded in the signal supervisor's office.

These tests should be made as follows:

(a) Each route must be set up in accordance with the manipulation chart and all latches of levers in the reverse position, together with latches of conflicting signal levers, must be tried to determine if they are properly locked.

(b) Such additional test must be made as is necessary to determine for an absolute certainty that all conflicting routes are locked and all non-conflicting routes are free to be set up, also levers operating switches, movable point frogs and derails are locked by the lock levers.

(c) The latches of interlocking machines must also be tested to determine if there is sufficient lost motion to affect the proper operation of the machine or units controlled by same.

1289. The following tests must be made at least weekly and the results of such tests recorded in signal supervisor's office:

(a) On route locking of the front lock design, by endeavoring to reverse signal lever while each track circuit is shunted throughout the route.

(b) On route locking of the back lock design, by endeavoring to latch signal lever in normal position while each track circuit is shunted throughout the route.

(c) On back locks on semaphore signals, by endeavoring to latch signal lever normal while the blade is held at an angle of five (5) degrees from stop indication, and on back locks on light signals by disconnecting the back lock wire at the control relay, and endeavoring to latch signal lever in normal position.

(d) On approach locking, by attempting to latch signal lever normal while the track circuits are shunted throughout the approach locking section.

(e) On time releases, by insuring that they do not close the approach or route locking circuits, or both, while any of the track circuits are shunted throughout each route before the expiration of the proper time interval.

(f) On detector locking as follows:

With signal lever reversed move switch or lock levers, as the case may be, of route affected as far as lost motion will allow, after which restore signal lever to normal position; then shunt track circuits in the detector locking section of each switch. After this has been done, attempt to complete stroke of switch or lock levers.

Above test to be made on each individual route.

(g) On switch indications, by endeavoring to latch switch lever when the switch fails to lock up on a three-sixteenths (3-16) inch obstruction placed between switch points and stock rail in both normal and reverse positions.

(h) On signal controls, by insuring that signals assume stop indication when track circuits are shunted and switch points are opened three-

sixteenths (3-16) of an inch by hand operation throughout the route. The operation of distant signals must also be noted in connection with this test.

1290. All apparatus used in connection with pole changing circuits must be tested with the same relative polarity to determine if all units are assembled for proper polarities and uniformity of operation. Also, before such apparatus is put into service for governing train movements, the operation of units controlled must be carefully observed and checked to insure correct results and proper indications.

1291. Facing point lock plungers must have at least eight (8) inches of stroke and clear lock rod one (1) inch when withdrawn. The holes or notches in lock rods and the ends of plungers or locking dogs must have square edges. The holes or notches must not be more than one-sixteenth (1-16) inch larger than plunger or locking dog measured in a horizontal line.

(a) Detector bar must be placed on the high side of curves and shall be arranged to give fifty-four (54) feet continuous protection for all switches, derails and movable point frogs, and when located ahead of switch points shall lap the switch points a distance equal to stroke of bar.

(b) Detector bars, when practicable, must be connected so that the unlocking movement when switch is in the main line position, shall be in reverse direction to the facing movement of traffic over the points.

(c) Fifty-four (54) foot detector bars must be mounted on sixteen (16) rail clips, and a proportionate number of clips shall be used for longer or shorter bars.

(d) Detector bars must raise a minimum of

three-fourths ($\frac{3}{4}$) inch above top of rail at every point during the locking and unlocking of the switch, and shall rest one-fourth ($\frac{1}{4}$) inch below top of rail at every point when lever travel is completed.

(e) When practicable, center of rail clips must be placed eight (8) inches and twenty-six (26) inches respectively from end, and the remaining clips approximately three (3) feet nine (9) inches apart.

(f) Rail clips must be secured with hook bolts attached to base of rail whenever practicable, with the exception that when butt stops are used the first two motion plate clips shall be fastened with one hook and one machine bolt.

(g) When for obvious reasons hook bolts cannot be used, the rail clips must be secured by bolting through web of rail with two machine bolts.

1292. The notch in the switch bar of a bolt lock must not be more than one-eighth ($\frac{1}{8}$) inch wider than the signal bar where the bolt lock is placed on the same ties as the switch to be bolt locked, and not more than three-sixteenths (3-16) inch wider than the signal bar when the bolt lock is placed on a separate foundation.

1293. Switch circuit controllers must be adjusted to make or break circuit when switch points are not more than three-sixteenths (3-16) of an inch open.

1294. All foundations must be rigid, level and in good line. Distance from rail and elevations are to be maintained in accordance with standard plans, when practicable.

(a) The bearings of all movable parts must be kept free from grit, and, except pipe carriers, shall be properly oiled. Care shall be taken to

use sufficient oil, but without wasting. Parts shall be cleaned before being oiled. Special oil shall be used where required.

(b) Wire wheels must run free in frames, and be properly lined. They shall be replaced when broken or worn to such an extent as to affect proper operation of signals.

(c) Cotter pins of proper size must be in place in every hole provided for that purpose. They shall be in good condition, and points spread not less than 45 degrees.

1295. Signal masts must be kept vertical. No wire other than signal wire or attachments shall be placed on a signal mast.

(a) Ladders must be in good condition and properly secured to signal masts, bridges and platforms. Bases of ladders shall be secured to suitable foundations.

(b) Signal chain must be of such length and so adjusted that split links and wire eyes will not come in contact with chain wheels throughout any portion of the stroke. A split link must not be used to splice a chain, when such splice is to be placed in the groove of the wheel. The ends of split links must be closed.

(c) All signal apparatus requiring padlocks or the equivalent must not be left unlocked unless men working on same are present.

1296. Encroachments on right of way must be promptly reported to foreman and signal supervisor.

1297. Employes must provide themselves with a copy of the General Safety Rules effective March 1, 1914, and comply with same. They must also comply with Rules Governing the Maintenance of High Tension Electric Lines contained herein when occasion calls for it.

(a) When men have occasion to work in

close proximity to high tension wires they must confer with their foremen before doing so.

(b) Employes are cautioned against coming in contact with high voltage wires, either bare or covered, and must use extra care when working on wires adjacent to or liable to be crossed with high voltage wires.

(c) Dead wires are liable to accumulate an induced current of high voltage, or become crossed with live wires, and men are especially cautioned to see that such presumably dead wires are thoroughly grounded at point where work is to be done, and that they be authorized in writing by the foreman in charge to this effect before working on same.

(d) It is considered dangerous to approach wires carrying from 2200 volts up, nearer than fourteen (14) inches.

(e) Trolley, messenger, pull-off, guy, guard, feed or power wires attached to poles on catenary bridges in the electrified zones of the New York and New Haven Divisions should be considered as charged with at least 11,000 volts alternating current at all times.

(f) Foremen authorized to do grounding must provide themselves with grounding device and test set of lamps, as called for in Rules 403 and 407 of the General Safety Rules, effective March 1, 1914.

(g) Ground connections must be inspected from time to time and kept in good condition.

1298. All electric wires must be properly tagged.

1299. Roundels and lamp lenses must be kept bright and clean. Roundels or lamp lenses broken sufficiently to allow any portion to fall out shall be renewed at once.

1300. Lamps must be so placed on lamp brackets, and brackets so adjusted, as to insure

proper alignment with respect to spectacle and track, and so that spectacle casting will not be liable to strike lamp.

1301. An exposed flame must not be taken near gasolene or other volatile oil or receptacle in which it is contained, or where vapors of such oils are liable to exist.

1302. Tools provided by the Company to workmen must be kept in good condition and ready for use. Any Company tools worn or broken by ordinary use will be replaced.

(a) If tools are lost or stolen the fact must be promptly reported to the foreman, who shall notify the signal supervisor.

(b) Upon leaving the service, all tools and other property of the Company in possession of workmen must be returned.

SIGNAL SUPERVISORS.

1303. Signal supervisors will report to the division engineer on maintenance of signals and to the superintendent on operation of same.

(a) They are responsible for the safe condition and proper maintenance of all signal apparatus in their territory.

(b) They shall have charge of all forces engaged on maintenance and authorized construction assigned to them, and must see that men under their charge perform their duties properly.

(c) They must see that foremen are furnished with and follow standard plans and specifications of the signal engineer.

(d) They must know that foremen are supplied with tools and materials necessary for the efficient performance of their duties, and see that they are properly cared for.

(e) They must see that their subordinates

receive instructions as to the proper methods of maintenance, with a view to safety, efficiency and economy.

(f) They must know that foremen are provided with current time-table, rules, circulars, forms, and special instructions pertaining to their duties, and that they fully understand and comply with them.

(g) They must caution all foremen to constantly look out for the safety of their men, especially those just entering the service, and if signal foremen are unable to do this personally, appoint a man for that purpose where necessary.

(h) They must make frequent inspections of all signal apparatus and see that same is in proper working order.

(i) They must detail sufficient men at interlockings during storms to keep plant working and prevent detention to trains.

(j) They must investigate and report on accidents which may be attributed to defects in the signal apparatus.

(k) They must investigate all failures or improper working of signal apparatus and see that repairs are promptly made and a report forwarded to the superintendent giving the nature and cause of the trouble and the action taken.

(l) They must keep themselves informed in regard to all work performed in their districts by contractors or others who do not come under their charge, and see that nothing is done by them that will interfere with the safe operation of signal apparatus.

1304. They must not, except by proper authority, permit experimental trials of appliances or devices nor give out information of the results of any trial.

1305. They must see that all signal apparatus is tested frequently to determine defects or irregularities, and instruct foremen as to what and how such tests are to be made.

1306. They must be careful to have their men co-operate with the employes of all other departments.

1307. They must submit a weekly report of all signal failures to the superintendent, division engineer and signal engineer, giving the cause of failure, location, number unit failing and action taken to prevent similar failures. Such report to include all failures during the week ending Saturday at 12 midnight.

1308. They must have careful inspections made semi-annually, during April and October, of all signal apparatus under their charge and shall render duplicate report in detail to the division engineer, with copy to superintendent and to the signal engineer, on the last day of April and October.

1309. They must keep a complete file of plans for each interlocking plant and block signal installation or other signal device in their office.

1310. They must keep a book record of all keys issued for signal apparatus and a receipt taken for same. Keys must be issued only to those whose duties require their use.

1311. They must keep the division engineer and train dispatcher advised daily as to where they may be found, and probable movements.

1312. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

1313. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation or rules that comes under their notice.

SIGNAL INSPECTORS AND GENERAL FOREMEN.

1314. Signal inspectors and general foremen report to and receive instructions from the signal supervisor and have charge of such work as may be assigned to them.

(a) They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

SIGNAL FOREMEN.

1315. Signal foremen report to and receive instructions from the signal supervisor.

(a) They are responsible for the safe condition and proper maintenance of all signal apparatus under their charge.

(b) They must make frequent inspections of all signal apparatus and see that same is in proper working order, reporting any irregularities to the signal supervisor.

(c) They must select competent and intelligent men and shall instruct them in the proper execution of their work.

(d) They must see that their subordinates receive instructions as to the proper methods of maintenance with a view to safety, efficiency and economy.

(e) They must see that employes under their charge are punctual in attendance regarding hours of service and faithful in the discharge of their duties. Men who are incompetent or neglect their duties must be discharged.

(f) They must investigate and report on accidents which may be attributed to defects in the signal apparatus.

(g) They must personally investigate all important signal failures and report findings to the signal supervisor as promptly as possible.

(h) They must be responsible for the proper checking, care, and economical use of tools and material necessary for the efficient performance of their duties.

(i) They must see that there is sufficient stock on their districts for making emergency repairs.

(j) They must make daily reports in detail, of the nature of the work performed.

(k) They are responsible for the correctness of time returns and labor distributions and shall see that these are properly made out.

(l) They must render all reports in accordance with schedule furnished them by the signal supervisor.

1316. They must not, except by proper authority, permit experimental trials of appliances or devices, nor give out information of the result of any trial.

1317. They must see that all signal apparatus and circuits are tested frequently to determine defects or irregularities, and instruct maintainers as to what and how such tests are to be made.

1318. They must make a prompt report to the signal supervisor of any defective material, instruments or electric circuits, and make sure that same are immediately taken out of service if not performing their proper functions.

1319. If stock rails at switches are not to proper gauge, they shall immediately communicate with the signal supervisor and section foreman and have proper adjustments made at once.

1320. They must notify the signal supervisor by written report and take such immediate action as may be necessary, where condition of tracks and switches is such that it is impossible to properly maintain signal apparatus.

1321. They must forward signal supervisor a report on the first day of January, April, July and October, showing a complete list of all Company tools in their possession and in the possession of men working under them.

1322. They must see that their men are properly distributed over the division during snow and sleet storms, and that plants are properly looked after. In case additional force is required they shall call on the signal supervisor for same and shall also report condition of plants to the signal supervisor, advising if snow is not being properly handled and interlocking connections not properly cleaned.

1323. They must see that all signals are kept in proper adjustment, and that the lamps are kept clean and give a bright light.

1324. They must report promptly and accurately any fault of operation and any disregard of signals coming to their personal knowledge.

1325. They must see that new material delivered out on the line is neatly piled and the small parts secured from theft. All surplus must be removed.

1326. They must see that litter or refuse is not permitted to remain on the right of way.

1327. They must, at least once a month, make careful inspection of their territory from engine cab, both day and night, reporting to the signal supervisor any condition of the signal apparatus that can, in their opinion, be improved, especially regarding the location of signals or rearrangement of lights.

1328. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1329. They must observe rules for other

classes of employes, so far as they relate in any way to the proper discharge of their duties.

SIGNAL MAINTAINERS.

1330. Signal maintainers report to and receive instructions from the signal foremen.

(a) They are responsible for the safe condition and proper maintenance of all signal apparatus assigned to their care.

(b) They must personally instruct their subordinates in proper methods of maintenance, with a view to safety, efficiency and economy.

(c) They must give lampmen necessary instructions and see that they perform their work properly.

(d) They must promptly investigate any failure of signal apparatus and forward report to signal supervisor and signal foreman.

(e) They must render all reports in accordance with schedule furnished them by the signal foreman.

(f) They must make such inspections of all appliances under their charge as will insure proper operation.

(g) They must make inspections of switches at least weekly and forward report to the foreman on form prescribed.

1331. They must make frequent tests of insulated parts to determine if insulation is defective. The section foreman must be notified promptly when an insulated joint requires attention.

1332. They must in case of accident at a highway crossing protected by crossing bell or signals, promptly make careful inspection of all apparatus in connection with bell or signals, obtain all information available relative to the accident, and report at once to signal supervisor and signal foreman.

1333. They must go on the ground immediately upon receipt of notice of wreck in which signal apparatus may be concerned, and wire supervisor and foreman the particulars, giving list of material required for immediate repairs. In case the accident was caused, or is alleged to have been caused, by any defect in the signal apparatus, a thorough examination must be made before any of the apparatus is disconnected; also, record of position of levers made, and a written statement of the conditions found must be sent to the signal supervisor and foreman.

1334. They must not take any apparatus out of service without proper authority, except in case of emergency. Should any emergency arise, the foreman must be notified immediately.

1335. They must not make alterations or additions to locking of interlocking machines, electric circuits, or any other part of the signal apparatus without authority from the foreman.

1336. They must not allow the case of a block instrument or electric lock to be left off unless they are present, except when changes are being made by authorized persons.

1337. They must see that proper drainage is provided, also that ballast, cinders, etc., are kept not less than one inch away from base of rail where track circuits are in use.

(a) They must see that ballast, dirt and cinders are kept at least two inches clear of interlocking connections.

1338. They must see that the surroundings of all block and interlocking stations are kept neat and clean and shall report promptly to the foreman when such work as should be done by other employes is neglected.

1339. They must be responsible for the proper checking, care and economical use of

tools and material necessary for the efficient performance of their duties and shall keep same neatly stored in a place provided for the purpose, making requisition to the foreman from time to time as additional supplies become necessary.

1340. They must co-operate with track forces in joint track and signal work, to see that signal apparatus is maintained in proper condition and in case of storm, if not enough men are on duty, notify signal foreman promptly.

1341. They must report promptly any fault of operation and any disregard of signals coming to their knowledge. They must keep wires of electric circuits properly tagged.

1342. They must inspect and test signal apparatus and circuits frequently to determine defects or irregularities and insure proper operation at all times.

1343. They must keep the contacts of electrical instruments clean and in perfect adjustment. Sealed instruments requiring attention or adjustment must be replaced. Instruments removed must be forwarded to signal shop for repairs.

1344. They must handle relays, track transformers and other electrical apparatus of a portable nature that is in service in a careful manner to avoid broken circuit connections and consequent failures. Such apparatus should not be moved any more frequently than is absolutely necessary.

1345. They must carry relays or similar electrical apparatus in such a manner as will not put the weight of the instrument on the binding posts, as the binding posts are not designed to withstand such a strain, and it is likely to result

in the breaking down of the binding post insulations

1346. They must check very carefully the adjustment of all circuit controllers, such as switch, signal and interlocking machine controllers.

1347. They must not allow relays or other electrical apparatus subject to grounds from moisture, to become exposed to stormy weather.

1348. They must exercise care in making terminal eyes to avoid any unnecessary bending, kinking, wringing or nicking, so that wire will not be weakened and easily broken.

1349. They must replace any wire which is damaged to the extent that it is likely to separate and result in failures.

1350. They must be on the lookout for irregularities at all times, particularly inefficient apparatus; even though apparatus is brand new, do not take for granted that same is in perfect working condition.

1351. They must check very carefully the adjustment of track circuits.

1352. They must use extreme care in connecting circuits to energy and must ascertain for a certainty that the instrument on the circuit is not designed to be operated on a lower voltage than that which will be impressed on it when the circuit is connected to energy. The above applies particularly to the low voltage light circuits, and the track winding of track relays.

1353. They must test all fuses thoroughly before putting them into service.

1354. They must use extreme care in disconnecting impedance bonds that are in service, and thereby creating an unbalanced impedance across the track circuit.

1355. They must never allow all the multiple

paths for the propulsion return circuits in a track circuit section to be open at the same time.

1356. They must not allow small tools or metal parts to lie around where same are liable to fall on wire terminals or the connecting posts of electrical instruments and cause short circuits.

1357. They must pass the examination required as to character, habits, education, ability and record of previous service. Also every three years for color perception, strength of vision and hearing.

1358. They must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1359. They must observe rules for other classes of employes so far as they relate in any way to the proper discharge of their duties.

LINE FOREMEN.

1360. Line foremen shall be responsible for the safe condition and maintenance of all wires, cable, pole lines and any other work assigned to their care. They must make frequent inspections with a view of discovering and correcting any defects in lines, or surrounding conditions that might cause trouble. They must carefully inspect all wires or cables passing over tracks, and see that they are kept in good condition, and that poles supporting them are sufficiently strong. They must see that all overhead wires or cables are kept at least 25 feet above top of rail, where they cross tracks, and at least 18 feet over public highway and 14 feet over private crossings.

1361. In working on a pole they must know that the men working with them are properly instructed and shall be careful not to subject themselves or their men to possible injury by the action of inexperienced or unauthorized persons.

1362. Line foremen must, so far as they are familiar with the instructions issued for the government of trains, report any neglect of duty or violation of rules that comes under their notice.

1363. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

BATTERYMEN.

1364. Battery men will report to and receive instructions from the signal maintainer. They must keep battery wells and lockers clean and also locked. Refuse material shall not be left around batteries.

1365. In cleaning or renewing batteries, jars and other battery material shall not be placed on battery boxes, trunking or other signal apparatus.

1366. Batteries must be kept at an even temperature, as nearly as possible, and protected from extreme heat and cold. The jars shall be kept clean and bright and free from creeping salts.

1367. Battery men must collect at headquarters all scrapped copper and other material. Material that is of value shall not be thrown away.

1368. Jumpers must be used when removing cells connected in series to avoid opening a normally closed circuit.

1369. When renewing track battery a sufficient number of cells shall be kept in service to work the relay at all times.

1370. In the maintenance of batteries, they must follow closely the special instructions issued by the signal supervisor.

1371. Old battery solution must be buried on the right of way and at sufficient distance from the roadbed, streams or places where solution would come in contact with pipes or wires on top of or buried in the ground.

1372. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

SWITCH AND SIGNAL LAMPS.

1373. Switch lamps, except the long time burning type, must be thoroughly cleaned and filled with oil each day. A supply of clean waste must be kept on hand for this purpose. Lamps must be lighted each day before sunset and not put out until after sunrise. On foggy and cloudy days they must be lighted earlier and kept burning later, if necessary. Care must be taken not to waste oil.

1374. When long time burning fonts are used, foremen must see that instructions issued covering their use are carried out.

1375. Section foremen will be responsible for the proper condition of switch lamps on their sections.

1376. When lamps are placed on switches lampmen must see that wick is at proper height to give the best possible light and does not smoke. Wicks should not be trimmed by cutting but by rubbing with a small stick or the finger and removing the crust.

1377. Do not entirely fill the oil cup. Leave a space of about one-half inch at the top unfilled, to provide an air space for expansion of the oil when lamp is lighted. Do not put greasy hands on switch targets.

1378. Do not handle the lamps roughly nor alter them in any way. Lamps needing repairs and those not giving satisfaction should be reported promptly to the supervisor.

1379. Empty oil cup at least twice a month and thoroughly clean. Refill with a fresh supply of pure, clean oil.

1380. New or repaired switch lamps must be tested before being used, to see that the lamp cannot be put on stand in the wrong position.

1381. Special attention must be given the lenses to keep them clean.

1382. If burners become foul they can be cleaned by dipping in boiling water, or boiling in an alkali solution, if necessary.

1383. All lanterns in service must be kept trimmed and filled with oil ready for immediate service.

1384. The tops of oil cans must always be kept on, to exclude dust and dirt.

1385. The wick must always be long enough to touch the bottom of the font and must fit the burner properly.

1386. Long time burning lamps must be trimmed as often as necessary. Remove burner from oil font and cut wick square, one-sixteenth inch above the top of burner. When lighted the flame should be about three-quarters of an inch high. If wick is too high it will smoke within 20 minutes. After the first lighting the wick will probably not require cutting oftener than once a month, but the crust should be brushed from end of wick with the finger

when re-trimming lamps. If the wick becomes pointed or irregular it should be cut square.

1387. Change the wicks in long time burning lamps every two months, and oftener if dirty. Wicks should be raised one-sixteenth of an inch above top of burner before lighting.

1388. Leave a space of three-quarters of an inch in font unfilled to allow oil to expand when lamp is lighted.

1389. Avoid opening lamps in daylight to see if they are burning. Look through the lens.

1390. Lamps must fit on switch stands properly, otherwise light may jar out.

LAMPMEN.

1391. Lampmen will report to and receive instructions from the signal foreman, unless otherwise instructed. They must be particularly careful when placing lamp on bracket to insure that it is in proper position and that the lamp or lamp handle will not come in contact with the signal casting.

1392. They must see that all lamps are lighted and placed in their proper positions before sunset and must not remove them until after sunrise. In dark or stormy weather they must be kept burning until the weather is again clear. Long time burning oil fonts can remain burning continually, except when receiving attention.

1393. When putting signal lamps in place on mast, the colored glass in spectacle casting must be wiped clean. After placing lamps, they shall be inspected from a distance to see that they show the proper light.

1394. Lamps equipped with one-day burners must be cleaned, filled and wicks trimmed

daily. Lamps equipped with long time burners shall be inspected, hard crust removed from the wick and flame properly adjusted as often as necessary to insure satisfactory results.

1395. Oil burning lamps must not be filled on signal poles.

1396. A space of one-half inch must be left unfilled in fonts for expansion and ventilation.

1397. Lamp fonts must be drained at least monthly and refilled with fresh oil.

1398. Lamp fonts must be kept clean, soot or dirt removed and all vents kept open, so that draft will not be impaired. Lenses shall be kept bright and clean.

1399. Burners must be kept clean and to this end may be boiled in an alkali solution. Air vents shall be kept open. Defective burners shall be inspected by the foreman before being scrapped.

1400. Wicks must be of sufficient length to reach the bottom of fonts and fit burner properly. They shall be changed every 60 days, or more frequently if necessary.

1401. Standard illuminating oil as specified by the Company shall be used in all signal lamps and lanterns. No attempt shall be made to improve the quality of oil by adding other oils; if unsatisfactory prompt report shall be made to foreman.

1402. Lampmen must keep signal or interlocking station windows and machinery neat and clean.

1403. They must see that no oily waste or old papers are kept around the signal or interlocking station, where a fire might occur from spontaneous combustion.

1404. They must keep the entire property in the immediate vicinity of signal or signal stations neat and free from rubbish.

1405. They must take care of tower heaters and remove ashes.

1406. They must co-operate with the section men in keeping the movable parts of interlocking free from snow and ice.

1407. In performance of their duties they must make careful inspection of the signal apparatus and if any defect is discovered, they must make prompt report to maintainer and see that traffic is properly protected until the defect is corrected.

1408. They must observe rules for other classes of employes, so far as they relate in any way to the proper discharge of their duties.

MAINTENANCE OF HIGH TENSION ELECTRIC LINES AND TROLLEY CONSTRUCTION.

1409. The organization for maintenance of electric power conductors in connection with overhead main track construction and operation, is as follows:

Emergency repairmen, reporting to their foremen.

Foremen, reporting to general foremen.

General foremen, reporting to supervisor of high tension lines, who in turn reports to the electrical superintendent.

On the maintenance of branch line construction and equipment, foremen report to the division signal supervisor, or as may be otherwise directed.

1410. Foremen are responsible for the safe condition and proper maintenance in accordance with standard plans, specifications, or special instructions, of all line structures and apparatus assigned to their care.

1411. They are subject to call at all times,

and must live where they can quickly respond in case of emergency. They shall keep telegraph or telephone office advised of their movements.

1412. They must have copies of the current time-table and be familiar with the rules and regulations therein. They must observe signals displayed by all trains and assure themselves before obstructing track, that all trains and sections due have passed, and that proper Stop signals are displayed in accordance with the rules.

1413. They must make inspections as required, of line apparatus assigned to their care, to insure that it is in proper working order, reporting any defects to the proper official.

1414. In case of damage to trolley lines or conductors, they must promptly assemble forces, tools and material and make repairs.

1415. They shall do no work that will interfere with the safe passage of trains except under proper flag protection.

1416. Except in case of emergency, they will not renew trolley wires or other attachments, or do any work on the main track that will interfere with the passage of trains without first notifying the chief train dispatcher. In any case where trolley wires, poles or other equipment is unsafe for the maximum speed of trains, foremen must display Stop signals in accordance with the rules.

1417. During heavy sleet storms, whether by day or night, whereby the trolley lines or any portion of the equipment becomes liable to damage, foremen and forces must be on duty and cover their lines, making sure that everything is safe.

1418. On high tension lines carrying 7500 volts or over, a foreman shall have direct su-

pervision of not exceeding eight men, unless otherwise directed. This in order that he may observe their movements and properly protect them.

Where a greater number than eight are to be employed at one point, they should be divided, and each gang of eight provided with a foreman, reporting to a general foreman.

1419. Bonding foremen report to and receive instructions from the division engineer. They will have such assistant foremen and other forces as may be authorized. Bonds shall be installed and maintained in accordance with standard plans and specifications or special instructions. The inspection of bonds shall be made in such manner and frequency as may be required by special instructions, to be issued.

1420. Section foremen shall notify the bonding foremen or signal supervisor, as the case may be, when changes are to be made in rails, switches or frogs, so that necessary bonding may be done without delay.

1421. Motor, hand or push cars must not be operated on the main tracks except under proper flag protection, as provided by the rules.

1422. Foremen of electricians, in charge of electric lighting, etc., report to and receive instructions from the division signal supervisor, or as may be otherwise directed, and shall be governed by the rules for other employes in the electrical department so far as they apply.

1423. When practicable, safety belts should be used by linemen in the pursuance of their work.

1424. Foremen must take every precaution against fires and see that rules relative to fire prevention are obeyed.

1425. They must report at once by telegraph on prescribed form all accidents or personal injury, however slight, to themselves or men, and follow this with a written report to the proper official.

1426. All employes should make themselves familiar with the "Rules of Resuscitation from Electric Shock," adopted by the National Electric Light Association, to be found on another page of this book.

1427. Each line foreman shall keep a list of names and addresses of those physicians who are to be called upon in emergencies.

1428. Foremen, linemen, assistants and groundmen, in removal or repair work, shall study and strictly observe the "Rules for Employes in Power Plants, Shops and Maintenance of Electric Lines and Equipment", effective March 1st, 1914, also the following supplementary detailed instructions:

1429. Test Poles Before Climbing:

Before climbing poles, ladders, scaffolds, or other elevated structures, first assure yourself that the pole, ladder, scaffold, tree, crossarm, messenger wire, cable car or boatswain's chair, or other elevated support, is strong enough to safely sustain your weight.

Poles must be tested for decay near the ground line with a bar, screw-driver, or other tool, and sounded for decay at the center by rapping with a heavy tool or block of wood.

When poles or crossarms are apparently unsafe from decay or unequal strains of wires on them, they must be properly braced and guyed, if necessary, before climbing.

1430. Use Pole Steps:

Where poles are stepped, make use of such steps in climbing.

Do not support yourself by pins, brackets, crossarm braces, or conductor wires.

1431. Care About Live Parts:

Do not go among any wires until you know their voltage.

Leaning over and crowding through wires should be avoided. Place yourself so that you will not fall on wires should an accident occur.

Do not depend on the insulation of wires, and treat all lines as alive unless they have been properly killed (except signal lines known to be clear).

Treat also as alive, all wires (unless thoroughly grounded) which are being strung near supply lines; regard them as being of the same voltage as the supply lines.

Avoid use of hand lines or measuring tapes containing metal strands.

In handling switches or fuses use only suitable insulating handles, rods or tongs.

1432. When Touching Live Parts:

When working on live equipment or lines, never allow any portion of the body to come in contact with any live or grounded part, other than that worked on.

While touching supply lines or equipment, avoid touching ground wires, span wires, metal pipes, metal sheaths, signal lines or equipment, transformer cases, hangers and other metal fixtures on poles, or metal poles. (Signal lines are included because of their liability to become grounded.)

While touching signal lines or equipment, metal sheaths, metal pipes, ground wires, or metal fixtures on poles, avoid touching supply lines or equipment, guy or span wires.

1433. Protecting Traffic:

When working overhead, keep tools and materials not in use in proper receptacles; tools or

materials must not be thrown to or from the man on the pole, but should be raised or lowered by means of a hand line, in proper receptacle.

Workmen must not stand where they can be struck by materials dropped by men working overhead.

Pole holes and obstructions shall be protected by watchmen or suitable guards and danger signals or lights in a location conspicuous to traffic.

When working overhead, or hoisting or lowering materials above spaces where traffic occurs, a man must be stationed to warn passers-by.

Where traffic is light, warning signs may be used in lieu of watchmen. Where traffic is congested, it may be necessary to rope off the space.

1434. Stringing Lines:

Never string wires near live lines except by means of suitable insulating hand lines or other appliances.

Wires should not be strung above live lines operating at over 750 volts, unless the wires being strung are effectively grounded and all the precautions for approaching those live parts are observed and the spacing provided in Rules 1435 and 1436 are maintained.

1435. Voltages Between 750 and 7500:

No employe shall come or bring any conducting object within six inches of any exposed live part whose voltage exceeds 750 in stations, testing rooms, in underground construction, or in overhead construction, except as follows:

(a) In dry locations this distance may be less than six inches if approved insulating or

grounded metal devices are placed between the person and the part or object.

Insulating devices might be shields, covers, or gloves. Grounded devices might include metal barriers, switch cases, etc.

The distance may also be reduced if approved insulating barriers (such as mats, stools or platforms, as well as shields or other approved barriers) are placed between the person and the ground, as well as between the person and all other conducting surfaces which he could accidentally touch at the same time.

(b) In all damp or dark locations, also, where grounded surfaces are exposed (unless grounded metal barrier devices are employed), the distance may be less than six inches if insulating devices are used both between the person and the live parts and between him and all other conducting surfaces.

Where safe distance cannot be secured by use of the special insulating tools and appliances furnished, properly tested insulating gloves and sleeves may serve as portable insulating devices between the person and live parts.

Care must be exercised in using insulating gloves to avoid puncturing them on sharp edges, especially in making wire splices.

1436. Voltage Above 7500:

No employe shall come or bring any conducting object within the distances named below, from any exposed live part at or above the voltage specified, except as permitted by (a) below.

Operating Voltage	Distance (feet)
7,500	1
13,000	2

(a) In dry locations these distances may be reduced, if approved insulating or grounded

metal guards or barriers are placed between the person and such part or object.

The enclosing case of a transformer, oil switch or other equipment is such a guard.

(b) If the part is being directly worked on, the tools or other mechanical appliances used must provide the full distance of insulating material unless protective guards are also used between the person and the live part. These protective guards may be discs of insulating material on the handles of rods or tools which are suitable for the voltages to be handled.

1437. Working Alone:

Except in extreme emergencies, no employe shall work alone near exposed live parts of equipment and lines where Rules 1435 and 1436 cannot be observed, or where work is done on live lines above 750 volts in wet weather or at night.

1438. Report Defects:

Report promptly to your immediate superior any dangerous condition observed arising from defective insulators, pins, crossarms, sagging wires, etc.

TELEGRAPH LINES.

1439. Section foremen shall keep themselves informed regarding the condition of the lines of poles and wires of the railroad company, and those of other companies on their sections, and in case of interruption, dangerous defects or breaks, shall promptly notify the track supervisor; also the nearest available lineman.

1440. In going over their sections, foremen shall note the general condition of telegraph and telephone lines, especially during and after heavy wind, sleet or snow storms, to see that

the poles are in proper position, that the wires remain upon the insulators and are free from contact with each other or with trees or other objects, and promptly report, by wire, all defects in their condition to the track supervisor and superintendent. Where poles have fallen, they shall be propped up to prevent wires coming in contact with the ground, or with each other. Any variation from the standard clearance of all overhead wires shall be promptly noted and reported to the proper officer.

1441. The telegraph and telephone service is important and must not be interrupted. It is the duty of all employes handling derricks or pile drivers, or work that is liable to interfere with the wires, to use every precaution to prevent damage to them. Contractors and others engaged in blasting or other work on the right of way must be prevented from damaging wire lines. Wires found broken or on the ground, crossed, or in any way obstructed, must be promptly reported by wire to the track supervisor and superintendent.

1442. In emergency cases section foremen must render prompt and willing assistance when called upon by linemen. At other times they should have instructions from the supervisor. They will be informed of the location of the division wire on the poles or crossarms on their sections, and if involved in any trouble, it must be given preference in clearing the lines.

1443. Section foremen shall prevent unauthorized persons not employes of the Company from stringing wires of any description, except at highways, over the track or along the right of way. They must also take measurements of the height of existing wires crossing

all tracks, and report to the track supervisor any such wires which are less than 25 feet above the top of rail, under the most unfavorable conditions of temperature or loading. When wires are to be strung over the tracks at highway crossings, by outside parties, the matter must be promptly reported, so that any action necessary may be taken to insure proper clearance.

1444. The measuring of clearance heights of electric power wires by means of a tape, cord, pole or any other direct measuring device, is forbidden; this information must be obtained by an engineer.

1445. All trees liable to fall on telegraph, telephone or other lines, shall be cut down. If not on the Company's property the owner of such trees must be consulted, and if objections are raised the facts must be reported and instructions requested.

1446. In construction and renewals all telegraph and telephone poles, where the width of right of way will permit, must be placed a sufficient distance from the track so that in case of falling they will not reach it.

Section foremen must report any variation from this rule.

FOREIGN TRANSMISSION LINES.

1447. Foreign companies making application for permission to cross or occupy the railroad right of way, with transmission lines, will be required to furnish complete information on the prescribed form, explaining in detail what is proposed, to determine whether it is in accordance with the Company's standards and specifications.

After this information has been submitted

to the proper authority, the arrangement approved, and an agreement executed when required, the line may be constructed. When the work has been completed a report shall be made to the engineer maintenance of way, so that arrangements may be made for an inspection by a representative of the railroad company.

1448. All employes of the maintenance of way department, in electrified territory, are cautioned against coming in contact with high tension power wires of overhead construction. No employe, other than a qualified electrician should attempt any work within two feet of these wires.

INSPECTION OF POSTS AND POLES ON RIGHT OF WAY.

1449. Poles supporting bridge guards shall be inspected twice a year by the district bridge and building foremen, or their representatives, in connection with the regular spring and fall inspection of bridges. Any defective poles found that are not considered amply safe for six months additional service, shall be replaced at once with sound poles.

1450. Sign posts and other similar posts on the right of way, belonging to the railroad company or to foreign corporations or individuals, shall be inspected at least once a year, preferably in October, by the section foremen. Any posts found sufficiently defective to require renewal within a year must be promptly reported to the track supervisor, who will arrange, as may be necessary, with the supervisor of bridges and buildings, for replacement of posts belonging to the railroad company, and forward reports of defective poles belonging to

outside parties to the division engineer for necessary attention.

1451. Telegraph and telephone poles on the right of way, belonging to the railroad company, shall be inspected in April and October of each year, by regular inspectors employed by, and reporting to the superintendent of telegraph.

1452. Telegraph and telephone poles on the right of way, belonging to foreign corporations or individuals, and especially those so located that they would obstruct the track in case of failure, should be inspected at least once a year by the owners, and oftener if necessary to insure safety.

Section foremen shall note the date that inspections are made, and if in their judgment proper attention is not given to the matter, report shall be made to the track supervisor, stating the conditions fully.

1453. Each inspector, while at work, should have two laborers to assist him, one to clean out around the poles in advance of the inspection, and the other to fill in and clean up after it has been completed.

1454. The tools generally preferred and used by inspectors are a small hatchet, small auger and prod.

A satisfactory prod is made from an octagonal steel bar, $\frac{5}{8}$ inch in diameter and 48 inches long, with chisel 2 inches long on one end, and point $2\frac{1}{2}$ inches long on the other.

In city work, where poles are surrounded by pavement, a prod is generally used, as it is impracticable to use a hatchet.

1455. The minimum circumference of sound wood is likely to be from two to six inches below the ground line. To determine the amount

of sound wood it will generally be necessary to remove the decayed wood.

This should be done with a hatchet all around the pole at the proper level, care being taken in this operation not to remove any sound wood. Measurements should be made with a tape provided for the purpose, care being taken that it is straight and that no dead wood or other obstacles prevent a close determination of the circumference of sound wood.

1456. Every pole should be sounded near the ground line by means of a hatchet in at least four places, evenly spaced around the pole to determine whether it may be hollow or not. If the pole is hollow, by carefully sounding with the hatchet, the place where the shell is thinnest may be located. The pole should be sounded from the ground line to a point four or five feet above the ground.

1457. The thickness of shell may be determined by a test boring made with a hand auger provided for the purpose, by noting when the auger breaks through the inner surface of the shell and also by observing the character of the chips brought out by the auger or by inserting a wire or prod into the hole bored.

Where the auger is used on a pole that does not require replacement, the hole must be carefully plugged with dowels provided for the purpose.

1458. Many poles have at the level where the general decay is greatest, "exposed pockets" extending into the pole for a greater or lesser depth. These pockets may be of such shapes and dimensions as seriously to weaken the pole, and must be carefully examined to determine whether renewal is necessary.

1459. Guy stubs and pole braces shall be

recommended for replacement for the same reasons as poles.

Specifications and detailed instructions will be furnished for the guidance of inspectors in deciding what poles should be recommended for replacement, and all such poles shall be reported on prescribed form.

USE OF TELEGRAPH.

1460. The telegraph wires are to be used in case of emergency only, or when delay would involve a loss to the Company. Telegraphing for material can usually be avoided if foremen will keep informed as to what material will be needed and ask for same by letter.

1461. Messages or orders relative to the condition of track, roadbed or structures, must be in writing.

1462. Messages referring to the personal affairs or comfort of employes are not to be offered for transmission on the railroad wires, except in case of accident or sickness.

1463. The heads of sub-departments, foremen and others, who are liable to be summoned by telegraph, must leave their addresses with the operator at their headquarters. They shall keep a record of the addresses, telephone and telegraph calls of all the men under their charge, so that they can be promptly called in case of emergency.

1464. Telegrams must be as brief as possible, consistent with clear understanding.

FIRE PROTECTION.

1465. In case of fire on or near the right of way, every effort must be made to extinguish it. Reports must be made promptly, giving

origin, nature and extent of damage caused, locality and name of owner of the property. If inflammable property is placed near right of way, the attention of track supervisor should be called to it and an effort made by foreman to induce the owner to move it.

1466. When necessary, the sod must be removed from around the base of trestles, sign and mile posts, telegraph poles and other wooden structures, also from around piles of ties, timber or piling, so that the grass, when dry, may not carry the fire to them. All combustible matter such as paper, waste, brush, driftwood, etc., must be kept away from all bridges, trestles, culverts, cattle guards or other structures. No grass or weeds shall be allowed to grow within five feet of wooden bridges, or trestles. Fire buckets, barrels and other appliances must be kept in proper place and order.

Special care must be taken to prevent the destruction of creosoted material by fire.

1467. The grass, weeds and brush on right of way must be burned as early in the season as possible and the right of way kept clear of all rubbish. When burning right of way, special care must be exercised to prevent fire from extending to fences, telegraph poles and adjoining property.

1468. Old material and rubbish must be burned at a safe distance from track, bridges and other structures, and the fires watched to prevent them from spreading to adjoining fences and property. Every effort must be made to extinguish accidental fires on right of way or adjoining property, and when such fires are known to be started from engines or when engines are seen to throw fire from their stacks,

a report shall be made promptly to the track supervisor, giving number of engine.

1469. When trackmen are aware of, or are notified of, fires on the right of way or adjacent property, they must proceed at once to extinguish them and shall fully investigate the cause and amount of damage, reporting promptly to the supervisor on prescribed form.

1470. At proper season, or when fields adjoining right of way require protection from fire, there shall be plowed, shovel-cut or burned, fire guards to protect such property and prevent fire from escaping from right of way. Farmers should be induced, when possible, to plow furrows parallel to right of way where growing crops are endangered.

1471. A clean strip of gravel, sand, or screenings should be kept around all tool houses and other small buildings.

1472. Every precaution must be taken to prevent loss or damage to buildings by fire. Instructions of the insurance inspector must be immediately obeyed; rubbish, oily waste, rags, straw, waste paper, or other combustible material, must not be allowed to accumulate in or about cars, offices, stations, or other buildings of the company. Matches, oil and lamps must be kept separate and in secure places. Electric wires, chimneys, stove pipes, stoves and steam pipes must be kept safe, and must be examined frequently. All fire protection appliances must be inspected at frequent intervals and kept in good condition.

1473. The heating and lighting facilities in all Company buildings occupied by outside parties must be frequently inspected to make sure that they are in accordance with the Company's standards and in good condition.

1474. When repairs are made to stations

and platforms, no shavings, rubbish or other combustible material shall be left under the floors or platforms, but the space must be cleared of everything that might cause a fire to start.

1475. When passing over a bridge or trestle, a lookout must be kept for sparks which may have fallen from ash pans of engines.

1476. Water barrels, of at least 45 gallons capacity, shall be placed at all wooden railroad bridges, and at all steel bridges with wood decks 50 feet long and over. On bridges 50 feet to 100 feet long, place one barrel in center. On longer bridges place one barrel 50 feet from each end, and additional barrels about 100 feet apart. Barrels shall be secured to platform outside of outer guard rail.

If found necessary to place barrels at the ends of bridges, they shall be set in the ground to within six inches of the top, about 12 feet from end of structure.

Barrels shall also be placed in the ground at the bottom of wooden trestles 20 feet high or over, when there is no stream or other body of water adjacent, spaced at intervals of 100 feet.

Inside of each barrel shall be placed a bucket of about four gallons capacity, the bottom of which shall have two small holes punched in it, to prevent its use for other purposes. All barrels shall be provided with covers, and painted on the outside.

1477. They shall see that water barrel rests at all bridges and trestles, at shops and other buildings occupied by their men, are in repair and supplied with barrels and buckets. Section foremen must keep barrels at section houses, and at other roadway department buildings, bridges and outlying stations where no

agent is employed, filled with water at all times.

1478. The observance of rules for prevention of fire, as set forth in notices displayed, and otherwise, is required, and all employes must be familiar with them. Where fire by-laws exist, they must be strictly observed.

1479. All employes in an official capacity should have a general knowledge of railroad laws governing in their territory. Supervisors will, when necessary, provide foremen with copy of special state laws governing forest fires.

EXPLOSIVES.

1480. Danger signs shall be conspicuously placed on all buildings and magazines in which explosives are stored.

1481. The supervisor must be familiar with the State and Federal Laws and Municipal Regulations governing the storage and transportation of explosives and must see that they are obeyed and that a printed abstract of the law is posted at every point where explosives are stored.

1482. Dynamite, powder and other explosives shall be stored in fireproof magazines, located at a safe distance from the company's buildings and the buildings and property of others, in accordance with law, and where they are not liable to be interfered with.

Only sufficient supplies shall be kept in the magazines for the requirements, to be removed in small quantities daily, as needed.

Fuses and caps must not in any case be stored in the same building with explosives.

Gasoline shall be stored where it will not endanger life or property.

1483. On sections where small quantities of explosives are kept for local use, they must be stored where an explosion would not endanger life or property, and where they are not liable to be disturbed by unauthorized persons.

1484. Dynamite and other explosives must not be thawed out or used by any but experienced men, and only with the greatest care, preferably in a room heated with steam pipes in which the temperature does not exceed 50 degrees Fahrenheit, and ample time must be given. Small quantities may be thawed by burying it in fresh manure, taking care to avoid contact with it. The water shall be heated over a distant fire and shall not be allowed to come in contact with the explosive. When dynamite cartridges become wet they are dangerous and shall be carefully cleaned before using them.

PUBLIC IMPROVEMENTS.

1485. It is desirable that the railroad company be promptly informed regarding all contemplated public improvements that would in any way affect its property. All supervisors, foremen and other employes should watch for notices of proposed improvements and make prompt report of same.

TIME RETURNS, PAYROLLS AND DISTRIBUTION.

1486. Time returns on prescribed form will be made out by each foreman or other employe in charge of men, certified to and forwarded promptly each week to the official to whom he reports. Time books and time returns shall

contain complete distribution according to directions given therein.

1487. The official receiving the time returns shall prepare the payroll.

1488. Payrolls of track supervisor, supervisor of bridges and buildings and signal supervisor and their forces will be made up from time books in their respective offices, shall be certified to by these officials and forwarded to the division engineer.

The rolls shall be approved by the division engineer and division superintendent and forwarded to the auditor.

1489. Payrolls of division engineer's assistants will be made up in the office of the division engineer from time returns, and shall be sent to the division superintendent who will approve and forward to the auditor.

1490. All rolls shall be numbered consecutively by the person who prepares them. In case they are consolidated by the person to whom they are sent, he shall give them another series of consecutive numbers.

1491. The distribution to the proper accounts of all work done shall be clearly shown on the time returns by the foreman returning the time. This distribution shall be drawn off in the office where the payrolls are prepared, the original being forwarded to the auditor, with copy to the engineer maintenance of way, through the division superintendent. The established distribution for maintenance of way and structures is as found in Classification of Operating Expenses as prescribed by the Interstate Commerce Commission.

DISCHARGE CERTIFICATES.

1492. Employes leaving the service of the Company shall be paid in full at time of leaving or as soon thereafter as practicable.

For this purpose, foreman should give employes order for discharge certificate (Form U-I), also identification slip (Form H-85). Upon presentation of this discharge certificate, Form T-50 will be issued or procured by track supervisor, supervisor of bridges and buildings or signal supervisor.

1493. If more convenient, the order for discharge certificate may be sent by letter or telegraph and the discharge certificate sent to an official of the Company for delivery upon proper identification.

1494. When an employe has been paid by a discharge certificate (which will only be issued to men leaving the service), his name will appear on the time returns and payroll in the usual manner with the notation "Certificate given". Parties issuing discharge certificates will be held responsible for the correctness and for the proper notation being made on time returns and payrolls. Any over-payment will be charged to them. Before time returns and payrolls are forwarded, the discharge certificate sheets should be carefully checked with same.

1495. Care should be exercised to see that the week in which service is performed is always correctly stated. If certificate be given for omitted time in one week to appear on payrolls for another week, note the fact prominently, in red ink, on the face of the check.

DEDUCTION FROM PAYROLLS.

1496. Deductions from the pay of employes will not be made on payrolls; and board orders, etc., will not be honored and should be declined, as the company will not do a collecting business for the public.

1497. When a service of garnishment or attachment is made on an employe of the Company, he should at once notify his immediate superiors, giving full information. The Treasurer, engineer maintenance of way and claims attorney should be notified at once by telegraph, the nature of the case, amount of the attachment, names of plaintiff and defendant, and occupation and location of the latter being stated. Papers served shall be forwarded by first train mail to the claims attorney for district in which the action is brought.

REPORTS.

1498. All reports now required, or that may be required, including those relating to accidents, personal injuries, broken rails, derailments, unsafe conditions, damage to property, fire losses, stock killed or injured, disregard of signals, work trains, tools and materials received, on hand, or used, time returns, accounting, work done, inspections, Public Service Commissions, daily movements of officials, and all others called for, shall be rendered promptly on the prescribed forms.

ACCIDENTS TO TRAINS.

1499. Section men must respond at all times, day or night, to calls from conductors or enginemen of trains in distress. In case of

an accident, wreck or other emergency, they must at once render all assistance in their power, whether the accident occurs on their own or a neighboring section, obeying the instructions of the conductor or officer in charge. Until the arrival of the track supervisor, or higher official, the section foreman on whose section the accident occurs will have charge of the assembled section forces.

1500. In case of serious accidents, requiring a collection of forces and material, foremen must immediately report by wire, in full, to the track supervisor, division engineer and superintendent, giving statement of material required to make repairs.

1501. When called upon, in case of accident, work trains will give such assistance as required by superintendent, and everything must be done to facilitate the quick and safe movement of trains.

1502. In case of a wreck, the section foreman shall, when necessary, at once appoint watchmen to prevent freight or railroad property being stolen. Such watchmen are to remain on duty until relieved.

1503. All articles found along the track must be taken to the nearest station and delivered to the agent and a report sent to the supervisor.

1504. As soon as possible after arrival at wreck, foremen must endeavor to ascertain the cause and preserve all evidence relating thereto. When an accident is caused by breaking of tools, appliances or rails, broken parts must be marked so as to be readily identified and immediately turned over to the supervisor.

1505. If track or switches have been tampered with, foremen must report the same at once, by wire, to the superintendent, division

engineer, and track supervisor, giving full particulars so that steps may be taken to apprehend the guilty parties.

1506. In case of derailments, where the cause appears to be obscure and not due to track conditions, the track supervisor and section foreman shall carefully examine the center and side bearings of the equipment involved; also, any other conditions that might have contributed toward the derailment.

It frequently happens that the bearings of equipment have been neglected and through the action of rust or dirt, stick instead of sliding, and thus tend to bring about a derailment.

1507. Track walkers must promptly report any accident or occurrence not consistent with safety.

1508. If from any cause the track becomes impassable for trains and the section foreman cannot promptly repair the damage, he must at once, after placing danger signals in both directions, telegraph the track supervisor, division engineer, and superintendent, giving nature and location of obstructions, material needed, and all necessary information.

1509. If notified of broken rails or anything requiring immediate attention on an adjoining section, foreman must at once take such force as is necessary to protect the defective point and make the track safe for the passage of trains.

1510. Foremen must keep an accurate account of all labor expended in clearing wrecks, also of labor expended and material used to repair damage to track and roadbed on account of wrecks, and report same to track supervisor on the prescribed form as soon as possible.

1511. In case of personal injury, or loss of life, the foreman will immediately make a report by wire to the superintendent, division engineer and track supervisor, giving in brief the nature of the accident. In case of damage to property or conditions involving safety of traffic, section foreman must immediately make a report by wire to superintendent, division engineer and track supervisor. The telegram must be followed promptly by full written report to the proper supervisor on prescribed form.

1512. Track supervisors will see that the tool train equipment under their supervision is at all times in accordance with standard requirements, in first-class condition, and always ready for use, as provided for under "Equipment".

ACCIDENTS TO PERSONS.

1513. When passengers or employees are injured everything possible must be done for their proper care, and the nearest Company surgeon immediately notified by messenger or wire. If seriously injured, the nearest competent surgeon available should be called to attend until the Company surgeon arrives; or, if able to be moved, they should be taken to the nearest place at which the Company has a surgeon, and placed in his charge.

1514. When tramps, boys or other persons, climbing on or jumping from moving trains, or persons walking or lying on the track are injured, they should be sent to their homes, or placed in charge of the county, city or village authorities, and no expense incurred on the part of the railroad in the matter.

1515. Reports of all accidents, giving names

and addresses of the injured persons, and extent of their injuries, are to be telegraphed to the superintendent and division engineer, and as soon as possible a full and detailed report made and forwarded to the proper supervisor, a separate report being made for each person injured.

1516. In every case of accident to persons, whether by being struck by train or in any other manner, caused by the operation of trains, and in every case of accident to any employe, whether in train service or in other departments, a full and complete report must be made at once by every employe present, no matter whether he considers his statement of importance or not, answering every question on the standard form fully, if possible. Reports should also be procured, wherever possible, from injured parties, being careful to have injured persons answer all questions fully, as per standard form.

1517. Every effort must be made to procure the names and addresses of all persons, whether employes or others, who witness an accident.

1518. When persons are injured in any way in which the accident may have been caused by defective appliances, tools or machinery, the cars or appliance, tools or machine must be immediately examined by the person in charge to ascertain its condition, and report made of the inspection, giving the numbers and initials of cars examined and names of the persons making the inspection. This inspection must be made before the car or engine leaves the place where the accident occurs, to the proper supervisor by party who makes inspection.

1519. When an accident is caused by the breaking of machinery, tools, appliances or

rails, the broken parts must be so marked as to be readily identified and immediately turned over to the supervisor concerned.

INFORMATION FOR EMPLOYEES IN CASE OF INJURY.

General.

1520.

(a) The injured person should not be moved until it is known what part is injured; and full report of condition as found, rendered, and anything pressing upon or holding it is removed.

(b) Hemorrhage must receive the first attention, no matter what are the other injuries.

(c) When there is a wound, it should be covered with a clean dressing and bandage.

(d) A written dispatch, telegram or messenger should be sent at once to the nearest surgeon, as provided under "Accidents to Persons", giving such particulars as will enable him to bring the necessary remedies and appliances.

(e) Bystanders shall not be permitted to crowd about an injured person.

(f) It is best not to administer alcohol, except on the advice of a doctor. If necessary, hot tea, coffee or milk may be given.

(g) In moving the injured person, a stretcher shall be used if obtainable; but in any event the body must be very gently raised and moved, any injured limb being carefully supported.

(h) Remove the injured person to the nearest convenient clean place. Put the patient in as comfortable a position as possible, with the least amount of handling.

(i) If there is hemorrhage, use no stimulants.

(j) If the patient is weak from severe shock, a teaspoonful of aromatic spirits of ammonia or a little brandy and water may be given and warmth should be applied to the extremities by means of hot water pads, but care should be taken to avoid burns.

Bleeding Wounds.

1521.

(a) It is most important that bleeding be controlled, and a patient's recovery often depends upon the promptness with which this is done.

(b) Remove foreign bodies, such as broken glass, pieces of clothing, etc., seen in the wound. Do not search for foreign bodies not seen.

(c) Bandage tightly over the dressing, unless foreign bodies are suspected to be in the wound, or unless there is danger of causing injury to a fracture, in which case a light dressing only should be applied.

(d) If the blood is bright red, showing an injured artery, apply a tight bandage above the wound. A handkerchief loosely tied around the limb and tightened by twisting with a stick, will always stop the hemorrhage. Care should be taken not to use greater constriction than sufficient to stop the bleeding and the pressure should be occasionally lessened to avoid danger of producing gangrene of the limb below.

(e) If the blood is of dark color, showing injury to a vein, the bleeding can be stopped by applying a piece of gauze directly over the wound and binding it tightly with a bandage.

(f) All wounds, with or without hemorrhage, should be covered at once with sterile gauze from one of the emergency packages. The gauze can be held in place by means of a bandage, and should not be disturbed until the arrival of the surgeon. The wound should not be washed with water or any other solution.

Injuries to Head.

1522. Apply a clean dressing to the wound and keep the patient in a recumbent position. Do not give stimulants. As a general rule, if the face is pale, place the head lower than the body; if the face is flushed, elevate the head. This may be done when a stretcher is used by raising the foot or head of the stretcher.

Fractures.

1523.

(a) When hemorrhage accompanies a fracture, it must be attended to first, and the wound covered by a clean dressing.

(b) Attend to the fracture on the spot; steady and support the injured limb at once. Straighten it with great care, and hold in position until it has been secured by splints and bandages.

Broken or Injured Arm, Leg or Foot.

1524. If the bones are pushed through the skin they should be gently replaced, and the injured limb placed as nearly as possible in the same position as the uninjured one, and kept there by splint on either side, held in place by bandaging. In the case of a broken arm, the hand should be put in a sling. A patient should never be lifted by an injured limb, or the limb allowed to remain unsupported.

In order to keep a restless or delirious person who is badly injured about the legs, feet or arms quiet, long stockings, bags or pillow cases should be filled with dry sand or earth and placed beside and bandaged to the injured limbs. This will tend to prevent the parts jerking, and is especially useful in moving persons a long distance by train or otherwise.

Broken Collar Bone.

1525. A small pad should be put in the armpit, the elbow raised by a bandage being placed beneath it, and the whole arm bound to body by bandaging.

Broken Ribs or Bruised Chest.

1526. A broad bandage should be applied around the entire body on a level with the injured ribs, to prevent movement as far as possible, and the injured person kept on his or her back. If there is any open wound a pad of sterile gauze should first be applied.

Broken Back.

1527. The usual signs of a broken spine are paralysis and loss of sensation in the limbs below the injury. The injured person should be kept upon his back and moved as little as possible until he can be taken to a hospital.

Burns or Scalds.

1528. If possible, a warm solution of bicarbonate of soda (baking soda) should be poured upon the clothes over the burnt area, before attempting to remove the clothing. The clothing should then be carefully cut off, and some

preparation of oil, such as sweet oil, linseed oil, castor oil, vaseline or flour, may be applied to the burnt area which should then be covered with gauze, cotton batting or linen, to keep out the air. Treat for shock.

Frost Bites.

1529. The frozen parts should on no account be rubbed, but should be kept in cold water until the frost is out of them. The temperature of the water should then be gradually raised to 99 degrees. When circulation is restored, keep the patient in a room at a temperature of 60 degrees.

Insensibility.

1530. Arrest hemorrhage if apparent. Place the patient in a recumbent position. Do not attempt to give anything by the mouth while unconscious, give warm tea or coffee if there is no bleeding. If in state of convulsion, support the patient's head; keep him from biting his tongue and striking objects near him, but do not completely check his movements.

Shock.

1531. Lay the patient on the back with the head low. Loosen tight clothing. Provide for a free circulation of fresh air. Restore the heat of the body by covering the patient with coats or blankets. Give hot tea, coffee or milk, and speak cheering words.

TREATMENT FOR ELECTRIC SHOCK.

General Information.

An accidental electric shock usually does not kill at once, but may only stun the victim and for a while stop his breathing.

The shock is not likely to be immediately fatal, because:

(a) The conductors may make only a brief and imperfect contact with the body.

(b) The skin, unless it is wet, offers high resistance to the current.

Hope of restoring the victim lies in prompt and continued use of artificial respiration. The reasons for this statement are:

(a) The body continuously depends on an exchange of air as shown by the fact that we must breathe in and out about 15 times a minute.

(b) If the body is not thus repeatedly supplied with air, suffocation occurs.

(c) Persons whose breathing has been stopped by electric shock have been reported restored after artificial respiration has been continued approximately two hours.

The Schafer or "prone pressure" method of artificial respiration, slightly modified, is illustrated and described in the following resuscitation rules. The advantages of this method are:

(a) Easy performance; little muscular exertion is required.

(b) Larger ventilation of the lungs than by the supine method.

(c) Simplicity; the operator makes no complex motions and readily learns the method on first trial.

(d) No trouble from the tongue falling back into the air passage.

(e) No risk or injury to the liver or ribs if the method is executed with proper care.

Aid can be rendered best by one who has studied the rules and has learned them by practice on a volunteer subject.

INSTRUCTIONS FOR RESUSCITATION.

Follow these instructions even if the victim appears dead:

Break the Circuit Immediately.

1532. With a single quick motion separate the victim from the live conductor. In so doing, avoid receiving a shock yourself. Many have, by their carelessness, received injury in trying to disconnect victims of shock from live conductors.

Observe the Following Precautions.

(a) Use a dry coat, a dry rope, a dry stick or board, or any other dry non-conductor to move either the victim or the wire, so as to break the electrical contact. Beware of using metal or any moist material. The victim's loose clothing, if dry, may be used to pull him away; do not touch the soles or heels of his shoes while he remains in contact—the nails are dangerous.

(b) If the body must be touched by your hands, be sure to cover them with rubber gloves, mackintosh, rubber sheeting or dry cloth; or stand on a dry board or on some dry insulating surface. If possible, use only one hand.

If the victim is conducting the current to ground, and is convulsively clutching the live conductor, it may be easier to shut off the current by lifting him than by leaving him on the ground and trying to break his grasp.

Open the nearest switch, if that is the quickest way to break the circuit.

If necessary to cut a live wire, use an axe or a hatchet with a dry wooden handle, or properly insulated pliers.

Send for the Nearest Doctor.

1533. This should be done without a moment's delay, as soon as the accident occurs and while the victim is being removed from the conductor.

Attend Instantly to Victim's Breathing.

1534. As soon as the victim is clear of the live conductor, quickly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). Then begin artificial respiration at once. Do not stop to loosen the patient's clothing; every moment of delay is serious.

Lay the subject on his belly, with arms extended as straight forward as possible, and with face to one side, so that the nose and mouth are free for breathing (see Figure 1). Let an assistant draw forward the subject's tongue.

If possible, avoid so laying the subject that any burned places are pressed upon.

Do not permit bystanders to crowd about and shut off fresh air.

Kneel straddling the subject's thighs and facing his head; put the palms of your hands on the loins (on the muscles of the small of the back), with thumbs nearly touching each other, and with fingers spread over the lowest ribs (see Figure 1).

With arms held straight, swing forward slowly so that the weight of your body is grad-



FIG. 1—INSPIRATION;
PRESSURE OFF.

FIG. 2—EXPIRATION;
PRESSURE ON.



nally brought to bear upon the subject (see Figure 2). This operation, which should take from two to three seconds, must not be violent—internal organs may be injured. The lower part of the chest and also the abdomen are thus compressed, and air is forced out of the lungs.

Now immediately swing backward so as to remove the pressure, but leave your hands in place, thus returning to the position shown in Figure 1. Through their elasticity, the chest walls expand and the lungs are thus supplied with fresh air.

After two seconds swing forward again. Thus repeat deliberately 12 to 15 times a minute the double movement of compression and release—a complete respiration in four or five seconds. If a watch or a clock is not visible, follow the natural rate of your own deep breathing, swinging forward with each expiration and backward with each inspiration.

While this is being done, an assistant should loosen any tight clothing about the subject's neck, chest or waist.

Continue artificial respiration (if necessary, two hours or longer) without interruption, until natural breathing is restored or until a physician arrives. Even after natural breathing begins, carefully watch that it continues. If it stops, start artificial respiration again.

During the period of operation, keep the subject warm by applying a proper covering and by laying beside his body bottles or rubber bags with warm (not hot) water. The attention to keeping the subject warm should be given by an assistant or assistants.

Do not give any liquids whatever by mouth until the subject is fully conscious.

First Care of Burns.

1535. When natural respiration has been restored, burns, if serious, should be attended to until a doctor comes.

A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off—cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0.5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil, such as machine oil, transformer oil, vaseline, linseed, carron or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs or other soft cloth, held lightly in place by a bandage.

The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

Do not open blisters.

Surgical Appliances.

1536. A "first aid" box is carried on all trains, for use in case of accident or emergency. Instructions will be found in the box regarding the use of its contents.

First Aid Instructions.

1537. It is usually very important in case of accident that first aid be furnished in a prompt and efficient manner. Employes are urged to attend any lectures given by first aid instructors, as these are followed by practical demonstrations which assist in a correct understanding of the instructions covering aid to the injured.

First Care of Burns.

1535. When natural respiration has been restored, burns, if serious, should be attended to until a doctor comes.

A raw or blistered surface should be protected from the air. If clothing sticks, do not pull it off—cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (3.5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil, such as machine oil, transformer oil, vaseline, kerosene, sardon or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs or other soft cloth, held lightly in place by a bandage.

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REPORT ON SURFACE INVESTIGATION
 OF THE ...

The ... of the ...

The ... of the ...

SUPPLEMENTARY DATA

**DRAWINGS, TABLES AND MISCELLANEOUS
 INFORMATION.**

The ... of the ...

INSTRUCTIONS RELATIVE TO WHITE
 WASH AND COLD-WATER PAINT
 The use of white wash is preferable to cold-water
 paint. All white wash prepared is to be pre-
 pared according to the receipt of the Quar-
 termaster's Department, U. S. Army, which is as
 follows:

White wash is prepared by mixing
 one part of white wash with one part of water
 and by stirring as above. It is used
 for painting wood, brick, or stone, and
 for coloring whitewash as prescribed by
 the Quartermaster's Department, U. S. Army,
 which is as follows:

SUPPLEMENTARY DATA.

DRAWINGS, TABLES AND MISCELLANEOUS INFORMATION.

A pint of this mixture, if properly applied,
 will cover one square yard, and will be almost
 as serviceable as paint for wood, brick or stone,
 and is much cheaper than the cheapest paint.
 For inside purposes, such as the covering of
 brick walls of kitchens, shops, round houses,
 etc., either white wash or cold-water paint may
 be used, although the white wash will ordin-
 arily be found to be somewhat cheaper. The
 method of coloring white wash as prescribed by
 the Quartermaster's Department, U. S. Army,
 is as follows:

INSTRUCTIONS RELATIVE TO WHITE- WASH AND COLD-WATER PAINT.

For outside purposes, as on wing fences, etc., the use of whitewash is preferable to cold-water paint. All whitewash hereafter is to be prepared according to the receipt of the Quartermaster's Department, U. S. Army, which is as follows:

Whitewash.

Take half a bushel of unslaked lime, slake it with boiling water, cover during the process to keep in steam, strain the liquid through a fine sieve or strainer, and add to it a peck of salt, previously dissolved in warm water, three pounds ground rice boiled to a thin paste and stirred in while hot, half a pound of Spanish whiting, and one pound clean glue, previously dissolved by soaking in cold water and then hanging over a slow fire in a small pot hung in a larger one filled with water. Add five gallons hot water to the mixture, stir well and let it stand a few days, covered with dirt. It should be applied hot, for which purpose it can be kept in a kettle or portable furnace.

A pint of this mixture, if properly applied, will cover one square yard, and will be almost as serviceable as paint for wood, brick or stone, and is much cheaper than the cheapest paint.

For inside purposes, such as the covering of brick walls of kitchens, shops, round houses, etc., either whitewash or cold-water paint may be used, although the whitewash will ordinarily be found to be somewhat cheaper. The method of coloring whitewash as prescribed by the Quartermaster's Department, U. S. Army, is as follows:

Colored Whitewash.

Coloring matter may be added to whitewash prepared as above as desired. For cream color, add yellow ochre; pearl or lead, add lamp black or ivory black; fawn, add proportionately four pounds raw umber or two pounds lamp black.

Cold-Water Paint.

Mixing directions for cold-water paint are practically the same as prescribed by the various manufacturers, and the following is given as the directions for mixing:

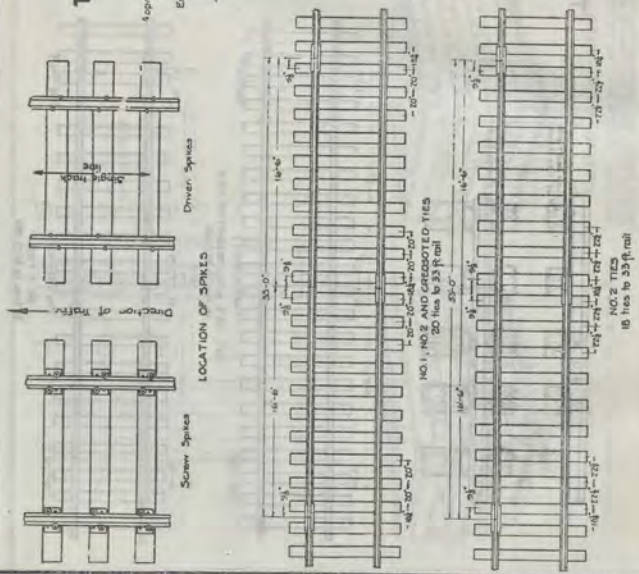
First place the powder in a clean pail. Never pour the water into the pail before the powder. Add cold water gradually to the powder and bring the mixture to a thick, stiff paste. This should be stirred thoroughly until smooth and even. To reduce to proper consistency, which is that of oil paint, slowly add more water, stirring in the meanwhile. Five pounds of the powder will make about one gallon of paint. When ordering white, specify whether for inside or outside use.

N. Y. N. H. & H. R. R.
STANDARD
TIE SPACING AND SPIKING
33 FT RAIL

Scale 6" = 1'-0"
 Approved by
 Chief Engineer
 Approved by
 President

Leg all tie squares to the line of the track.
 The ends of ties shall be true to line on both ends and double checked by the track men with the column indicator.
 477 lb. rail when any of these spikes is used.

- 100" spikes
 - 80" spikes
 - 78" no 1 and no 2 drilling
 - 70" no 1 drilling
- The following rail sections require a modification of the tie spacing of ties - 70 lb. (70 lb. rail) shilling, 30 rail length, and 47 lb. - but apply directly to 40 lb. tie with following:



NO. 2 TIES
18 ties to 33 ft rail

Sheet No. 1 of 2, single.

N. Y. N. H. & H. R. R.
LENGTHS OF TIMBER
FOR SIDE TRACK TURNOUTS.

Approved by
 Chief Engineer
 Approved by
 President

NOTE: All ties 7'-9".
 Ties spaced same as Standard Turnouts up to 145' lengths. Standard 6'9" has then used.

NO. OF TIES	LENGTH	NO. OF TIES	LENGTH
22	145'-0"	37	105'-0"
23	135'-0"	38	115'-0"
24	125'-0"	39	125'-0"
25	115'-0"	40	135'-0"
26	105'-0"	41	145'-0"
27	95'-0"	42	155'-0"
28	85'-0"	43	165'-0"
29	75'-0"	44	175'-0"
30	65'-0"	45	185'-0"
31	55'-0"	46	195'-0"
32	45'-0"	47	205'-0"
33	35'-0"	48	215'-0"
34	25'-0"	49	225'-0"
35	15'-0"	50	235'-0"
36	5'-0"	51	245'-0"

NO. OF TIES	LENGTH	NO. OF TIES	LENGTH
40	255'-0"	57	505'-0"
41	265'-0"	58	515'-0"
42	275'-0"	59	525'-0"
43	285'-0"	60	535'-0"
44	295'-0"	61	545'-0"
45	305'-0"	62	555'-0"
46	315'-0"	63	565'-0"
47	325'-0"	64	575'-0"
48	335'-0"	65	585'-0"
49	345'-0"	66	595'-0"
50	355'-0"	67	605'-0"
51	365'-0"	68	615'-0"
52	375'-0"	69	625'-0"
53	385'-0"	70	635'-0"
54	395'-0"	71	645'-0"
55	405'-0"	72	655'-0"
56	415'-0"	73	665'-0"

TABLE OF RAIL WEIGHTS

WEIGHT PER YARD	TONS PER 100 TRACK FEET (TWO RAILS)		TONS PER TRACK MILE (TWO RAILS)		WEIGHT OF ONE NEW RAIL TONS	
	NEW RAIL	NEW RAIL	NEW RAIL	NEW RAIL	30 - FOOT	33 - FOOT
107 LBS	3.185	168.143	0.478	0.525		
100 "	2.976	157.143	0.446	0.491		
90 "	2.679	141.428	0.402	0.442		
80 "	2.381	125.714	0.357	0.393		
79 "	2.351	124.143	0.353	0.380		
78 "	2.321	122.571	0.348	0.383		
75 "	2.232	117.857	0.335	0.368		
74 "	2.202	116.286	0.330	0.363		
70 "	2.083	110.000	0.313	0.344		
66 "	2.024	106.557	0.304	0.334		
67 "	1.994	105.286	0.299	0.329		
66 "	1.964	103.714	0.295	0.324		
60 "	1.786	94.286	0.268	0.295		
ESTIMATES ARE BASED ON LONG TONS - 2240 LBS.						

N. Y. N. H. & H. R. R.

BRIDGE DEP'T

JULY 1913.

TABLE SHOWING NUMBER AND SIZE OF

HARD PINE STRINGERS PER RAIL FOR

MAIN LINE AND SIDE TRACK. 200,000^{lb} LOADING.

FIBRE STRESS $\frac{12000}{2000}$ MAIN LINE. NO IMPACT.

SPAN IN FEET	MAIN TRACKS								SIDE TRACKS 60% OF MAIN LINE.										
	SIZE OF STRINGERS								SIZE OF STRINGERS										
	7x14"	12x12"	10x14"	8x16"	12x14"	10x16"	12x16"	10x18"	10x18"	7x14"	12x12"	10x14"	8x16"	12x14"	10x16"	12x16"	10x18"	10x20"	
5	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	
6	3	2	2	2	2	2	2	2	2	1	1	2	1	1	1	1	1	1	
7	3	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	
8	3	2	2	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	
9	3	2	2	3	2	2	2	2	2	2	2	2	1	2	1	1	1	1	
10	3	3	3	3	2	2	2	2	2	2	2	2	2	2	1	1	1	1	
11	4	3	3	3	2	2	2	2	2	2	2	2	2	2	1	2	1	1	
12		4	3	3	3	3	2	2	2	3	2	2	2	2	2	2	2	2	
13		4	4	4	3	3	3	3	2	3	3	3	2	2	2	2	2	2	
14				4	4	4	3	3	2	4	3	3	3	3	2	2	2	2	
15					4	4	3	3	3	4	4	3	3	3	3	2	2	2	
16						4	4	4	3		4	4	3	3	3	2	2	2	
17							4	4	3			4	4	3	3	3	3	2	
18								4	4			4	4	4	4	3	3	2	
19									4				4	4	4	3	3	2	
20									4					4	4	3	3	3	
21															4	4	4	3	
22																4	4	3	
23																	4	4	3

Horizontal Shear 120^{lb} Main Line, 200^{lb} Sidetrack.

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