

VICTORIAN RAILWAYS.

WAY AND WORKS BRANCH.

# INSTRUCTIONS

(SUPPLEMENTARY TO BOOK OF RULES AND REGULATIONS).

FOR THE GUIDANCE OF

WORKSMASTERS  
ROADMASTERS  
INSPECTORS  
FOREMEN

GANGERS  
LEADING HANDS  
SIGNAL ADJUSTERS  
REPAIRERS

EFFECTIVE AS FROM 1ST NOVEMBER, 1910.

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874.1.10

# INSTRUCTIONS.

## Supplementary to Book of Rules and Regulations.

*NOTE.—In order to expedite reference the Instructions have been subdivided into the different divisions shown hereunder, but every officer or employe to whom this book is issued must make himself thoroughly acquainted with the whole of the Instructions.*

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### Interpretation.

Wherever it appears in these Instructions, the term "Head Office" shall mean and include the offices at Spencer-street, Melbourne, of the Chief Engineer of Way and Works, the Engineer of Works, the Engineer of Way, the Engineer of Signals and Interlocking, and the Estate Officer.

The terms "Engineer of Signals and Interlocking," "Worksmaster," "Roadmaster," "Inspector of Ironwork," "Inspector of Signals and Interlocking," "Foreman," "Ganger," "Repairer," "Signal Adjuster," and "Fencer," shall mean and include every officer or employe employed or acting in such respective positions.

The term "Trackmen" shall mean and include every Ganger and Repairer, and every other employe engaged in connection with the maintenance of the permanent way.

### General Instructions.

1. Every Roadmaster is under the immediate supervision of and must report to the Engineer of Way, and is responsible within his Section for the safe, efficient, and economical maintenance of the track, ballast, roadbed, right-of-way, fencing (except picket or any special type of fencing), and of every unpaved roadway, pathway, or other surface, ditch, drain, and channel (except any piped or lined ditch drain and channel), and also of such other works as may be allotted to him.

2. Every Workmaster is under the immediate supervision of and must report to the Engineer of Works, and is responsible within his Section for the safe, efficient, and economical maintenance of every building (except any signal-box in the Metropolitan area), platform, fixture, picket or special type of fence, non-interlocked gate, cattle guard, paved surface, stock yard, fuel stage, ash pit, tunnel, retaining wall, culvert, pier, wharf, dock, jetty, grain conveyor, set of buffer stops and piped or lined ditch, drain and channel; for all painting, including the painting of every signal-box and semaphore, and of interlocking connections, levers and footplates of apparatus in the signal-box, and the numbering of every semaphore at an interlocked station; and, except as hereinafter provided, for the safe, efficient, and economical maintenance of every bridge, viaduct, subway, turntable, traverser, lifting crane, weighbridge, water supply work (including every reservoir, water course, water crane, fixed tank, cistern, meter, syphon, valve, windmill, pipe track, water pipe and fixture), and such other works as may be allotted to him.

3. The construction and maintenance (with the exception of painting), of every signal-box in the Metropolitan area, and of every semaphore, and all interlocking apparatus and connections, is under the supervision of the Engineer of Signals and Interlocking.

4. The Inspector of Ironwork is responsible for the safe, efficient, and economical maintenance of every turntable, traverser, and water supply work, and the ironwork of every lifting crane, bridge, viaduct, and subway, in the Metropolitan area; and the ironwork and mechanism of every weighbridge. The Inspector of Ironwork will be governed by, and must enforce, so much of the instructions issued to Workmasters and Foremen as apply to employes and works under his supervision.

5. Every Workmaster, Roadmaster, and Inspector must maintain a complete knowledge and close practical control of every employe and every work under his supervision; closely scrutinise the details of all work, confer frequently with his Foremen or Gangers, give them full instructions, and see that his orders are carried out; see that proper discipline is maintained, and that every employe under him is of sober habits and capable and attentive to his duties; and report any employe whom he considers deficient in these qualities.

6. A Workmaster, Roadmaster, Inspector, Foreman, or Ganger must not countenance any neglect of duty, and must suspend or report for suspension any employe deemed guilty of serious neglect of duty, and forward particulars to his immediate superior as early as possible.

7. The Inspector of Ironwork and every Workmaster will be held responsible for compliance with the instructions on page 137 of the General Appendix respecting the responsibility of the Way and Works and Rolling Stock Branches for the examination, testing, and maintenance of any crane or other lifting appliance.

8. The Rolling Stock Branch will maintain rolling stock used by the Way and Works Branch, and will be responsible for the repair and renewal of every water tank on a truck. Any workmen's sleeping car which has been taken off the line must not be put into running again until examined and tested by a responsible representative of the Rolling Stock Branch, and sufficient notice to enable the examination to be made must be given the Rolling Stock Branch.

9. The Rolling Stock Branch will effect minor repairs to any turntable or water crane at Ararat, Ballarat, Benalla, Bendigo, Dimboola, Echuca, Geelong, Korumburra, Maryborough, Seymour, Stawell, Traralgon, and Wodonga, and at such other places as may be agreed on from time to time. Repairs of any magnitude, however, must be carried out by the Way and Works Branch, and the Workmaster must report when such repairs are required.

10. In order to avoid sending a Fitter or other employe a long distance to execute small repairs, Locomotive Foremen

will, whenever practicable, render mechanical and all other assistance in the repair of any mechanical appliance, on application by the Workmaster or Roadmaster.

11. Any lamp which requires repairs, and any spare lamp must be sent to the Lamp repairing shop, Spencer Street, and the Telegraph Superintendent must immediately be advised that the lamp has been forwarded.

12. Every Roadmaster and every Ganger must hasten to any accident which occurs near them, whether on their own section or length, or not, and must collect the necessary men, and in conjunction with the senior Rolling Stock and Transportation officers present give every possible assistance in clearing the line, and putting the track in order. A casualty train proceeding to the scene of the accident will pick up trackmen on the way, if necessary. The Workmaster and the Foreman also must hasten to any accident which may affect a work for which they are responsible.

In the event of a derailment, the Roadmaster and the Ganger must comply with the instructions on page 23 of the General Appendix, and, as soon as possible after the accident, must take a record of the gauge and level of the track, at intervals of six (6) feet, for at least thirty (30) feet from the point of derailment.

13. The Roadmaster must effect the replacement of buffer stops which have been knocked out of position, and the removal, re-erection, and minor repair of buffer stops, and the Workmaster must effect any extensive repairs which may be necessary.

14. The Workmaster and the Roadmaster must work in conjunction in carrying out any work which affects the responsibilities of both, and must meet, discuss their instructions, and arrange as far as practicable in what order, and on what dates, each portion of the work will be performed.

Any Workmaster, Inspector or other officer who requires the speed of trains reduced temporarily, or to break or block the line for any purpose, must supply full particulars on the proper form to the Roadmaster, who in every instance is responsible for notifying the Head Office, vide Instruction No. 141. The Roadmaster must also be advised promptly when any speed restriction may be withdrawn.

15. Special Permanent Way Warning and Caution Signals (Regulation No. 274, and General Appendix, page 119), will, when required, be supplied from the Head Office upon the requisition of the Roadmaster, and must be used only when it is necessary to restrict the speed of trains continuously for more than seven (7) days, as in the case of relaying or re-grading operations, bridge renewals, etc.

Any requisition for such signals must be forwarded not less than five (5) days before the signals require to be brought into use, and the signals must be returned to the Engineer of Signals and Interlocking, Newport, when finished with.

The Roadmaster is responsible for the erection and maintenance of such signals in their proper positions, and for seeing that the lights burn brightly at night.

Any Workmaster who requires such signals erected for the protection of any work to be carried out under his supervision, must give at least ten (10) days' written notice to the Roadmaster, to enable the latter to arrange for the erection of the signals, and to comply with clause 5 of the instructions on page 119, General Appendix. The notice must state clearly the portion of the line which it is desired to protect. The Workmaster must also advise the Roadmaster in writing when the work is completed, and the signals can be removed.

16. The Workmaster and the Roadmaster are responsible for the proper use of any Duty pass issued to an employe under their control. A Duty pass must not be used by an employe except in the actual discharge of his duty, and any attempt to make use of such a pass for any other purpose must be reported promptly to the Head Office.

17. Interlocked points, lock bars, detectors, gates, wickets, and semaphores must not be adjusted by any person other than a Signal Adjuster. Trackmen must examine all points, and if any interlocked points are out of proper adjustment, the Signal Adjuster must be notified, and the attention of the Signaller and Station-master must, in the absence of the Signal Adjuster, be called at once to the defect; the points must then be disconnected from the interlocking gear, and securely spiked or worked by hand by trackmen, until the

arrival of the Signal Adjuster. The bolts of fishplates at the heel of interlocked points must not be screwed up so tightly as to prevent the blades from being moved easily by hand, when disconnected from the interlocking gear, nor must there be any spring in the blades when placed by hand against the stock rail; the bolts, however, must not be so loose as to allow a foul joint to occur.

18. Trackmen must keep the lines properly boxed up at every interlocked place. In any exceptional case in which a space between sleepers must unavoidably be kept open for drainage purposes, etc., adjoining sleepers carrying interlocking gear must be connected securely by means of iron straps, which will be provided and fixed by the Signal Adjuster, and in any such case the Inspector of Signals and Interlocking must be duly notified by the Roadmaster before ballast is removed.

19. At least seven (7) days before it is proposed to commence any alteration at an interlocked place, which will interfere in any way with the position of the signals or interlocking gear, the Workmaster or the Roadmaster, as the case may be, must give written notification to the Inspector of Signals and Interlocking; but in any instance in which the alteration will not interfere with the existing position of interlocking connections, twenty-four (24) hours' oral notice by the Foreman or Ganger to the Inspector of Interlocking will be sufficient.

20. At least seven (7) days before it is proposed to commence any alteration to any stock yard, or to any siding leading thereto, the Head Office must be advised of the probable length of time that the yard or siding will be out of use, so that the Transportation Branch may be notified accordingly.

21. At least seven (7) days before it is proposed to commence any work likely to affect the telegraph lines either of the Railway or of the Postal Department, the Head Office must be advised, so that any necessary alteration to the wires may be made. The notice must state whether the poles or wires are the property of the Railway or of the Postal Department.

22. At least seven (7) days before it is proposed to commence any work which will necessitate the removal of any

advertisement board or frame at a station, the Head Office must be advised, so that the Advertising Licensee may be requested to remove such board or frame.

23. At least seven (7) days before it is proposed to commence the removal of any Departmental Residence, the Workmaster must advise the Roadmaster of the intention to perform such removal.

24. Every employe must, whilst on duty, devote himself exclusively to the work allotted to him. The week's work consists of forty-eight (48) hours, irrespective of the time occupied in going to and returning from work, with or without tools. The working hours of every employe (excluding any gatekeeper), on each working day, except Saturday, are from 7.30 a.m. to 12 noon, and from 12.45 p.m. to 5 p.m., and on each Saturday, from 7.30 a.m. to 11.45 a.m. The time required for examining the length is part of the day's labour, but the employe making the examination must be at one end of the length ready to commence this work at 7.30 a.m. Every Workmaster, Roadmaster, Inspector, Foreman, and Ganger must see that every employe adheres rigidly to the prescribed hours.

25. Any employe who comes on duty late must be cautioned for the first offence, and if he repeat the offence a report must be furnished to the Head Office.

26. Time lost through wet weather, or other cause, will not be paid for. Every Foreman and Ganger, however, must be on duty in all weathers during the prescribed hours, and as much longer as may be necessary if danger to the track is apprehended.

27. Instructions other than those issued from the Head Office, or by Way and Works Supervising Officers, must not be acted upon, except in emergency. In case of danger, accident, or damage, all employes must unite to secure the safety of the travelling public, and to protect Departmental property.

28. Smoking must not be permitted during working hours.

29. Any work which can be performed on week-days without interfering with or endangering the traffic, must not

be carried out on a Sunday, unless it be specially urgent, and then only with the authority of the Head Office. Any necessary Sunday work must, if possible, be confined to the early hours of the day.

30. In any instance in which it is necessary to complete work promptly, adequate hands must, if possible, be employed during ordinary working hours, and overtime must not be worked unless it is unavoidable.

31. The use of intoxicants by any employe while on duty is forbidden, and any employe who is under the influence of intoxicants while on duty, who reports for duty under the influence of intoxicants, or who causes intoxicants to be brought on to Railway works during working hours, will be severely punished.

Any employe who considers that another employe is under the influence of intoxicants while on duty must report the circumstance to his immediate superior, and in addition must draw the attention of some other person thereto, so that corroborative evidence may be obtained.

32. Civil deportment and proper conduct are required of every employe, and especially of every employe entrusted with the supervision of others. An employe must not, under any circumstances, use abusive, profane, or vulgar language, nor enter into an altercation with any person, and if any provocation be given, he must report the facts to his immediate superior.

33. The Roadmaster and the trackmen must be on duty during the prescribed hours on all common holidays

34. The Annual Leave of trackmen shall be arranged so that not more than one man on each length will be absent from duty at any one time.

35. Every communication referring to Departmental business which is received from a person outside the Railway service must be acknowledged, and referred to the Head Office, and the writer must be informed that such action has been taken.

36. All correspondence must be returned promptly. If any delay occurs, the cause must be explained. Correspondence



dence must be kept and returned in a scrupulously clean condition. Indorsements must not be made on Secretary's correspondence.

Each memorandum must deal with only one subject

In replying to any communication, either by telegraph or otherwise, the following instructions must be observed:—

Read the communication carefully to ascertain clearly the nature of the information required.

Frame the reply so that it will run as closely as possible in the same paragraph order as the communication to which it refers.

Supplement the reply with any information which may be considered of value or interest.

37. Every important letter, and the envelope in which such letter is enclosed, must be marked "Urgent." The uniform telegraph code must be used for Departmental telegrams.

38. Every circular and letter marked "Acknowledge," must be acknowledged promptly by means of a receipt card.

39. Every report which requires the attention of the Head Office must be forwarded promptly by the Supervising Officer, with all information in regard to the case.

40. Official correspondence must be regarded as strictly confidential.

41. Every endeavour must be made to reduce the cost of work by the exercise of skill, and by the use of modern appliances and methods. Every employe must display activity and zeal in the performance of his duties. A capacity for increased responsibility is essential to gain promotion.

42. No deviation shall be made from the standard plans, special drawings, specifications, or schedules of any work, without the authority of the Head Office, unless such deviation is necessary for safety, in which event any essential action must be taken at once, and a report furnished.

43. In any instance in which the actual expenditure upon a work is less than the amount authorised, the surplus must not, under any circumstances, be appropriated for any other work.

44. Any delay in the commencement or carrying out of a contract, and the completion of each contract, must be reported promptly to the Head Office.

45. Any quantity in excess of the quantity specified in the contract must not be passed, except with the authority of the Head Office.

46. An employe must not witness the signature of any contractor to a competitive tender for any advertised work.

47. Except in a case of emergency (in which covering authority must be obtained promptly), extra labour must not be employed, without the sanction of the Head Office.

Any employe in an extra gang must not be transferred to an ordinary gang, and extra labour approved for any specified purpose must not be utilised for any other purpose, without the authority of the Head Office.

48. The authorised track force for each length must be maintained and, unless otherwise provided for, any deficiency caused by the absence of any member of the gang (except on annual leave) must be made up within one (1) month by employing temporary labour.

49. The authorised track force for each length must not be exceeded without authority, which must be obtained on the proper form. Extra track force will be granted only when the gang is required to perform extra work, or is unable to cope with the ordinary track work, and when required, it must be applied for promptly and worked up as early as possible after approval. It should not be necessary to ask for extra track labour for any period under twelve (12) days, but extra track labour may be asked for if the period for which it is required exceeds twelve (12) days, and if it has not been occasioned by the loss of track labour at various times through the performance of small extra works.

**Right of Way.**

70. Every Workmaster, Roadmaster, Foreman, and Ganger must make himself familiar with the boundary lines of the Department's property, and must see that encroachment is not permitted without the authority of the Head Office, and must report promptly any attempt at encroachment, giving the name and address of the offender, and all the facts connected therewith.

71. The construction of a private siding or the extension of an existing private siding on which Departmental rolling stock may run, must not be permitted without the authority of the Head Office.

72. Every private siding not maintained by the Department, whether on Railway land or private property, on which Departmental rolling stock is run, must be inspected by trackmen at least once a month. If any such siding be deemed unsafe for traffic, the Head Office must be advised, and repairs must not be made without the authority of the Head Office.

73. In any instance in which the owner of a siding, inside or outside the Railway fences, commences or proposes to remove the siding, the Head Office must be informed, so that, if necessary, the removal may be prevented.

74. Any change of ownership, or of the persons using a private siding, must be reported promptly to the Head Office.

75. No advertisement may be painted, pasted, or affixed to Railway property without authority; and the name and address of any person offending in this respect must be taken, and full particulars reported. Advertisements which the Advertising Licensee has permission to display must appear on proper boards or frames, which must not be fixed direct to the walls of buildings or fences, but must be fastened to battens attached thereto.

The Workmaster must see that every hoarding erected by the Advertising Licensee is properly constructed, securely fixed, and maintained in good order. A hoarding must not in any instance be placed in a dangerous position.

**76.** Railway land must not be fenced off for grazing, cultivation, or other purpose, without the written authority of the Head Office. Every employe or other person in occupation of any part of the railway reserves (except as prescribed in Instruction No. 80), must sign an agreement and pay rent and all rates and taxes. The Roadmaster must advise the Estate Officer of any instance in which an employe or other person in possession of railway land is not paying rent.

**77.** The tenant of any land leased for grazing purposes must fence off every semaphore, semaphore stay and connection, telegraph pole stay, and ornamental or other tree and shrub, and the tenant of any land leased for cultivation purposes must not disturb the surface by digging or ploughing within a distance of six (6) feet of any semaphore, semaphore stay or connection, telegraph pole stay, or ornamental or other tree or shrub.

**78.** The tenant of any land must not erect fencing within ten (10) feet of the nearest track rail, nor within four (4) feet of the top of any cutting, nor plough within ten (10) feet of the nearest track rail, nor within four (4) feet of any Railway boundary fence, or the top of any cutting. The slope of any embankment or cutting must not be leased.

**79.** A building must not in any instance be erected, altered, or added to without the written authority of the Head Office, and the Roadmaster must advise the Head Office of any breach of this instruction.

Every authorised addition proposed to be made by an occupant to a Departmental residence must be erected to the approval of the Workmaster, and detached at least four (4) feet from the residence. The Department will not recognise any claim for any addition or improvement, but upon transfer or retirement the occupant will be permitted to remove any addition which he has provided, or to otherwise dispose of it.

**80.** Every employe not entitled to free quarters, and every other person in the occupation of a Departmental residence or building, must sign an agreement and pay rent and all rates and taxes. The Roadmaster must advise the Estate Officer of any instance in which an employe or other person in occupation of a Departmental residence or building is not paying rent.

Provided that sufficient land be available, one quarter of an acre adjoining a Departmental residence will be allowed free of rent to the tenant.

**81.** The Roadmaster and the Ganger must see that the drainage from every dwelling and urinal receives proper attention. Every employe in the occupation of a Departmental residence must keep clean every open drain, silt pit, spouting and tank connected therewith. Trackmen must keep every other drain and silt pit clean. In any instance in which a silt pit is close to a dwelling, the silt must not be thrown out over the surface, but must be removed to a suitable place, where it will not be offensive.

**82.** The owner or occupier of any land adjoining that of the Department must not be permitted to divert drainage into a railway drain without the authority of the Head Office. In any instance in which a landholder or Shire Council wishes to divert drainage from a private property or street into a railway drain, a report giving full particulars must be forwarded to the Head Office.

**83.** Mining on a Railway reserve must not be permitted without the authority of the Head Office, and then only if the work be carried on so as not to endanger the track.

**84.** When blasting operations are being carried on inside the Railway fences, or anywhere near Railway premises, every precaution must be taken to avoid accident or damage. Explosives, when not in use, must be kept locked in a proper magazine.

**85.** No person shall be permitted to fire across the Railway line, and the Roadmaster and the Ganger must report if any rifle range is placed in such a position as to endanger the lives of the travelling public or employes.

**86.** Any horse, cow, or other animal found straying within the Railway fences must at once be driven out, and inquiries must be made as to how it obtained access to the line, and any evidence of it having come through the station gates must be brought under the notice of the Station-master or Transportation employe in charge. Full particulars of brands, the name of the owner, if possible, and the distance to the nearest pound must be reported to the Head Office, and instructions will then be given as to what proceedings, if any, must be taken.

87. In any instance in which a horse, cow, sheep or other animal straying on the Railway line is injured by a train, beyond the possibility of recovery, the Ganger must put an end to its sufferings, and take a note of the brands and description of the animal, how it obtained access to the line, and whether it was straying on a public road. Inquiries must then be made for the owner, who, if found, must be informed of the occurrence. In the event of the owner refusing to take the carcase away, the Ganger must either burn or bury it, but must not remove the hide unless the owner gives him permission in writing to do so. In any instance which an animal is disabled, but not injured beyond the possibility of recovery, inquiries must first be made for the owner; and if he cannot be found within twenty-four (24) hours, or if he refuse to either kill or remove the animal, the Ganger must kill it and burn or bury the carcase, subject to the above-mentioned conditions as to the removal of the hide.

88. Under the provisions of the "Vermin Destruction Act" the Department is required to suppress and destroy rabbits on Railway property, and on half the width of any road adjoining the Railway line. The Ganger must make every effort to keep his length and half the width of any adjoining road clear and free of rabbits, and must draw the attention of the Roadmaster to any place at which he considers special steps are necessary to cope with the rabbit pest. The Roadmaster must, when necessary, supply the Ganger with suitable appliances for exterminating rabbits, and see that continued action is taken to comply with the Act.

### Clearance.

92. For the purposes of these instructions, and diagrams relating to minimum structures, the Melbourne Suburban radius shall be considered as terminating at the "down" end of the following stations, within ten (10) chains from the centre of the passenger platform, viz.:—Williamstown Pier, Williamstown Racecourse, Werribee, St. Albans, Broadmeadows, Flemington Racecourse, Fawkner Cemetery, Preston Reservoir, Fitzroy, Eltham, Ringwood, Kew, Dandenong, Spring Vale Cemetery, Frankston, Sandringham, St. Kilda, Port Melbourne, including also the lines from Burnley to Waverley Junction, and Fairfield Park to Oakleigh.

A straight track, without super-elevation, and on which passenger trains run, must not be nearer to any structure than is shown in the diagrams on pages 143, 145 and 147 for lines of 5ft. 3in. gauge, and on page 149 for lines of 2ft. 6in. gauge.

In any instance in which a track is canted through the existence of super-elevation, the measurements required to determine the position of structures with reference to the track, must not be made horizontally or vertically, but must be made either parallel to a straight edge resting on both rails, or square to it, as the case may be; and the centre line over the track must not be assumed to be vertical, but must be square to this straight edge. That is, the track must first be set to correct super-elevation, and then all the centre lines and directions of measurements must be taken as leaning over in the same way as a vehicle would when standing on the track. The measurements must be made with the aid of appliances provided by the Department.

On the diagram on page 145 for new structures within the Melbourne Suburban radius, the clear space below rail level is for a future possible third rail for electric traction, and its distance from the centre of the track will not be affected by curvature.

Above rail level, all the horizontal distances from centres of tracks to structures must be increased wherever practicable, according to the radius of the curve, as shown in the tables A, B, C, D, and E, on pages 22, 23, 24, and 25.

The required vertical distances above rail level are not affected by curvature.

On a curve on which the outer rail is worn, the centre of the track must be taken as though the rail was not worn.

To preserve the proper distance between the track and the platform one long sleeper must be placed near each end, and one near the centre of the platform, and the ends of such sleepers must abut against the front of the platform. At timber faced or decked platforms these long sleepers must abut on the posts.

TABLE A.

Minimum lateral distances required from centre of track to structures between rail level and 8 inches above rail level in the case of structures erected before 1905; and at rail level for structures erected after 1905 outside the Suburban radius.

LINES OF 5 FT. 3 IN. GAUGE.

ON THE OUTSIDE OF CURVES.			ON THE INSIDE OF CURVES.		
Radius.		Distance Required.	Radius.		Distance Required.
From—	To—		From—	To—	
Over 390 ft.	430 ft.	4 11	Over 310 ft.	430 ft.	4 3
" 430 "	490 "	4 10	" 430 "	700 "	4 2
" 490 "	570 "	4 9	" 700 "	35 chains	4 1
" 570 "	670 "	4 8	" 35 chains		4 0
" 670 "	820 "	4 7			
" 820 "	15 chains	4 6			
" 15 chains	21 "	4 5			
" 21 "	32 "	4 4			
" 32 "	75 "	4 3			
" 75 "		4 2			

TABLE B.

Minimum lateral distances required from centre of track to structures from 8 inches above rail to platform level in the case of structures erected before 1905, from 8 inches above rail level to platform level in the case of structures erected after 1905 outside the Suburban radius, and from rail level to platform level in the case of structures erected after 1905 within the Suburban radius.

LINES OF 5 FT. 3 IN. GAUGE.

ON THE OUTSIDE CURVES.			ON THE INSIDE OF CURVES.		
Radius.		Distance required.	Radius.		Distance Required.
From—	To—		From—	To—	
Over 320 ft.	370 ft.	5 9	Over 380 ft.	420 ft.	5 9
" 370 "	440 "	5 8	" 420 "	470 "	5 8
" 440 "	540 "	5 7	" 470 "	530 "	5 7
" 540 "	690 "	5 6	" 530 "	610 "	5 6
" 690 "	970 "	5 5	" 610 "	730 "	5 5
" 970 "	23 chs.	5 4	" 730 "	900 "	5 4
" 23 chs.	59 "	5 3	" 900 "	18 chs.	5 3
" 59 "	...	5 2	" 18 chs.	26 "	5 2
			" 26 "	53 "	5 1
			" 53 "	...	5 0

TABLES C.

Minimum lateral distances required from centre of track to Goods platforms and high level Passenger platforms.

LINES OF 2 FT. 6 IN. GAUGE.  
To Goods Platforms (1 ft. 10 in. above rail level).

On the Outside of Curves.			On the Inside of Curves.		
Radius.		Distance Required.	Radius.		Distance Required.
From.	To.		From.	To.	
Over 130 ft.	180 ft.	5 5	Over 105 ft.	140 ft.	5 4
" 180 ft.	300 ft.	5 4	" 140 ft.	200 ft.	5 3
" 300 ft.	640 ft.	5 3	" 200 ft.	320 ft.	5 2
" 640 ft.		5 3	" 320 ft.	20 chs.	5 1
			" 20 chs.		5 0

On the Outside of Curves.			On the Inside of Curves.		
Radius.		Distance Required.	Radius.		Distance Required.
From.	To.		From.	To.	
Over 130 ft.	180 ft.	5 5	Over 105 ft.	140 ft.	5 4
" 180 ft.	300 ft.	5 4	" 140 ft.	200 ft.	5 3
" 300 ft.	640 ft.	5 3	" 200 ft.	320 ft.	5 2
" 640 ft.		5 3	" 320 ft.	20 chs.	5 1
			" 20 chs.		5 0

NOTE.—For Narrow Gauge Clearance diagram on a straight track see page 149.

CLEARANCE.

TABLE D.  
Minimum lateral distances required from centre of track to structures above platform level.  
LINES OF 5 FT. 3 IN. GAUGE.

Radius.		ON THE INSIDE OF CURVES.													
		Structures Erected prior to 1905.				Structures Erected 1905 or since.				In the case of—					
From—	To—	Up to 9 ft. 8 in. from rail.		At 12 ft. 7 in. from rail.		At 13 ft. 9 in. from rail.		Up to 11 ft. from rail.		At 13 ft. 2 in. from rail.		At 14 ft. 6 in. from rail.		At 15 ft. 6 in. from rail.	
		ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Over 400 ft.	450 ft.	7 4	7 3	9 8	9 8	7 8	7 8	9 8	7 8	5 6	5 5	6 6	3 3	3 3	3 3
" 700 "	510 "	6 11	7 2	5 8	5 8	3 8	3 8	5 8	3 8	3 5	3 4	3 1	3 2	3 2	3 2
" 26 chs.	590 "	6 10	7 1	5 7	5 7	3 7	3 7	5 7	3 7	3 4	3 3	3 0	3 1	3 1	3 1
	700 "	6 9	7 0	5 6	5 6	3 6	3 6	5 6	3 6	3 3	3 2	3 0	3 1	3 1	3 1
	850 "	6 9	7 0	5 5	5 5	3 5	3 5	5 5	3 5	3 2	3 1	3 0	3 1	3 1	3 1
	16 chs.	6 11	6 11	5 4	5 4	3 4	3 4	5 4	3 4	3 1	3 0	2 10	3 1	3 1	3 1
	24 "	6 9	6 10	5 3	5 3	3 3	3 3	5 3	3 3	3 0	2 10	2 9	3 0	3 0	3 0
	39 "	6 8	6 9	5 2	5 2	3 2	3 2	5 2	3 2	2 11	2 9	2 8	3 0	3 0	3 0
	158 "	6 7	6 8	5 1	5 1	3 1	3 1	5 1	3 1	2 10	2 8	2 7	3 0	3 0	3 0
	158 "	6 7	6 7	5 1	5 1	3 1	3 1	5 1	3 1	2 10	2 8	2 7	3 0	3 0	3 0

CLEARANCE.

TABLE E.

Minimum lateral distances required from centre of track to structures above platform level.

LINES OF 2 FT. 6 IN. GAUGE.

ON THE OUTSIDE OF CURVES.				ON THE INSIDE OF CURVES.			
Radius.		Platform level to 9 ft. 6 in. above rail.	At 12ft. 6in. above rail.	Radius.		Platform level to 9 ft. 6 in. above rail.	At 12ft. 6in. above rail.
From—	To—			From—	To—		
Over 100 ft.	...	ft. in. 6 5	ft. in. 5 2	Over 120ft.	140 ft.	ft. in. 6 10	ft. in. 5 7
				" 140	160 "	6 9	5 6
				" 160	195 "	6 8	5 5
				" 195	250 "	6 7	5 4
				" 250	340 "	6 6	5 3
				" 340	600 "	6 5	5 2
				" 600	37 chs.	6 4	5 1
				" 37 chs.	...	6 3	5 0

93. On adjacent tracks the distance measured in the "6ft." between the running edges of the nearest rails, must not be less than 6ft. 5in. on tracks of 5ft. 3in. gauge, and 8ft. 6in. on tracks of 2ft. 6in. gauge, and in the event of the rails being worn this measurement must be taken as though they were not worn.

The minimum distance required between tracks for various curves is shown in Table F, on page 26. In the event of the outer track having more super-elevation than the inner one, the 6ft. must be further increased by an amount equal to twice the difference of the super-elevation, for the 5ft. 3in. gauge, and three times the difference for the 2ft. 6in. gauge. In the event of the outer track having less super-elevation than the inner one, the widening due to curvature may be reduced by an amount equal to three-quarters of the difference of the super-elevation, in the case of 5ft. 3in. gauge, and by an amount equal to the difference in the case of 2ft. 6in. gauge.

TABLE F.

Minimum distances required in the "6 ft." between adjacent tracks measured between the running edges of rails.

5 FT. 3 IN. GAUGE.			2 FT. 6 IN. GAUGE.		
Radius.		Distance Required.	Radius.		Distance Required.
From—	To—		From—	To—	
Over 350 ft. ...	370 ft.	7 9	Over 110 ft. ...	165 ft.	8 10
" 370 " ...	390 "	7 8	" 165 " ...	310 "	8 9
" 390 " ...	420 "	7 7	" 310 " ...	42 chains	8 8
" 420 " ...	455 "	7 6	" 42 chains ...	...	8 7
" 455 " ...	490 "	7 5			
" 490 " ...	540 "	7 4			
" 540 " ...	590 "	7 3			
" 590 " ...	660 "	7 2			
" 660 " ...	750 "	7 1			
" 750 " ...	850 "	7 0			
" 850 " ...	1000 "	6 11			
" 1000 " ...	19 chains	6 10			
" 19 chains ...	25 "	6 9			
" 25 " ...	38 "	6 8			
" 38 " ...	81 "	6 7			
" 81 " ...	...	6 6			

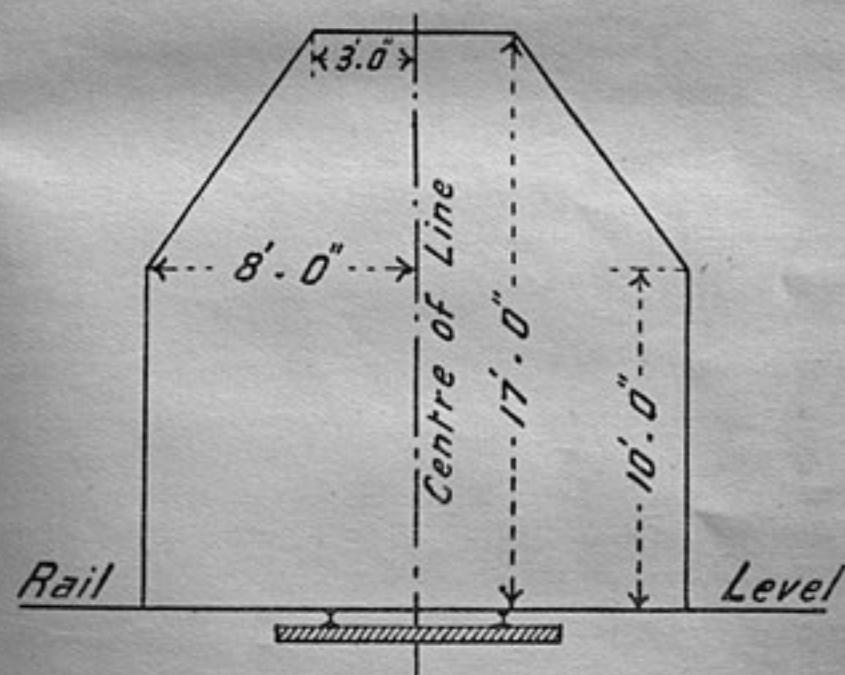
In any instance in which the minimum measurements to structures on straights as shown in diagrams, the increased minimum measurements to structures on curves as shown in Tables A, B, C, D, and E, the minimum distance between tracks on straights, or the increased minimum distance between tracks on curves, as shown in Table F, do not exist at any place, the Workmaster or Roadmaster must report the facts in writing, so that full particulars may be properly recorded; but, except in a case of emergency, an alteration must not be made to the position of an existing structure or track without special instructions from the Head Office.

94. Every structure on which a contractor or other person is working must be kept safe for the passage of trains, or properly protected with signals.

95. The track under any bridge, or in any tunnel, goods shed, warehouse, locomotive and car shop or shed, or workshop, must not be lifted without the written authority of the

Head Office. In any locomotive shed, the lowest points of the ends of smoke troughs, where liable to be touched by the chimney of a locomotive, must not be less than ~~13ft. 11in.~~ <sup>14ft. 3 inches</sup> above rail level.

96. The Inspector of Interlocking must see that, where necessary, semaphores are stayed, so that in the event of a mast falling, the tracks will be clear. Any stay across the track must, if possible, be avoided, but when any such stay is required, the minimum clearance from rail level, as shown in the diagram hereunder, must be strictly observed.



97. Any tree which is in danger of falling on the track, or which interferes with the clearance of trains, or obscures the view at a level crossing or elsewhere, must be trimmed, or, if necessary, cut down. In the event of any such tree being on private property, or on a public road, the Head Office must first be notified, so that arrangements may be made with the landholder for its removal.



### Fences, Roadways, Crossings, and Signs.

**104.** The Ganger must see that every fence on his length is kept in good order, and is not less than 3ft. 6in. in height. Where the ground outside is high, as at a level crossing, the fence must be kept correspondingly higher, and where the ground has silted up, the fence must be raised. Where the ground under the fence is cut away by the action of water, the line must be properly protected from horses, cattle, or other animals.

**105.** The following extract from the Fences Act is included for general information:—

Any fence of any of the kinds hereinafter mentioned and described shall be a sufficient fence within the meaning of this Act:—

- (1) A post and rail fence at least 3ft. 6in. in height, of substantial material, firmly erected, with no greater distance between the rails or the bottom rail and the ground than 1 foot, unless there be a wire inserted between the rails, and the posts not more than 9 feet asunder.
- (2) A substantial paling fence at least 3ft. 6in. in height, with no greater distance between the palings than 4 inches.
- (3) A substantial wire fence at least 3ft. 6in. in height, having wires tightly stretched with no greater distance between each of the three lowest wires or the bottom wire and the ground than 7 inches, and the posts or standards or binding wires of which are not more than 11 feet from each other, with straining posts not more than 100 yards apart.
- (4) A bank or wall of substantial materials at least 4 feet in height, and not less than 2 feet wide at the bottom and 9 inches at the top.
- (5) A close hedge or live fence at least 4ft. 6in. in height, and capable of resisting the trespass of cattle.
- (6) A log fence not less than 4 feet high, 3ft. 6in. wide at the base, and 1ft. 6in. wide at the top.

- (7) A fence at least 4 feet in height, composed of logs and chocks, the logs not exceeding 18 feet in length between the chocks, and the chocks of no greater thickness than will leave an opening of 1 foot between each log and between the bottom log and the ground.
- (8) A combination of any of the above-mentioned fences at least 4 feet in height.

**106.** Dropper fencing, as per diagram on page 151, is the standard adopted by the Department for country districts, and must be adhered to except in any special place, such as at a wing or guide fence to a public road crossing, or at a station yard, etc., on an important line, at which post and rail, or other approved type of fencing, must be erected. The top of every post used for dropper fencing must be neatly rounded off. The wires of dropper fencing must not be fixed to any gate post, but to a properly strutted post placed alongside.

**107.** The Ganger must see that the wires attached to cattle guard beams are kept in good order.

**108.** The Workmaster and the Roadmaster must report to the Head Office any instance in which a fence or hand rail is not required in its existing position, or in which a gate is not required, or should be replaced by a smaller gate.

**109.** The Roadmaster and the Ganger must see that every fence erected on land leased for grazing purposes is maintained in good order and condition by the lessee. The following is the description of fence which must be erected (see also the diagram on page 153):—

- (1) Every post must have a sectional area of not less than 21 square inches, and be not less than 1ft. 10in. in the ground, nor more than 33 feet from the next post.
- (2) There must not be less than five wires, viz.:—4 plain wires of number 10 gauge, and 1 barbed wire on top, except in any station yard at which the fence adjoins a roadway or pathway, where a plain wire

must be used on top in place of barbed wire. To facilitate inspection of bridges, barbed wire must not be used on or within 10 feet of any fence turned under the span of a bridge.

- (3) The wires must be spaced as follows:—The bottom wire must not be more than 6 inches above the surface of the ground, the next wire 6 inches higher, the next 8 inches higher, the next 11 inches higher, and the top wire, whether plain or barbed, 14 inches higher.
- (4) At intervals of not more than 8 feet 3 inches between the posts, droppers, each 3 feet 9 inches by 2 inches by 1 inch, must be fastened securely to each wire.
- (5) The lessee must provide a proper entrance gate to the land and must maintain it in good order.

**110.** The owner or occupier of any land adjoining that of the Department must not be permitted to fix any fence wire or rail to the pile of any bridge; and any fence erected by a landholder on railway land opposite a bridge must be on the down stream side only, and at least six (6) feet away from the nearest pile of the bridge. Every such fence must be specially authorised by the Head Office.

**111.** The roadway and pathway at every public cattle guard crossing, within a distance of seven (7) feet from the outer rail on each side of the track, every pathway constructed on Railway land adjoining a public crossing, the roadway at every occupation crossing, and every other roadway and pathway within Railway fences, must be properly maintained, unless special instructions to the contrary are issued by the Head Office.

The roadway and pathway at every public gate crossing must be properly maintained for a distance of seven (7) feet outside the gates on each side of the railway.

**112.** In any instance in which doubt exists as to who is responsible for the maintenance of a roadway, pathway, culvert, drain, etc., an application containing full particulars must be forwarded to the Head Office for instructions.

113. The Ganger must give close attention to the condition of every road and foot crossing. The ballast must be kept level with the top of the rails throughout the whole width of the crossing, and for a distance of at least three (3) feet on either side of the defined roadway and pathway, and any side drain, etc., within a similar distance, must be covered with old sleepers. When repairing the track or the roadway at a level crossing care must be taken to thoroughly blind and consolidate the material so as to leave the surface uniform and prevent any loose metal, etc., accumulating at or near the rails. The metal or gravel used must be of small gauge, and any stones larger than  $1\frac{1}{2}$ " should be picked out and removed. The crossing, or track adjacent to it, must not be left stripped of ballast overnight. All material must be kept clear of the flangeways.

114. Channel fishplates must not be used at any level crossing. The rails, fishplates, and sleepers, at every level crossing must be examined periodically by opening up to see that they do not become excessively worn, and that they are in proper order.

115. Grass must be chipped away from inside and around every cattle guard, so that an inducement will not be offered cattle to cross, stray on, or become foul of the guards.

116. The guide posts at every gate and cattle guard crossing, and the bridge piles at the public roadway under any bridge must be painted white.

117. In every instance in which it is known that the adjacent land on opposite sides of the railway at an occupation crossing belongs to different owners, or that an occupation or public road crossing is no longer required, a full report must be sent to the Head Office.

118. Unless otherwise instructed, the wicket gates must be taken out at any cattle guard crossing, from which the gatehouse has been removed, and the fence must be made good.

119. The Worksmaster must place notice boards at every cattle guard crossing, in accordance with the diagram on page 155, and at every level crossing used for foot traffic, in accordance with the diagram on page 157. Every such notice must be placed clear of the roadway, so that it may be plainly seen by any person approaching the line from either side and so that it will not interfere with the lighting of the crossing.

120. The Roadmaster must place notices referring to the closing of gates at every occupation crossing.

121. The Roadmaster must place trespass notices at every Bridge of 150 feet in length and over. The Ganger must report to the Roadmaster every instance in which it is considered necessary to place trespass notices at any other bridge, or at any point on the line where it is known that trespass takes place or is likely to occur. At such places, the Roadmaster after inspection must arrange for the erection of trespass notices if he is satisfied that they are required.

122. The Roadmaster must place whistle posts, in accordance with the diagrams on pages 159 and 161, at every cattle guard crossing and at other specially approved places.

123. The Roadmaster must place curve boards, in accordance with the diagram on page 163, four feet from the nearest rail, at the tangent points of transition curves and straight track at each end of every curve of 15 chains radius or under. At the up end of the curve the board must be placed on the left hand side going from Melbourne, and at the down end the board must be placed on the right hand side going from Melbourne.

The board must show the radius of the curve in chains, and the pointed end the direction of the curve. For a right-handed curve the pointed end must be on the right side of the post, and for a left-handed curve on the left side of the post.

124. The Worksmaster must erect mile and half-mile posts in accordance with the diagram on page 165. Every mile post must show the mileage from Melbourne, and every mile and half-mile post must be placed on the down side of the line in the position in which it can be seen most easily from passing trains.

125. The Roadmaster must erect gang posts, in accordance with the diagram on page 167. Every gang post must be placed diagonally to the line on the up side, at the boundaries of lengths, and must show the number of the gang on each side of the post.

126. The Roadmaster and the Ganger must see that every notice, notice-board, track sign, and whistle or other post is maintained in its proper position, and that the printed matter thereon is renewed when necessary.

127. Marks and figures showing mileages, etc., must be carefully preserved, and in the event of it being necessary at any time to temporarily remove them, great care must be taken to preserve their exact position, and carefully replace them.

### Roadmasters and Gangers.

**138.** The Roadmaster must continually be vigilant in the inspection of his section; and must note the condition of the track, and take the necessary action to secure its safety and proper running order; travel frequently on the engine, and go over every length, either walking, or by hand car, or motor car, twice a month, accompanied by the Ganger at least once a month; visit specially any new or extra works in progress; enter daily in his diary full particulars of each day's inspection, and forward such diary once in every month to the Superintending Roadmaster for his perusal.

**139.** The Roadmaster must see that every windmill is kept properly oiled by trackmen.

**140.** Trackmen must clear the ashes from every engine pit and load them into trucks, except at any depot at which this work is performed under contract, and must discharge ashes whenever required, and the Roadmaster must see that these duties are properly performed. Ashes must not be allowed to accumulate at any depot, but must be removed as often as necessary. The Way and Works Branch has the right to all ashes, and they are not to be sold or otherwise disposed of without the authority of the Head Office.

**141.** In any instance in which it is necessary to reduce temporarily the speed of any train, or to break or block the line for any purpose, the Roadmaster must notify the Head Office on the proper form. Every such notification, except in a case of emergency, must reach the Head Office not later than Friday, to ensure inclusion in the "Weekly Notice." The Roadmaster must advise the Head Office promptly when any speed restriction may be withdrawn.

**142.** The Roadmaster must advise the Estate Officer promptly when any Departmental residence, gatehouse, portable or other building becomes vacant, and of any change in occupation. Trackmen must see that any vacant Departmental house, etc., is not used by tramps or unauthorised persons.

**143.** The Roadmaster must use the carbon memo. book with which he is provided in every instance in which he gives a written order to an employe under his control, and must keep on the block a copy of the order.

144. A Depot Ganger must not be transferred from his ordinary length to take charge of extra work on any other length without the authority of the Head Office.

145. The extent of any Ganger's length must not be altered without the authority of the Head Office.

146. Every Track Ganger is under the control and direction of the Roadmaster, and is responsible to him for the safe, efficient, and economical maintenance of the length. Every Ganger must engage personally in work, and see that all employes in his charge, viz.: Fencers, Repairers, and other track Labourers and Way and Works Gatekeepers, perform their duties faithfully. In a case of emergency, the Ganger must arrange to relieve any Gatekeeper from duty, and place a suitable person in charge of the gates and report the circumstances to the Roadmaster.

147. The Ganger and the Fencer must write up their respective diaries at the end of each day, showing full particulars of the work done by the gang, and forward the sheet to the Roadmaster every week.

148. Each length must be patrolled and examined from end to end on every day on which a train is scheduled to run thereon; but in any instance in which trains do not run daily, and the length cannot be patrolled and examined before the passage of the first train, the duty must be performed on the previous evening, subject to the reservation that in every instance it must be carried out at such time of the day as the Roadmaster may direct in writing. The Ganger should patrol the length personally, but may, if necessary, appoint a trustworthy trackman to perform part of this duty. The Ganger must, however, examine the whole of the length personally at least once a week.

149. Every length over which a train is scheduled to run on Sundays must be patrolled by the Ganger and senior Repairer on alternate Sundays. The senior Repairer, whilst patrolling the length on Sunday, is practically in the position of acting Ganger from 7.30 a.m. until midnight, except in a case of emergency (such as accident), when the Ganger, if he is available, must take charge, and assume full responsibility, and the senior Repairer resume his usual place in the gang.

(Special attention is directed to Regulation 288, respecting the safety of Way and Works during wet weather, storms, and floods.)

150. Trackmen, when patrolling a length, must carry the tools and materials necessary to secure loose fastenings, and a red flag and six (6) detonators, and, when passing through a tunnel, they must carry a lighted hand lamp. The road-bed, track, and points and crossings, and every bridge, culvert, cattle guard, fence, and road crossing, must be examined carefully, and any defect or obstruction which cannot be repaired or removed must be protected in accordance with the regulations, until attended to.

A close inspection must be made of every rail and fish-plate, so that any breakage or flaw may be detected.

When passing through a cutting, trackmen must keep a sharp look-out, and if any loose portion of earth, rock, etc., is deemed likely to fall, the track must, if necessary, be protected at the point until arrangements are made for the removal of the loose matter.

The Worksmaster must immediately be furnished with particulars of any damage to a non-interlocked gate or of any such gate which is out of repair, or any accident or apparent weakness affecting the safety of any bridge or structure.

The Signal Adjuster must immediately be furnished with particulars of any damage to an interlocked gate, or of any such gate which is out of repair.

Any gate found open at a place at which no one is in charge must be closed.

The Station-master must immediately be informed of any damage to buffer stops.

Any truck cover or lashing lying at a No-one-in-charge station must be folded and tied up, and placed on the platform, so that it may be picked up readily by the guard.

**151.** Trackmen must give close attention to the Telegraph and Telephone wires, whether belonging to the Railway or the Postal Department; and must observe the following instructions:—

Any unsafe pole must be secured.

Any tree, sapling, etc., which is likely to touch or fall upon the wires, must be cut down to a safe height, and neatly trimmed.

Any wires which are twisted or touching must be separated. Any wire touching the roof of a building must be raised so as to swing clear. Any wire swinging low over the track must be raised so as to give not less than seventeen (17) feet clearance from rail level; and any wire swinging low over a crossing must be raised so as to give not less than eighteen (18) feet clearance for road traffic. The ends of any broken wire must be scraped for 3 or 4 inches, so that clean metal surfaces will touch, and then twisted, and the tie wire—with which each Ganger is supplied—must be wound round the joint. If the ends cannot be brought together, they must be connected with the tie wire, of which several thicknesses must be used so as to stand the strain.

In any instance in which two or more wires are broken, care must be taken, by tracing back the wires on either side, to see that they are not connected up to wrong ends.

A wire must not be allowed to touch any metal, such as a wire fence, or the stay of a semaphore. Any wire resting on an iron bracket must be lifted off. Any wire which has come down, but is not broken, must be raised so as not to touch the ground. In dry weather a wire may be tied to the bare poles, but in wet weather must be tied to the insulators by means of a tie wire.

Every repair which has been made, and every fault which has been noticed, must be reported immediately to the nearest Telegraph office.

Every effort must be made to prevent the breakage of telegraph insulators. A sharp look-out must be kept for offenders in this respect, and if any breakage can be traced definitely the case must be reported to the Head Office.

**152.** Where track circuits are in use for any purpose such as the automatic control of signals, or for the operation of crossing bells, trackmen must observe strictly the following instructions:—

The ballast must be kept clear of the rails, and the rail top must be kept clear and free from scale. Special care must be taken and special attention given in any instance in which the rails are near dead ends.

Whilst packing sleepers, every care must be taken to prevent the accidental breakage of the bonding wires.

Any metallic connection, such as a wire, rod, bolt, tool, or other metallic substance, which might connect the two opposite rails of the same line, must be removed, or, if necessary, the Electrical Fitter sent for. The Electrical Fitter must also be communicated with at once in any instance in which any bonding wire at a rail joint has been displaced, or in which any other connection is defective.

The Electrical Fitter must be in attendance in every instance in which a rail is taken out, and must disconnect the bonds, and re-connect them when the rail has been replaced. An insulated block at a rail joint must not be removed, unless the Electrical Fitter is present to see that it is efficiently replaced, and only the special plugs provided for the purpose must be used between rail ends at the joint. This instruction, however, does not apply to any broken rail or other defective materials, which must be removed from the track with the least possible delay, and replaced with sound materials.

During preparations for relaying, the new rails must not be left in such positions as to cause any metallic connection with the running rail. The new rails

must be drilled and bonded before being placed in position, and, when they are ready for slewing, the Electrical Fitter must be on the ground to disconnect the bonds from the old rail, and re-connect them to the new rail.

A special wooden track gauge must be used in place of the usual iron gauge. In any emergency in which a wooden gauge is not available, a piece of dry paper must be placed between the gauge and the rail to prevent any interruption of the track circuit.

Before any motor car or hand car (i.e., trolley, tricycle or quadricycle) is placed upon the line in a track circuited area the Ganger, Repairer or other person in charge must advise the Signaller on duty of its destination, and must not proceed until the Signaller's permission has been obtained. The Ganger, Repairer or other person in charge must also be careful to ascertain that the Fixed Signal or Signals controlling the entrance to the section on to which he is about to proceed are all at danger.

Where treadles are attached to the rails for any purpose, the track and ballast in the vicinity must not, except in a case of emergency, be disturbed, unless the Electrical Fitter is present. In a case of emergency, the nearest Signaller must be informed before the treadle or the track is disturbed.

Where crossing bells are operated by track circuits, the Ganger will be supplied with a special key for testing the bell, and will be instructed in the use of the key by the Electrical Fitter, and must test the bells daily when patrolling the length.

If the bell is found to be ringing continuously, the fault will probably be due to a broken bond wire, or to the rails being connected together by some metallic substance.

In any instance in which the bell is not working properly, word must be sent to the Electrical Fitter by the quickest means, and a report furnished to the Roadmaster as early as possible.

**153.** Trackmen must read carefully the special train notices at stations, and note the running of any special train, and must, as far as possible, acquaint the trackmen of any adjoining length where there is not any station, of the running of any special train, and also deliver any correspondence, for which purpose a letter box must be provided where the lengths adjoin.

**154.** Trackmen must shift the camp, tools, and equipment of Fencers, and also, if necessary, assist to load or unload and distribute fencing material.

**155.** At every gate crossing at which a fireplace is provided in the cabin, seventy (70) unserviceable sleepers per annum must be supplied free of cost.

**156.** Every Gatekeeper must keep the cabin private, and must not permit any one other than an employe in the execution of his duty to enter. Loiterers must not be permitted to remain on railway crossings.

### Roadbed, Drainage, and Ballast.

165. The roadbed is the foundation of the track below the ballast, and upon its solidity and permanence the stability of the track mainly depends. As far as practicable, it must be constructed and maintained to the prescribed standards, in accordance with the diagram on page 203. To secure uniformity, trackmen must use standard earthwork templates, unless otherwise directed.

166. In any instance in which the formation is narrow, but can conveniently be widened to the proper standard, the work must be done gradually by trackmen.

167. The growth of vegetation on the slopes of every bank and cutting, except in rock, must be encouraged in order that the slopes may be protected permanently against the action of the elements. In any rock cutting, scrub growth, and any portion of rock likely to fall on to the track, must be removed.

168. Earth material required for any purpose must, if possible, be obtained in such a way as to benefit the line, viz.:—by widening cuttings, trimming side cuttings, ditches, drains, etc. Surface soil for making up the formation cesses must be taken out uniformly, and not in an irregular and patchy manner.

169. The lines of every ditch and drain, and the edges of every slope must be well and neatly defined, and a "nicking out" line must always be used for the purpose. Every ditch and drain running in the same direction as the track must be parallel with the rails, or with the slopes of any cutting or bank, except in any special case, in which it is necessary to deviate to make the drainage effective.

170. Side cutting must not be taken out in a station yard, except with special authority.

171. The most important factor in the maintenance of track is drainage. Water is the worst enemy of good track, and trackmen must lead it as quickly, and as far as possible, from the ballast and roadbed.

172. The formation cesses must not slope from the outer edge towards the track, as more water would thereby be led to the ballast, and prevented from draining away.

173. Every drain and ditch necessary to divert water from the roadbed, or to a culvert, must be maintained properly, and the cleaning of every old, and the cutting of every new ditch must be completed before each winter. Every drain and ditch must be watched and any tendency to scour on the track side must be checked promptly by the use of spalls, brush, or old sleepers. In any instance in which it is necessary to trim the bed to remove vegetation, care must be taken that hollows are not left to form pools of stagnant drainage.

174. Ballast must be kept neatly trimmed, and must be shaped in accordance with the standard diagram on page 203, and boxed up level with the top of sleepers. Large stones or boulders must be broken up, or picked out, and stacked in heaps for use as spalls.

175. The depth of ballast must conform to the standard diagrams on page 203 for first class, second class, and narrow gauge lines, respectively. In any instance in which less than the prescribed depth exists, and more ballast is required, the track must be lifted, unless the level is fixed by the clearance of structures, etc., in which event the roadbed must be excavated to get the depth under the sleepers. In any instance in which a greater depth exists, the formation cesses must not be built up to the prescribed depth, unless provision is made for properly draining the ballast.

176. The depth of ballast under sleepers on any bridge must be three (3) inches.

177. In any soft spot, the soft material must be taken out in dry weather to such a depth, and in such manner, as to ensure proper drainage, and the space filled with ashes, gravel, or other suitable material. In some places it may also be necessary to provide French drains, or space the sleepers 1ft. 9in. centres, but the authority of the Head Office must be obtained therefor.

178. Before ballast is distributed, the roadbed must be properly prepared. Any unsuitable material above formation level must be removed and, if necessary, utilised to widen banks. Earth or clay must not be mixed with ballast, nor ballast wasted down the slopes of banks.



**179.** In any instance in which the ballast becomes hard in the centre and causes the track to rock (which may more frequently occur with strong gravel ballast), a light running lift must be made to take the track off the old bed, and to restore elasticity, but if this cannot be done owing to the scarcity of ballast, or other cause, the ballast must be taken out from under the centres of the sleepers so that the bearing takes place under the rails, as shown in the diagram on page 74.

**Track.**

190. The track comprises the rails, fastenings, and sleepers. Sections of all classes of rails are shown in the diagram on page 169. Particulars of materials used with all classes of rails are given in the statement on page 51.

191. Steel rails 80lb. "O" class, and 100lb. "P" class, are the standard sections for new rails on heavy lines, and standard fastenings for these rails are shown in the diagrams on pages 171 and 173.

192. Special lengths of rails are made for use in connection with points and crossings.

193. Short length rails are used for the inner rail of curves, in combination with the standard or general lengths. They are four (4) inches shorter, but the lead at any joint is not to exceed two (2) inches. The approximate number of short length rails for various curves can be found by the following rules:—

On a line of 5ft. 3in. gauge.

Multiply the length of the curve in chains by  $16\frac{1}{2}$ , and divide by the radius in chains.

On a line of 2ft. 6in. gauge.

Multiply the length of the curve in chains by  $8\frac{1}{4}$ , and divide by the radius in chains.

194. Any rail shorter than eighteen (18) feet in length must not be used in main track, except for closures in connection with points and crossings.

195. Unless otherwise instructed, standard rail must be laid with broken joints, as shown in the diagram on page 175—the joints of one rail to be opposite the middles of the other rail. Through any station yard, and with points and crossings, standard rail must be laid with square joints, as shown in the diagram on page 177, the joints to be exactly opposite each other. Special lengths of rails must be used, where required, to avoid rail joints on the roadway at any level crossing, or at the ends of any bridge, etc., and, if necessary, standard rail may be changed for a few lengths from broken to square joints.

**Statement showing Track Materials for Various Classes of Rails.**

Class.	Rails.		Fishplates.		Fishbolts.		Spring Washers.		Pins.		Dog Spikes.		Sleepers.		Permissible Wear of Rail Head.	
	Total in Main Tracks at 30.6.1907.	Weight per Yard.	General length.	Type.	Per Joint.	Size.	Size.	Size.	Size.	Size.	Size.	Standard Section.	No. per General Rail Length.	Inches.	Inches.	Inches.
Iron A	16	50	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$9 \times 4\frac{1}{2}$	8	8	8	8
Steel B	17	50	22	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$9 \times 4\frac{1}{2}$	8	8	8	8
Iron C	78	60	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel C	113	60	22	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel D	1,755	60	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel D	165	60	28	Channel	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	12	12	12	12
Steel N	30	60	31	Channel	6	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	12	12	12	12
Steel E	188	66	22	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel F	62	66	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel H	502	75	23	Channel	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel I	63	75	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Iron K	27	80	23	Flat	4	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	8	8	8	8
Steel K	76	80	31	Channel and angle	6	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	12	12	12	12
Steel O	548	80	31	Channel and angle	6	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	12	12	12	12
Steel P	111	100	31	Channel and angle	6	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$10 \times 5$	12	12	12	12

**196.** Rails must not be unloaded from any train in motion, and both ends of each rail must be dropped simultaneously. Rails which are being unloaded into stacks, must be slid down proper skids. In every instance the greatest care must be taken to avoid injury by dropping a rail on another, or on a hard or uneven surface. Any rail bent in unloading must be straightened before being laid in the track. Any rail with a flaw or defect in the bottom flange must not be placed in the main track, as it is liable to break in service.

**197.** Rails must be laid with the rolling mill brand outwards, and the date on which they are placed in the track must be branded on the outside of web, at the starting and terminating points, and at half-mile and mile posts.

**198.** New or serviceable rails must be laid continuously with other rails of the same class; and serviceable rails of similar condition of wear must, as far as possible, be laid together.

**199.** When track is being relaid, the joint sleepers must be promptly and properly spaced, and completely fastened to avoid creep. The spacing and renewal of the other sleepers, and the surfacing and lining of the track, must then be done not later than the following day.

**200.** When one or two rails at a time are being renewed, serviceable rails of the same class, and, as far as possible, of the same condition of wear, must be used, and each rail must be branded with the date on which it is placed in the track.

**201.** Rails of different classes must have their heads brought to the same gauge and level by junction fishplates. A good fit must be obtained in junction plates and the joint sleepers must be kept well packed.

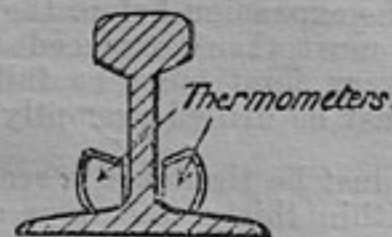
**202.** The Roadmaster and the Ganger must watch closely the wear of rails on curves and on straights; and the Roadmaster must frequently test, with rail templates, any place at which the heads of rails have become much worn. In any instance in which the template can be inserted so that it rests on the flange with the two beads touching the web, as shown in the diagram on page 181, the rails must be replaced as soon as practicable.

**203.** Proper allowance must be made for expansion, according to the length of the rails, and the temperature when they are being laid, as shown in the following table:—

Lengths of Rails.	20' to 23'.	28' to 31' 9".	37' 3" and 42' 9".
Range of Temperature.	Expansion Space. Inches.	Expansion Space. Inches.	Expansion Space. Inches.
40° to 65° .. ..	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{1}{8}$
65° to 90° .. ..	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{5}{16}$
Over 90° .. ..	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{5}{16}$

The expansion space must be secured by using iron expansion gauges, which are issued in sets, consisting of 170 gauges of each thickness shown in the table. The gauges are threaded on steel rings; and three (3) steel hooks, and three (3) thermometers are issued with every set. Care must be taken to avoid injuring the gauges by any blow or bump. The gauges must be left in the joints until the track is fully spiked and bolted, and, if necessary, the steel hooks must be used for withdrawing them. After withdrawal, the gauges must be threaded on the proper rings, and well oiled before being put away.

The temperature of the rail must be obtained by placing two thermometers on the rail flange for fifteen (15) minutes, as indicated in the diagram hereunder, and ascertaining the mean temperature.



Readings of thermometers must be taken at reasonable intervals throughout the day, and when the temperature is rising, and approaching the maximum temperature for the

thickness of gauge being used, it is of the greatest importance to remove all the gauges from the rail joints as soon as possible, to allow the rails to expand freely; and, if the track is not fastened to prevent creep, to substitute other gauges corresponding to the higher range of temperature.

**204.** As rails tend to buckle during hot weather, trackmen must see that proper expansion is maintained at each joint, and that the joint is not screwed up so tightly as to prevent the rails from expanding.

**205.** The clearance space between the rails on any truck weighbridge and the track rails must not be less than a quarter of an inch, nor more than half an inch, and any variation from these limits must at once be attended to.

**206.** Angle fishplates, for both inside and outside plates, are standard for 80lb. "O" and 100lb. "P" class rails. They are thirty (30) inches long, and extend across the joint sleepers. The plate with the large oval holes for the neck of the fishbolt is the outside fishplate.

**207.** Every fishbolt must be placed with the nuts on the inside of the rail.

**208.** The types of fishplates, and the number and size of fishbolts for each class of rail, are shown in the table on page 51. Care must be exercised to use the proper inside and outside plates for each class, and the proper kind of bolts for the different types and makes of plates.

**209.** At the time the rail is laid, the two centre bolts, and, in the case of six-bolt plates, also the two end bolts must be placed in the joints, and tightened sufficiently to hold the rail in line and preserve the expansion before the joints are spiked. The remaining bolts must then be placed, and tightened as soon as possible. Every joint must be fully bolted, and, if necessary, the rail must be drilled promptly.

**210.** Every nut must be tightened a second and, if necessary, a third time within thirty (30) days after the track is laid.

**211.** When a rail is being unfished, any tight nut on a bolt must not be knocked off with the hammer, but must be

oiled, and taken off with the spanner when practicable. Every old bolt must be considered serviceable until proved to the contrary. When a rail is being released for use elsewhere, the fishplates must be paired, the bolts placed in the paired plates, and the nuts screwed on.

**212.** Spring washers are used with all new fishbolts, and each nut must only be screwed up sufficiently to compress the washers.

**213.** Sleepers, 9ft. x 10in. x 5in., are standard for main tracks, unless otherwise specified by the Head Office.

**214.** For 80lb. and 100lb. rails, the standard number of sleepers per standard length of rail for either broken joint or square joint track, is twelve (12), as shown in the diagrams on pages 175 and 177. For every other class of rails, the present standard number in main track per general length of rail, is shown in the table on page 51. In any instance in which the existing number is less than the standard number, additional sleepers must not be put in without the special authority of the Head Office.

**215.** For standard rails, the space between the joint sleepers must be ten (10) inches, and for every other class of rails, not less than eight (8), nor more than ten (10) inches. Intermediate sleepers must be properly spaced, and, when additional sleepers are being put in, all the sleepers must be properly re-spaced.

**216.** Every sleeper must be laid at right angles to the track before being spiked, and must not be skewed to suit the pin holes or irregular joints. In any instance in which pins are used, one at each rail end will be sufficient, and it may be driven at any point across the sleeper, not closer than two (2) inches from the edge. In any instance in which the joints are irregular, the lead must be taken off and the joints brought square, and, if necessary, other rails may be used for the purpose.

**217.** Except as instructed in connection with points and crossings, every sleeper must be adzed for the rail seat to a slope of 1 in 20, so as to incline or cant the rails inwards. The adzing must be true and even across the sleeper, and the full width of the rail flange. Adzing must be marked and tested with the templates supplied for the purpose.

**218.** Every sleeper must be adzed so that the portions outside the rails are of equal length. In any instance in which slotted-angle or slotted-channel fishplates are used the joint sleepers must be adzed for a greater width and depth than the intermediates, as shown in the diagrams on pages 175 and 177. Special templates are supplied for marking and testing such adzing.

**219.** In or about April of each year, the Roadmaster, accompanied by the Ganger, must examine the sleepers on each length on his section, and mark and count those which should be renewed during the next financial year. The Roadmaster must make up his estimate accordingly.

**220.** There is probably no item in track work in which the Roadmaster and the Ganger can waste or save as much money as in marking sleepers for ordinary renewals. The importance of the line, the possible speed of trains, the state of adjoining sleepers, and the alignment of the track are the main factors to be considered. A sleeper which will last safely another year must not be renewed.

**221.** When a sleeper is being renewed, the old bed and adjacent sleepers must not be disturbed more than is essential. If necessary, the old bed must be skimmed to get the new sleeper in, and when placed in position, it must be solidly packed. When sleepers are being renewed, practically in a face for any distance, or when additional sleepers are being put in and existing sleepers re-spaced, a light lift may be given and all the old beds must be thoroughly broken up, so that the track will settle down uniformly.

**222.** Every sleeper must be placed in the track with the heart side down. The largest and best sleepers must be used at joints, and on curves.

**223.** First-class sleepers, 9ft. x 9in. x 4½in., and second-class, third class, and serviceable sleepers, of either size, must be used in sidings.

**224.** Crossing timbers of 10in. x 5in. section must be used for all permanent turnouts, etc., unless instructions are issued from the Head Office to use 12in. x 6in. section. The

**244.** The general arrangement of turnouts, crossovers, single and double compounds, points, bolted and blocked crossings, riveted crossings and spring crossings is shown on pages 183, 185, 187, 204, 205, 206, 207, 208, 209, 210 and 211.

crossing timbers must vary in length in six (6) inch steps, as shown in the standard diagrams on pages 204, 205, 206, and 207, and must be spaced and lined in conformity with such diagrams.

**225.** Dogspikes three-quarters ( $\frac{3}{4}$ ) of an inch square are standard for 10in. x 5in. sleepers; they are chamfered at the end, and are five (5) inches long over the head which is shaped on the underside to fit the bevel of the rail flange.

**226.** Every rail must be fully spiked with four (4) spikes to each sleeper, except on a curve of 25 chains radius or under, or where pins take the place of spikes at joint sleepers. Every spike must be driven touching the rail, not quite vertically, but inclined at right angles to the sloped rail seat or adzing as shown in the diagram on page 179, so that when driven home the head of the spike will fit the bevel of the rail flange on both the inside and the outside of the rail.

**227.** To fit the bevel of angle or channel fishplates, the spikes in the slots of both the inside and the outside plates must be inclined slightly from the pitch of the rail, as shown in the diagram on page 179.

**228.** Every hole for a three-quarter ( $\frac{3}{4}$ ) inch dogspike must be bored with a three-quarter ( $\frac{3}{4}$ ) inch auger, and for a five-eighth ( $\frac{5}{8}$ ) inch dogspike with a five-eighth ( $\frac{5}{8}$ ) inch auger. The centre of each hole must be bored 2½ inches from the edge of the sleeper. The two inside and two outside spikes must be on opposite sides of the centre of the sleeper, as indicated in the diagrams on pages 175 and 177, except on a curve of 25 chains radius or under, on which the inside spike for the outer rail must be in the centre of the sleeper. The two outside spikes must lead in the direction of trains on double track and down-hill on single track.

**229.** The outside of the outer rail of every curve of 25 chains radius or under, must be fastened by two (2) dogspikes at each sleeper, except where pins take the place of spikes. In any instance in which slotted-angle or slotted-channel fishplates are used, the additional spike must be provided.

**230.** In spiking, great care must be exercised to avoid striking the rail flange which, if struck with a hammer, is likely to break in service. The last blow must be lightly given so as to avoid breaking the spike head or injuring the rail flange.

**231.** The track must always be tested with the gauge when spiking.

**232.** In any instance in which it is necessary to take out a spike, it must be drawn carefully, so that it can be used again, if possible. Every spike must be drawn from an old sleeper before the sleeper is thrown aside.

**233.** In any instance in which pin holes are provided, at least one (1) pin must be put in at each end of each rail; otherwise the rails creep, and it becomes necessary to adjust the expansion. Every pin must be driven at right angles to the bevel of the rail flange, and every hole must be bored with an auger of less diameter than the pin.

### Points and Crossings.

244. The general arrangement of turnouts, crossovers, single and double compounds, points, bolted and blocked crossings, riveted crossings, and spring crossings, is shown on pages 183, 185, 187, 204, 205, 206 and 207.

245. The main track through points must, wherever practicable, be straight.

246. Three-throw points must not be used in the main track, nor in any yard, except in a place at which double leads, i.e., modified three-throw points, cannot be used.

247. New points and crossings are made from 60lb. "D," 80lb. "O," and 100lb. "P" class rails only.

248. The following table shows the standard radii of leads, and angles of crossings, for turnouts and ordinary connections off straight; also the length, throw, and spread of point blades for new standard points of 60lb., 80lb., and 100lb. rail.

The standards must be adhered to, except for special connections, for which data will be supplied by the Head Office.

Description.	Weight of Rail per Yard.	STANDARD RADII.		
		600 ft.	800 ft.	1000 ft.
Angle of crossing	{ 60, 80 and 100 lb.	7.52	8.7	9.72
Length of blades	{ 60 lb.	12 ft.	15 ft.	15 ft.
	{ 80 & 100 lb.	13 ft. 6 in.	15 ft. 9 in.	18 ft.
Throw at toe	{ 60 lb.	4 in.	4 in.	4 in.
	{ 80 lb.	4 5/16 in.	4 5/16 in.	4 5/16 in.
	{ 100 lb.	4 1/2 in.	4 1/2 in.	4 1/2 in.
Spread at heel	{ 60, 80 and 100 lb.	5 3/4 in.	5 3/4 in.	5 3/4 in.
Length of lead	{ 60, 80 and 100 lb.	55 ft. 4 in.	64 ft. 0 in.	71 ft. 5 in.

The lead of a turnout is the distance from the heel of the point blade to the intersection of the crossing, measured along the straight track. The "spread" of a blade is the distance at the heel, and the "throw" the distance at the toe, between the gauge sides of the blade and the stock rail.

249. Rails for leads must be curved before being laid.

250. The stock rails for standard leads of 600ft., 800ft., and 1000ft. radii, are set when made, and the Roadmaster must state on each order whether they are required for right hand or left hand turnouts. The diagrams of turnouts on page 189 show how to distinguish right and left hand points, and right and left hand crossings.

251. New point chairs are made with level seats for the stock rails and level slides for the blades, and timbers or sleepers used with points having such chairs do not require adzing to cant the rails.

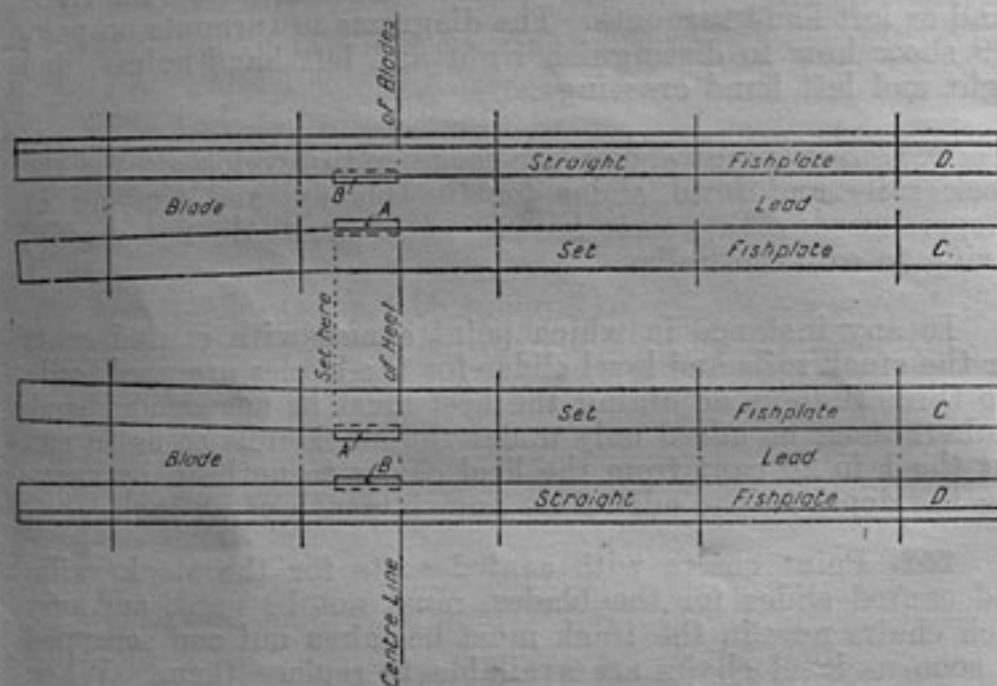
In any instance in which point chairs with canted seats for the stock rails and level slides for the blades are used, only the three timbers adjoining the heel must be adzed, and such timbers must be adzed only under the stock rails so as to run out the 1 in 20 cant from the heel chairs to nothing by varying the depth of the adzing by one-sixteenth of an inch.

252. Point chairs with canted seats for the stock rails, and canted slides for the blades, must not be used, and any such chairs now in the track must be taken out and scrapped as soon as level chairs are available to replace them. When the level chairs are put in, the three timbers or sleepers adjoining the heel chairs must be renewed and adzed so as to ensure a proper bearing to all the rails.

253. Every crossing is made without cant, and every rail used with points and crossings must be laid level; adzing is not required on the timbers or sleepers in crossing work, except as may be necessary to run out the cant from the heel chairs, as specified in Instructions 251 and 252. The cant of 1 in 20 required in the adjoining tracks must be obtained gradually, by varying the adzing by one sixteenth of an inch over three sleepers in the first length of rails in each track beyond the points and crossings.

254. Particular care must be exercised not to screw up bolts in braced point chairs too tightly. The spring washer on each bolt must not be completely compressed.

255. Special heel fishplates, as shown in the sketch hereunder, will be provided for all points made from 100lb. "P" and 80lb. "O" class rail, and will be supplied machined and accurately set for the respective standard lengths of blades, viz., 13ft. 6in., 15ft. 9in., and 18ft. The three (3) bolt hole end must be secured to the leads; and only two bolts will be required for the blades.



*Sketch showing Right and Left Hand Pairs*

These fishplates will be set for right and left hand, and fitted with packing pieces "A" and "B" which will bear against the web of the rail, and thus prevent foul joints. Each pair of fishplates will be stamped on the back with figures representing the length of the blade with which they are to be used, and the letters "R.H." or "L.H." for right hand or left hand, as the case may be.

256. Flat fishplates with six bolt holes will be supplied for use in sharp angle crossings of 80lb. and 100lb. rail, in which angle or channel fishplates cannot be used.

257. The usual flat fishplates will be supplied for the 60lb. "D" material, but the fishplates for the points will be machined, set, and otherwise treated similarly to those for 80lb. and 100lb. rails.

258. In ordering points and crossings, the Roadmaster must state the class of rail with which they are to junction, and order fishplates, if necessary.

259. Rails of the same class as the points and crossings must be used throughout turnouts or other connections, so that junction plates joining rails of different heights will not be placed on the crossing timbers. When junction plates are necessary, they must be placed, if practicable, at least one rail length clear of the points and crossings.

260. The whole of the closures for single and double compounds will be cut to the proper length, and supplied with the points and crossings. Each rail must be used in its proper place, as shown in the diagrams on pages 208, 209, 210 and 211.

Compounds on curves will be treated specially, and closures cut on the ground.

261. In any instance in which packing is required, between the rail and sleepers or crossing timbers, special cast-iron chairs will be provided on the requisition of the Roadmaster, and must take the place of the timber packing formerly used. Special dogspikes seven (7) inches long will be supplied for use with the chairs.

262. Unless specially asked for, chairs, chair bolts, pins, fishplates, heel blocks, heel bolts, connecting rods and pull rods will not be sent with points; nor guard rails with crossings. In any instance in which guard rails are specially asked for, they will be supplied with bolts, ferrules, and washers.

263. In laying a turnout, the rails in the main track must not be cut, but the stock rails must be fished to the nearest joint, and closures provided to fill the space between the crossing and the adjoining rail. To avoid cutting main track rails in laying a temporary siding, the lead may be slightly lengthened or reduced.



**264.** To obtain the angle of a crossing, divide the distance in inches from the point of intersection to the heel of the crossing by the width or spread in inches over the gauge lines at the heel; or, the angle is the distance in feet and decimals between a spread of six (6) inches in both directions from intersection.

These methods do not apply when the rails in the crossing are curved; but the angle is stamped on the wing rail of all crossings.

In any instance in which tracks cross, the distance between the intersections of the "V" crossings can be obtained by subtracting the gauge from the distance between the gauge sides of the tracks, and multiplying the result by the angle of the crossings. The distance between the intersections of "V" and "K" crossings can be obtained by multiplying the gauge by the angle of the crossings.

**265.** Guard rails opposite a crossing must be properly placed, and kept securely fastened, and must be at least eleven (11) feet long, and laid parallel to, and one and three-quarter ( $1\frac{3}{4}$ ) inches from, the running rail for a distance of six (6) feet opposite the nose of the crossing. They must be splayed out to two and a half ( $2\frac{1}{2}$ ) inches from the running rail towards both ends, which must be sharply curved. The diagram on page 187, shows the standard guard rail.

The normal distance of  $1\frac{3}{4}$  inches between the running rail and the guard rail, must vary only if special instructions are issued from the Head Office to widen the gauge at the crossing, in which event the guard rail clearance must be increased by the extent the gauge is widened. Washers are provided, and the inside flange of the guard rail is cut away, and as the wear of the guard rail takes place, the washers must be removed, and the distance between the running rail and the guard rail preserved.

**266.** An ordinary spring crossing has a movable wing, and presents a continuous-bearing main track rail, as shown in the diagram on page 185. An ordinary spring crossing must not be used in a siding without special authority, and in a main track only where most of the trains pass over the crossing on the main track. It must be laid with great care, and the timbers uniformly packed so that the spring wing

may slide freely on all the plates. The spring must be set so that the wing, after being opened and released, will close with a sharp snap against the V of the crossing, and yet will be opened by the wheel of the lightest empty truck likely to pass through the crossing.

**267.** In ordering spring crossings, the Roadmaster must state whether such crossings are required for right hand or left hand turnouts.

**268.** Trackmen must give careful attention to all points and crossings, and must keep them in proper gauge, surface and line, and in good working order and repair.

**269.** "Blocked" crossings are the standard type for track work. "Riveted" crossings still in use, if worn on one wing only, may however, be forwarded for repairs when required.

Riveted crossings, owing to the checking of the timbers for the plate and boring for rivet heads, are not interchangeable with blocked crossings and any riveted crossings returned after repair must only be used to replace others of the same type.

Every riveted crossing which is worn on both wings and the nose of the V to such an extent as to necessitate its removal from the track must, when removed, be consigned to the Chief Storekeeper, Scrap Depot, Spencer-street, in accordance with Instruction No. 391.

13.1.11.

### SIDINGS.

278. Derails must be kept free from obstruction and clear of ballast, ashes, grass, dirt, etc. The sleepers under a derail must be kept at right angles to the line, well packed to give a firm bearing, and must be in good condition. The rail on which a derail is placed, should, if it becomes badly worn, be replaced with a sound rail.

279. Derails catch points or catch sidings must be put in at any siding, which is on, or leads into a sharp incline, and at which a scotch crossing being tested is otherwise in good order and condition it need not be replaced unless the wing rail is worn to a depth equal to the depth of the projection on the gauge.

The following particulars in regard to the depth gauges for crossings are issued for the information of all concerned:—

1. The gauges will be issued to Roadmasters in sets. A Metropolitan Roadmaster's set will comprise 3 gauges, i.e., 1 for 60 and 66 lbs. rails, 1 for 75 and 80 lbs. rails, and 1 for 100 lbs. rails. A Country Roadmaster's set will comprise 2 gauges, i.e., 1 for 60 and 66 lbs. rails and 1 for 75 and 80 lbs. rails.

Each gauge will be stamped with a number corresponding with the weight of rail for which it is to be used—for instance, a gauge marked "75 and 80" is to be used to determine the wear on a crossing made from a 75 lb. or a 80 lb. rail.

2. Each gauge is machined true to a straight edge on the bottom, i.e., on the edge which carries the "nib" or projection, and this edge only must be used for testing.

3946.5.14

pecting the points, the trackmen must thoroughly clean and oil the points.

288. The Roadmaster must notify the Head Office when points leading to an unused siding are taken out, or when points are spiked for any reason; and must also advise the Head Office when points which have been removed or spiked are replaced or re-opened.

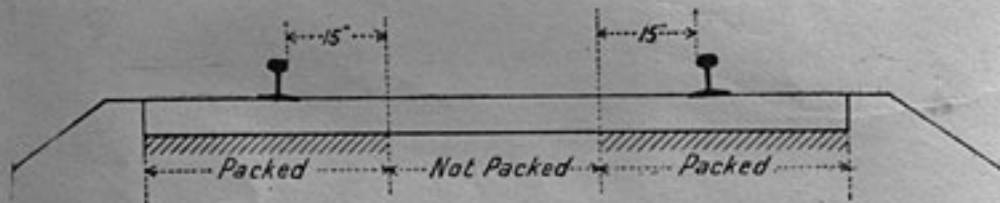
The Roadmaster and the Gauger must watch closely the wear of crossings, and the Roadmaster must frequently test with a depth gauge any crossings which have become much worn, in accordance with the following directions:—

- A. Before using the depth gauge the tops of the wing rails at the point of application must be scraped quite clean of gummy oil, dirt, etc.

### Line and Surface.

299. To maintain the track to good line and surface, the ballast under the sleepers must be properly packed with shovels or beaters, according to the nature of the material, and the amount of lifting or lowering to be done.

300. A sleeper must not be packed throughout its whole length, but only from the ends to fifteen (15) inches inside the running edge of each rail, as shown in the diagram hereunder, and the centre must be filled in lightly. The ballast directly under the rail must be packed especially hard to ensure that the principal support shall be given at this point. Every joint sleeper must be packed especially hard.



301. A track jack must not be used between the rails of the track.

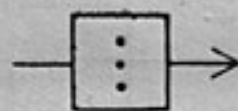
302. The track on any bridge or level crossing must be kept in good line and surface, and firmly embedded, so as to avoid any undue shock from a train travelling at a high rate of speed.

303. Joints of rails near bridge ends should, on the bridge, be at least six (6) feet, and on the embankment, at least ten (10) feet from the end of the bridge.

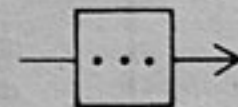
304. As far as practicable, a rail joint must not be on the roadway at any level-crossing, nor on any beam used in cattle guards. Dogspikes must be at least eighteen (18) inches from the end of cattle guard beams. Sleepers must abut the ends of cattle guard beams.

305. On every main track each curve is set out with centre pegs of 3 inches x 3 inches hardwood, the exact centre being defined by a nail in the top of each peg, and, if practicable, transition curves are set out at both ends of curves of 40

chains radius and under. The object of easing curves at their ends is to turn trains gradually and thus avoid shock to the rolling stock or the track, and to secure a gradually increasing elevation of outer rail. The length of transition curves is usually 150 feet on lines of 5ft. 3in. gauge, and 150 feet and 100 feet on lines of 2ft. 6in. gauge. The centre pegs are about 25 feet apart in transition curves, and in curves of 40 chains radius and under, and about 50 feet apart in curves of over 40 chains radius. The peg at the tangent point of a curve and the straight has a nail at each side of the centre nail, across the line of the track, thus:—



and the peg at the tangent point of the transition curve and the central curve has a nail at each side of the centre nail, along the line of the track, thus:—



Any centre peg must not stand more than half an inch above the sleepers, and must be carefully preserved. When the track is lifted, the position of every peg covered by the ballast must be indicated by another peg—driven alongside—so as to stand about level with the top of the sleepers. The Ganger must keep the top of every centre peg painted white, and maintain the track to true alignment in accordance with the pegs.

**Table Showing Radius in Chains and Curvature in Degrees for Various Curves.**

If the figures in Column 1 be taken as the radius in chains, those in Column 2 give the curvature in degrees; or, if those in Column 1 be taken as the curvature in degrees, those in Column 2 give the corresponding radius in chains.

Radius in Chains.	Curvature in Degrees.	Radius in Chains.	Curvature in Degrees.
Curvature in Degrees.	Radius in Chains.	Curvature in Degrees.	Radius in Chains.
Column 1.	Column 2.	Column 1.	Column 2.
1	86.81	14	6.20
1½	57.87	15	5.79
2	43.40	16	5.42
2½	34.72	17	5.11
3	28.93	18	4.82
3½	24.80	19	4.57
4	21.70	20	4.34
5	17.36	25	3.47
6	14.47	30	2.89
7	12.40	35	2.48
8	10.85	40	2.17
9	9.64	50	1.74
10	8.68	60	1.45
11	7.89	70	1.24
12	7.23	80	1.08
13	6.68	100	0.86

**306.** On every line of 5ft. 3in. gauge the super-elevation (hereinafter called cant) of the outer rail, and the maximum permissible speed (provided it does not exceed the maximum for the particular line, or part of a line), as shown in the table following, are adapted to the radii of the curves, having due regard to safety, comfort, and economy in track maintenance.

**CANT ON CURVES ON MAIN LINES OF 5 FT. 3 IN. GAUGE.**

Radius in Chains.		Max. permissible speed in miles per hour.	Cant in inches.
From.	To.		
100 and over	—	60	1
80	Under 100	60	1½
60	" 80	60	2
50	" 60	60	2½
40	" 50	60	3
35	" 40	50	3
30	" 35	40	3
25	" 30	35	3
20	" 25	30	3
12	" 20	25	3
9	" 12	20	3
8	" 9	15	3
6	" 8	10	3

On every line of 2ft. 6in. gauge, the cant for any curve will vary in accordance with the maximum speed enforced for the particular line, or part of a line, as shown in table following.

**CANT ON CURVES ON MAIN LINES OF 2 FT. 6 IN. GAUGE.**

Cant in Inches.	SPEED LIMITS IN MILES PER HOUR.						Cant in Inches.
	Up to 10.		Over 10 to 15.		Over 15 to 20.		
	Radius in Chains.		Radius in Chains.		Radius in Chains.		
	From.	To.	From.	To.	From.	To.	
2½	...	..	...	...	5	6	2½
2	...	...	3	4	over 6	8	2
1½	2	3	over 4	6	" 8	12	1½
1	over 3	5	" 6	12	" 12	21	1
½	" 5	...	" 12	...	" 21	...	½

Uniformity is far more important than the exact amount of the cant. The inside rail must be maintained to grade line, and the cant obtained by raising the outer rail.

Cant is not required on any curve at leads between points and crossings in a station yard, at which the speed of trains does not exceed ten (10) miles per hour.

On any line of 5ft. 3in. gauge the full cant must not be continued beyond the tangent points of the central curve, but must be decreased uniformly, at the rate of half an inch in 25 feet, on the transition curves or on the straights at the ends of any curve at which transitions are not provided, except in the case of reverse or following curves, in which the length of straight between them is too short to permit of the cant being thus run out, and in the latter event both rails midway between the two curves must be level, and a uniform increase of half an inch in every 25 feet given from this point in both directions, until the full cant for each curve is obtained. The diagram on page 191 illustrates how the cant must be graduated on curves, with and without transition curves, and on reverse or following curves with a short straight between them.

On any line of 2ft. 6in. gauge also the cant must be decreased uniformly, but in accordance with the figures given at each peg.

The proper cant is stamped in figures on the top of the centre pegs; and painted in white figures on the inside of the web of the outer rail opposite each peg, and the Ganger must maintain the track to proper cant at each peg, in accordance with the figures.

**307.** On every straight, the tops of the rails must be level with each other, except at the approaches to any curve which has not a transition curve.

**308.** The Ganger must not depend on the eye when sighting the track, and must use the straight edge, sight blocks, and level, when lifting either straights or curves.

**309.** Every spirit level in the possession of the Ganger must be verified from time to time by the Roadmaster.

**310.** Perfect gauge is an important feature of good track. Gauge of track is the distance between the running sides of the head of the rails, measured five-eighths of an inch below the top of the rails. The standard gauge is 5ft. 3in. for broad gauge, and 2ft. 6in. for narrow gauge tracks. Extra width must be given, as shown in the following table:—

## LINES OF 5 FEET 3 INCHES GAUGE

Radius in Chains.	Extra Width of Gauge.	Gauge of Track.
Under 8 ... ..	$\frac{3}{4}$ in.	5 feet 3 $\frac{3}{4}$ inches
8 to 14 ... ..	$\frac{1}{2}$ in.	5 feet 3 $\frac{1}{2}$ inches
Over 14 to 20 ... ..	$\frac{1}{4}$ in.	5 feet 3 $\frac{1}{4}$ inches
Over 20 ... ..	nil.	5 feet 3 inches

## LINES OF 2 FEET 6 INCHES GAUGE.

Radius in Chains.	Extra Width of Gauge.	Gauge of Track.
6 and under ... ..	$\frac{1}{4}$ in.	2 feet 6 $\frac{1}{4}$ inches
Over 6 ... ..	nil.	2 feet 6 inches

**311.** Points must be laid to the exact gauge, except the short blades of three throws, at the toe of which the gauge must be widened to the extent of the thickness of the long blades. In every instance, the gauge must be exact at the heel of points.

**312.** Every crossing on the straight or inner rail of a curve, must be laid one-quarter of an inch tight to gauge; and every crossing on the outer rail of a curve must be laid to the exact gauge. In any special case a crossing must be laid wide to gauge if instructions to that effect be given by the Head Office.

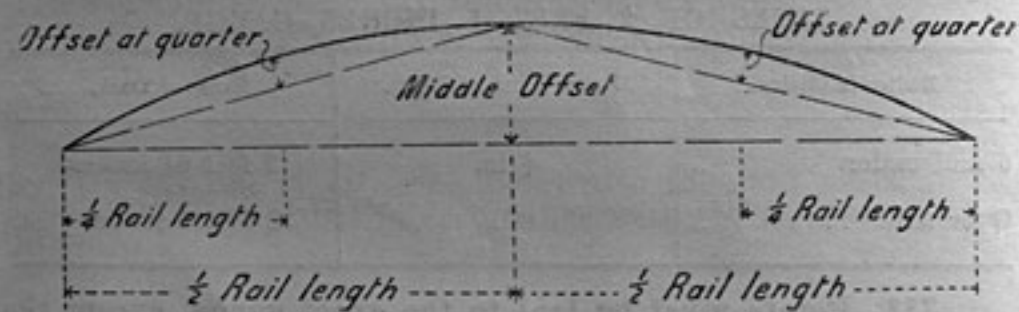
**313.** In any instance in which the gauge at any specified place, such as at a crossing or the tangent point of a transition and central curve, is other than normal, it must, if practicable, be gradually decreased or increased—as the case may be—from that place, to the extent of one-quarter of an inch in standard length rail (thirty-one (31) feet nine (9) inches), until the exact gauge is reached.

**314.** Every Roadmaster must test periodically, with the combined track gauge and level, the whole of the tracks on his section; see that every curve has the proper cant; that every straight is level, and that the track is kept in proper

gauge on every straight and curve, and at points and crossings; and enter in his diary the date on which the track is tested, and full particulars of any improper variation from the standards.

315. Rails for curves up to 20, 25 and 40 chains radius must, before being placed in the track, be separately curved by a rail curver, in accordance with the table on page 81.

316. Offsets at quarters equal one-fourth of middle offsets, as shown in the following diagram:—



Care must be taken to thus ensure uniform curvature of the rails throughout their entire length. It is better to give slightly less curvature than too much. Hammering rails to curve them is strictly forbidden.

317. To obtain the radius of a curve in chains, stretch a 66ft. tape or string on the inside of the outer rail, measure the middle offset in inches, and divide 99 by the middle offset.

318. Every curve of 20 chains radius or under, on a bridge, must have a guard rail laid along the inner rail. The top of the guard rail must not be higher than the running rail. The guard rail must extend a distance of not less than twenty (20) feet beyond each end of the bridge, and the space between the running rail and the guard rail must be two and a half (2½) inches, increasing to six (6) inches in six (6) feet at each end.

Middle Offsets for Curving Rails.

Length of Rail.	Radius of Curve in Chains.	14' 0". 13' 6".	20' 3". 20' 0".	23' 0". 22' 8". 22' 6". 22' 2".	29' 3". 29' 0". 28' 6". 28' 0".	31' 9". 31' 6". 31' 5".	37' 3".	42' 9".	Length of Rail.	Radius of Curve in Chains.
40	40	1/8	1/4	1/6	1/3	1/2	2/3	1/2	40	40
30	30	1/6	1/3	1/4	1/2	2/3	3/4	2/3	30	30
25	25	1/5	2/5	1/3	2/3	1/2	2/3	2/3	25	25
20	20	1/4	1/2	1/2	2/3	1/2	2/3	2/3	20	20
18	18	1/3	2/3	1/2	2/3	1/2	2/3	2/3	18	18
16	16	1/2	2/3	1/2	2/3	1/2	2/3	2/3	16	16
15	15	1/2	2/3	1/2	2/3	1/2	2/3	2/3	15	15
14	14	1/2	2/3	1/2	2/3	1/2	2/3	2/3	14	14
13	13	1/2	2/3	1/2	2/3	1/2	2/3	2/3	13	13
12	12	1/2	2/3	1/2	2/3	1/2	2/3	2/3	12	12
11	11	1/2	2/3	1/2	2/3	1/2	2/3	2/3	11	11
10	10	1/2	2/3	1/2	2/3	1/2	2/3	2/3	10	10
9	9	1/2	2/3	1/2	2/3	1/2	2/3	2/3	9	9
8	8	1/2	2/3	1/2	2/3	1/2	2/3	2/3	8	8
7½	7½	1/2	2/3	1/2	2/3	1/2	2/3	2/3	7½	7½
7	7	1/2	2/3	1/2	2/3	1/2	2/3	2/3	7	7
6	6	1/2	2/3	1/2	2/3	1/2	2/3	2/3	6	6
5	5	1/2	2/3	1/2	2/3	1/2	2/3	2/3	5	5
4	4	1/2	2/3	1/2	2/3	1/2	2/3	2/3	4	4
3½	3½	1/2	2/3	1/2	2/3	1/2	2/3	2/3	3½	3½
3	3	1/2	2/3	1/2	2/3	1/2	2/3	2/3	3	3
2½	2½	1/2	2/3	1/2	2/3	1/2	2/3	2/3	2½	2½
2	2	1/2	2/3	1/2	2/3	1/2	2/3	2/3	2	2

### Weeding, Chipping, and Burning Off.

**329.** The ballast and formation must be kept free from grass, weeds, and other growth. The weeds in the ballast must be taken out by the roots and shaken to avoid waste of material. The weeds on the formation cesses must be chipped without unduly skimming away the earth. Weeds, chippings, etc., must be removed clear of the formation, and must not be deposited on the slope of any cutting.

**330.** In any exceptional place in which the growth is so prolific during the growing season that it is impracticable to keep the whole of the ballast and formation weeded, the grass, etc., must first be removed from both sides of each rail, to ensure a clear run for the wheels of trains, and, when this has been done, the weeding of the whole of the ballast and formation must be proceeded with promptly.

**331.** Weeds must be removed before they flower.

**332.** Every Thistle, Bathurst Burr, Blackberry, Sweet Briar, Furze, Cape Broom, Prickly Acacia, St. John's Wort, Pepper Wort, Stink Wort, and other noxious thistle or weed growing on Railway property, or on half the width of any public road adjoining the Railway, must be removed and burned, so that the spread of such weeds may be checked. The owner of any land separated from the Railway land by a road is responsible for keeping half the width of such road clear of noxious weeds.

**333.** The Roadmaster is empowered to receive offers for the purchase and removal of grass on Railway land, and to accept any such offer which he considers satisfactory, and he must have a grass cutting agreement form signed by each purchaser, pay every amount received to the nearest Stationmaster, and furnish the Estate Officer with full particulars in every instance.

**334.** The Ganger must chip along the Railway boundaries for a width of at least three (3) feet from the fence line, before the grass is dry enough to burn, and must also chip around any wooden structure, pile of a bridge, stack of sleepers, firewood or timber, telegraph post, semaphore mast, track sign, bench mark, intersection peg, etc., and remove any grass and rubbish a sufficient distance to prevent the possibility of their catching fire.

In any instance in which the growth of grass is prolific, a swath at least six (6) feet wide must be cut early with a scythe along the line of chipping, and burnt off before the main body of grass is burnt.

**335.** Great care must be exercised to prevent fire spreading to any land adjoining the Railway line; and in every instance, at least twenty-four (24) hours' notice in writing on the proper form must be given to every owner or occupier of such land before burning off is commenced.

**336.** The Ganger will be held responsible for the service of such notices, and must attend at the time and place named therein. A separate notice must be given for each day's burning off; and if any owner or occupier lives too far away to be served personally with the notice, the notice must be forwarded by post as a registered letter.

**337.** All grass, stumps, logs, and rubbish lying between the boundary fences, or on any part of the Railway property, must be burnt off whenever the weather renders it practicable to do so; and on Crown lands adjoining the Railway fences, the grass must also be burnt off for a distance of 30 feet from the Railway fences.

**338.** The burning of grass, etc., must be commenced as soon as the patches become dry, so that the continuity of the fire may be checked, and must be carried out at the time of the day best suited to the circumstances of each case. The Ganger must, if necessary, arrange to commence work earlier, or continue work later, as the case may be, in order to secure a favourable time for burning. As far as possible, burning off must be done on the windward side of the line.

Burning off must not be done when the temperature exceeds 100 degrees in the shade, or on any day on which a strong wind is blowing; and the men must, if necessary, be distributed over the most dangerous parts of the length, when any train is passing, to prevent any fire from spreading.

Great care must be taken to avoid injury to any tree, shrub, hedge, creeper, etc., growing along the line either inside or outside the Railway boundaries.

Every stump, log, old sleeper, etc., within the burnt area must be examined at the end of each day's work, and all trace of fire extinguished before leaving.

339. In every instance in which a camp fire is lit during the summer months from November to February inclusive, for boiling water or for any other purpose, the dry grass, leaves, etc., must be removed for a distance of ten (10) feet from the site of the fire, and the fire must be carefully extinguished, or buried with earth, before being left.

340. All grass, stumps, logs, and rubbish on leased railway land must be burned off in precisely the same way as on unleased land whenever the weather renders it practicable to do so, and in every instance at least 24 hours notice in writing on the proper form must be given to the Lessee of such leased land before burning off is commenced.

341. Every Cultivation lease provides that any crops must be cut and removed while green, and if this provision is not adhered to the Ganger must serve the Lessee with notice on the proper form, that the crop will be burnt off at the expiration of three (3) days. The notice must be served on the date which it bears, and at the expiration of the notice the crop must be burnt off, weather permitting.

**CANCELLED.**

342. The Roadmaster must give special attention to the chipping, mowing, and burning-off operations; see that they are carried out thoroughly, and in good time; and, if necessary, arrange for emergency staff to be employed at any place at which danger from fire is anticipated.



**Neatness and Appearance.**

353. Every station yard, approach, road, pathway, platform, stock yard, level crossing, etc., must be kept clean and tidy, in good repair, and free from rubbish and weeds. Waste paper and other refuse gathered up by employes of the Transportation Branch, should be placed by them in the bin provided for the purpose; and the Ganger must see that this refuse is not swept on to the track, and must empty the bin and dispose of all rubbish.

354. Ashes must not be placed on any passenger platform.

355. The Ganger must devote a few hours each week to cleaning up and putting things in order on the length. Old tins, rubbish, etc., must be picked up and buried or burnt. All material must be gathered up and neatly stacked. Every rail stand, points and crossings stand, and tool house must at all times have a neat and tidy appearance. The arrangement of tools and materials must be systematic, and everything kept in its proper place.

356. Two sets of prizes will be awarded each year in the district of each Superintending Roadmaster, one for the best kept length with metal ballast, and the other for the best kept length with gravel, scoria or sand ballast.

Each set will consist of a first prize of £20; a second prize of £12; and a third prize of £6; and the prize granted in respect of any length will be distributed among the men who have been employed thereon for at least six (6) months during the year, and as mutually agreed upon by the men concerned.

The awards will be subject to the following conditions:—

- (1) Any length will be eligible for competition, provided that its condition has been improved during the year, with the following exceptions:—
  - (A) Any length which has been improved during the year with the help of additional track force, or of an extra gang, will not be eligible for any prize or for commendation.

- (B) Any length awarded first prize one year will not be eligible for any prize or for commendation during the two (2) following years.
- (C) Any length awarded second prize will be eligible only for first prize in the following year.
- (D) Any length awarded third prize will be eligible only for second or first prize, in the following year.
- (E) Any length commended will be eligible for any prize in the following year.

The lengths will be judged during the months of May and June, and each Superintending Roadmaster may recommend one length for special commendation with each set of prizes.

(2) The maximum number of points obtainable will be:—

Line of track . . . . .	20
Surface of track . . . . .	20
State of fastenings . . . . .	15
Condition of cuttings, ditches and side drains . . . . .	10
Cleaning, trimming, and making up formation cesses . . . . .	10
Weeding ballast . . . . .	10
General appearance, including trimming and regulating ballast . . . . .	15
Total . . . . .	100

In awarding the points, consideration will be given to the amount of extra work performed on the length by the gang during the year, such as putting in sleepers, etc.

A favourable entry will be made in the history of each employe who participates in a prize, or has been employed at least six months during the year in a gang which has been commended; and special consideration will be given to any application from any such employe for transfer, etc., to a vacancy in a more favoured locality. Any second class Ganger whose length is awarded a prize, or is commended, will be promoted to a first class length as vacancies arise.

Independently of prizes, every length must be maintained in a proper standard of efficiency. Any Ganger whose work is behind hand will be dealt with. An untidy length will be considered evidence of incompetency on the part of the Ganger.

**357.** A first prize of £6; a second prize of £3; and a third prize of £1, and a commendation, will be awarded yearly in each Workmaster's district, for the four best kept Departmental residences respectively occupied by daily paid employes. These prizes are distinct from the prizes awarded annually by the Transportation Branch for tree planting and station decoration, and no plantation will be eligible to compete for both.

The awards will be subject to the following conditions:—

(1) Every daily paid employe in any branch, occupying a Departmental residence will be eligible to compete, with the following exceptions:—

- (A) Any residence awarded first prize one year will not be eligible for any prize or for commendation during the two (2) following years.
- (B) Any residence awarded second prize will be eligible only for first prize in the following year.
- (C) Any residence awarded third prize will be eligible only for second or first prize in the following year.
- (D) Any residence commended will be eligible for any prize in the following year.

(2) The residences will be judged between 1st October and 31st December in each year, by the Workmaster and Superintending Roadmaster for the respective districts, and, as far as practicable, all the residences in each district which are considered to have a reasonable prospect of gaining a prize or commendation will be inspected within a fortnight.

(3) The maximum number of points obtainable will be:—

(A) Care, cleanliness, and neatness of residence and surroundings . . . . .	50
(B) Work done during the year in planting trees and maintaining the whole plantation . . . . .	30
(C) General appearance of the whole plantation . . . . .	20
Total . . . . .	100

- (4) Any daily paid employe who has been transferred during the year from a residence which has gained a prize or commendation will be given credit for the proportion of the year he occupied such residence.
- (5) Cultivation must be carried out in such a manner as not to cause dampness close to any building; and trees, shrubs, etc., must not be permitted to grow within three (3) feet of the main residence, nor higher than four (4) feet from the ground at any residence at a cattle guard crossing, in which they would obstruct the view at either side of the crossing.
- (6) Trees, shrubs, etc., up to a reasonable number, will be supplied, free of cost, including carriage to the place named by applicant, and, as far as practicable, will be delivered between April and July, according to the climate, on application being made on the proper printed form, which must reach the Head Office not later than the 25th March each year.
- (7) Trees, shrubs, etc., must be planted with as little delay as possible, in accordance with the instructions re tree planting, issued from the Head Office in booklet form in September, 1907.
- (8) Trees, shrubs, etc., supplied by the Department must not be planted outside Railway property.

A favourable entry will be made in the history of each employe whose residence is awarded a prize, or is commended.

Independently of prizes, every Departmental residence and the surroundings thereof must be kept in good order (fair wear and tear excepted) and clean and tidy. The Workmaster must inspect every residence annually, and report to the Head Office any found in a dirty or untidy condition, so that the tenant at fault may be dealt with.

**358.** The Roadmaster must inspect promptly any Departmental residence vacated, before another tenant takes possession, and must draw the attention of the Workmaster to any necessary repairs, and report to the Head Office any tenant who has shown wilful neglect, either by a lack of cleanliness or in any other way.

**359.** Works employes must keep the surroundings of every bridge, building, or other structure upon which they are engaged in a tidy condition, and must clean up and dispose of all worthless material, rubbish, etc., and trim and level the ground, where necessary, on completion of the work. Useless material must be burnt, and all trace of fire must be extinguished before leaving the work. Sound materials, together with all bolts, washers, etc., must be taken to the nearest station, or returned to the depot, as the Workmaster may direct.

Every workshop and depot, and the surroundings thereof, must at all times present an orderly and tidy appearance, and tools and materials of all descriptions must be kept in good condition, and in recognised places.

### Tools, Materials, and Supplies.

370. The Roadmaster and the Ganger must have a sufficient stock of tools and supplies. The kind and number for each gang will depend upon the nature of the ballast, the number of men in the gang, and other conditions. The following list shows the general equipment for a Roadmaster, and for a gang of four (4) men:—

Description.	Stock for	Equipment	Remarks.
	Roadmaster.	for gang of four (4) men.	
	Number.	Number.	
Adze, with handle	6	1	Sizes as required.
Auger	60	3	
Axe, with handles	6	1	
Bar, Claw	18	3	
" Plain	6	1	
Beater (Packing), with handle	24	8	
" (Fire), with handle	6	4	
Boning Rods, set	2	*	
Box, for tools	2	1	
Brace, Carpenter's, with bit	3	*	
Brand, for iron	2	nil	For cleaning drains.
" for wood	2	nil	
Broom (Bass)	3	*	
Cant Board	6	1	
Chain, for hand and motor cars	12	3	
Cold Chisel (crosscut)	12	1	
" " (flat)	12	2	
Cold Sate	12	2	
Cutters	6	nil	
Detonator	216	24	
Dog Lifter	6	1	More if required
Drift, Hand	3	1	
" with rod	3	1	
Drill, for ratchet	24	6	
" Track, with bits, complete	1	*	
Figures, Branding, set	1	*	
Files, Auger	24	2	
" Flat	12	1	
" Saw	24	1	
Flag, Green, with handle	24	3	
" Red	24	3	Where metal ballast. Where required.
Fork, Metal	12	*	
" Weeding	12	4	
Gad, Steel	6	*	

Description.	Stock for	Equipment	Remarks.
	Roadmaster.	for gang of four (4) men.	
	Number.	Number.	
Gauge, combined track and level	1	nil	
" Track	4	1	
" Expansion, set	1	*	
Gouge	6	1	
Grindstone	1	nil	
Hammer, with handle, Branding	2	*	More in sleeper districts.
" " Blacksmiths'	6	1	
" " Claw	1	1	
" " Keying	6	3	Where D.H. rails.
" " Knapping	—	—	Where required.
" " Sledge	12	1	
" " Spalling	—	—	Where required.
" " Spiking	12	1	
" " Striking	6	1	
Handle, Adze	12	*	
" Axe	12	*	
" Beater or Pick	72	6	
" Flag	24	*	
" Hammer	48	2	
Hook for curving rails	2	*	
Jack, Track	2	1	
Jigger, for auger	12	1	
Jim Crow	1	1	For every fourth gang and at junctions & terminals
Label (addressed) for consigning tools	4	4	
Lamp, Hand-signal	6	3	
" Hurricane	6	*	
Level, Spirit	6	1	
Lever, Lifting	4	1	
Line, Nicking out	6	1	
Mattock	6	2	Where required.
Oil Can, 1 gallon	3	1	
Oil Feeder, 1 quart	3	1	
Padlock	24	4	More if required
Plank	18	2	
Pick, Chopper, for weeding, with handle	6	4	Where required.
Pick, Forked, for weeding, with handle	6	4	Where required.
Pick, Navy, with handle	24	1	
Punch, Centre, with rod	2	1	
Rake	6	1	
Ratchet, with cramps	2	1	For every fourth gang, and at junctions & terminals.

Description.	Stock for	Equipment	Remarks.
	Roadmaster.	for gang of four (4) men.	
	Number.	Number.	
Ring for Tools	2	1	
Road Scraper, Hand	6	*	
Saw, Crosscut	2	*	
" Hand	6	1	
" Lightning	—	—	Where required.
" Hack, for rails, with frames	3	*	
" Blades, for. do.	36	*	
Scissors, Lamp	2	nil	
Scythe, with handle	6	1	
" Stone	12	1	
Shovel, Coal	6	*	
" Long-handled	6	*	
" Navy	48	4	
Sickle, Long Handled	6	4	Where required.
Slasher, with handle	6	4	Where required.
Spanner, Fishbolt	12	3	
Spanner, Shifting	2	nil	
Square, T	2	*	
Straight Edge	2	1	
Sight for Straight Edge	4	2	
Tape, Metallic	1	*	
" Steel	1	nil	
Template, Adzing	2	1	For each class of rail on section or length.
" Earthwork	2	1	
" Rail, set	1	nil	For testing wear of rails
Tent	12	nil	
Tongs	3	1	
Torch, Fire	2	1	
Trolley Stick	24	4	
Water Bag	6	1	
Wheelbarrow, Navy	18	1	
" Track	12	*	
Wire for Telegraph Lines, Coils	6	1	

A supply of kerosene, lubricating oil, antifriction grease, waste, and wick must be kept at each Roadmaster's depot, and on each Ganger's length.

\* Denotes tools, which can be obtained from the Roadmaster's Depot Stock, but must be returned when finished with.

**371.** Any appliance such as a rail saw, rail curver, etc., will be supplied on application, and must be immediately returned to the Tool Repair shop, Spencer Street, when finished with. A rail saw blade, when used, must be lubricated with a mixture made by dissolving from 4 to 6oz. of soft soap in 1 gallon of boiling water, which must be well stirred. During cutting, care must be taken to see that the saw blade is kept well moistened with the mixture.

**372.** The Roadmaster and the Ganger will be held responsible for the proper use, serviceable condition, and safe keeping of all tools and supplies, and for the maintenance of the necessary equipment, a list of which must be posted in every Ganger's tool hut or tool box. The Roadmaster must examine the tool box of every Ganger periodically without notice, and obtain an explanation from any Ganger whose complement of tools is not complete, and forward such explanation to the Head Office.

**373.** Any man casually employed repairing a length or on extra work must provide his own shovel.

**374.** Any tool requiring repairs must be sent to the Tool Repair Shop, Spencer Street, by a goods or mixed train on the days specified in the General Appendix. A reversible metal label must be attached, and the advice note inserted between the plates of the label. The Ganger must keep a record of the date on which any tool is sent in for repairs, and report any unusual delay in the return thereof.

**375.** Every worn out or scrapped tool must be forwarded to the Tool Repair shop, Spencer Street, at the end of each half-year.

**376.** Every leather fire beater must be sent to the Roadmaster's Depot after each grass burning season, and at the Depot every such beater must be cleaned, thoroughly greased, and stacked, and a heavy weight must be placed on the stack.

**377.** Every signal flag must be kept clean, and any flag which has become so worn or dirty as not to be easily distinguishable at a distance, must be replaced.

**378.** Every hand lamp must be kept cleaned and ready for use, and the wick must be kept free from crust. The crust can be removed easily with a match stick. The glass can be

kept bright by wiping with a piece of crumpled newspaper. Any hand lamp with a broken glass must be withdrawn from use, and an explanation of the breakage furnished.

**379.** A stock of material, to be known as the "Roadmaster's Material Stock" must be kept at each Roadmaster's Depot, and a stock of material, known as the "Ganger's Material Stock," must be kept on each length, and stacked where convenient. These stocks must be made up as follows:—

Description.	Roadmaster's Material Stock.	Ganger's Material Stock.	Remarks.
Rails	Number 5 pairs	Number 1 pair	Standard lengths of each class on section or length.
Points and Crossings	"	nil	*As authorised for each section.
Fishplates	50 pairs	2 pairs	Each kind on section or length.
" Junction	8 pairs	2 pairs	Each kind on section or length.
Fishbolt	300	50	Each size and kind on section or length.
Washer, Spring	500	50	For each size of bolt on section or length.
Dogspike $\frac{1}{2}$ "	2500	200	Three-quarter inch.
Pin	300	20	Each size on section or length.
Heel Bolt	48	6	
Guard Rail Bolt	48	6	
Chair	100	20	Where D.H. rails.
Key	500	100	Where D.H. rails.
Sleeper, 9' x 10" x 5"	200	20	
Crossing Timber (lin. ft.)	1200	nil	
Dropper Fencing (materials for)	1 mile	nil	
Post and Rail Fencing, 3 Rails (materials for)	† ..	nil	

**380.** As far as possible, all material must be kept in the tool hut provided for the purpose, which must be kept locked.

**381.** Every rail not in use must be kept on a rail stand, which must be floored with old sleepers, as shown in the diagram on page 193.

**382.** Points and crossings must be kept on a points and crossings stand, as shown in the diagram on page 195.

**383.** Fastenings must be stacked neatly so that they can be readily counted.

**384.** New sleepers must be stacked in accordance with the diagram on page 197, WITH THE HEART SIDE DOWN, so as to season the timber properly and prevent warping. Three (3) un-serviceable sleepers must be placed three (3) feet apart on the ground to stack on, and the stack must not be more than six (6) tiers high, unless the available space is limited. The two (2) top tiers must be sloped to form a roof, as shown in the diagram.

**385.** Any rails, points and crossings, fastenings, scrap, sleepers, etc., removed from the track must be classified properly and stacked neatly in convenient places for loading. Great care must be taken not to classify as un-serviceable any material which can be used again.

**386.** Steel rails must be classified and marked as follows:—

New.	Serviceable for Main Track.	Serviceable for Siding.	Unserviceable.
Steel rails 18 ft. and over that have not been in the track	Steel rails released from the track 18 ft. and over, and free from defects	Steel rails 13 ft. 6 in. and over having slight defects, which render them unsuitable for use in main track; and new or sound steel rails 13 ft. 6 in. and under 18 ft.	Rails unfit for use either in main track or siding; and all rails under 13 ft. 6 in.
ENDS TO BE PAINTED RED.	ENDS TO BE PAINTED WHITE.	ENDS TO BE PAINTED GREEN.	ENDS TO BE PAINTED BLUE.

**387.** Any iron rail or fishplate which requires renewal, on removal from the track, must be classed as un-serviceable.

**388.** Any rail, steel or iron, under 13 feet 6 inches long, must be classed as scrap.

**389.** Any sleepers taken out of the track must be classified and marked as follows:—

Serviceable for Main Track.	Serviceable for Siding.	Serviceable for Fence Post.	Unserviceable.
Ends to be painted White.	Ends to be painted Green.	Ends to be painted Yellow.	Ends to be painted Blue.

**390.** New sleepers must be classified and marked as follows:—

1st Class.	2nd Class.	3rd Class.
Ends to be painted with one red stroke, thus—I	Ends to be painted with two red strokes, thus—II	Ends to be painted with three red strokes, thus—III

**391.** Any rails, points, and crossings except those required for material stocks in accordance with Instruction No. 379, or those allotted for renewals, or on hand for new works, must be loaded and consigned to the Chief Storekeeper, Newport. Any fastenings, cast iron scrap, wrought iron scrap, and steel scrap, must be loaded and consigned to the Chief Storekeeper, Scrap Depot, Spencer Street.

A transfer docket, addressed to the Chief Storekeeper, Newport, or Spencer Street, as the case may be, must be forwarded with each consignment, and must reach him before the arrival of the truck, so that the contents can be checked.

Each transfer docket must show:—

The number of the length from which material is removed.

The number of the truck.

The contents of the truck.

The classification and weight of the material; and, when points and crossings are consigned, the lengths of the blades and angles of crossings.

**392.** Iron and steel rails must not be forwarded in the same truck, and the different sections of rail must, as far as possible, be confined to separate trucks.

**393.** Every effort must be made to utilise tools, materials, supplies, and appliances in stock.

**394.** Every requisition on "Contractor" must be made out in quadruplicate and on "Stores" in triplicate, and one copy retained by the officer issuing it.

**395.** Every requisition for tools, materials, and supplies must be sent by the Roadmaster through the Superintending Roadmaster, and every other requisition must be sent direct to the Head Office. Every Requisition for Stationery must be sent in on 21st January, 21st April, 21st July, or 21st October, in each year. Any unusual delay in supply must be reported.

**396.** Tools, materials, and supplies forwarded by a Contractor or the Chief Storekeeper, must be checked carefully, and any discrepancy between the quantity consigned and the quantity received must be reported to the nearest Station-master, and to the Head Office.

**397.** In any instance in which any timber received from a Contractor is condemned, the Station-master at the station to which it was consigned must be notified promptly in writing, so that he can arrange for it to be detained until the freight is paid.

**398.** Tools, materials, and supplies must be examined carefully as soon as received, and any which are inferior or defective must not be issued, but must be rejected, and the Head Office advised.

**399.** Every tool and appliance must, on receipt, be branded with the Departmental brand, and must not be issued unbranded to workmen.

**400.** Any truck containing material to be discharged at a station must be discharged promptly and must not, under any circumstances, be detained longer than twenty-four (24) hours, and every effort must be made to discharge promptly any truck containing material to be discharged between sta-

tions. In every instance in which Works employes are not available the Roadmaster must arrange for any truck containing Works material to be discharged as soon as possible.

**401.** The Worksmaster must not supply the Transportation Branch with any article such as a gang board, etc., unless a proper requisition is furnished.

**402.** Material or other property of any kind belonging to the Department, or under its jurisdiction, must not be sold or removed without authority from the Head Office.

**403.** Any sale of material which has been authorised must be completed within one month from the date of approval, and the correspondence returned without delay, otherwise the sale must be cancelled.

Before delivery is given of old material, etc., payment therefor must be collected and handed to the Station-master at the Depot station.

Any material which has been sold to an employe must be used for himself only, and must not be re-sold, or otherwise disposed of.



### Motor Cars and Hand Cars.

411. Every Foreman, Ganger, and Signal Adjuster is responsible for the care and proper use of every handcar, i.e., quadricycle, tricycle, or trolley, in his charge; and must see that each is properly equipped with chain, lock and key; and used only for Departmental purposes, and not by any unauthorised employe. When not in use each hand car must be removed clear of the line and road approaches; placed under shelter, if available; and properly locked. In any instance in which two (2) or more men have joint use of a hand car, the Foreman, Ganger, or Signal Adjuster, as the case may be, must nominate the employe who is to be responsible for its proper use and safe keeping, and give him full instructions. In any instance in which a hand car is lent for Departmental purposes to an authorised employe in any branch, the key must be handed to him, and he must be responsible for the proper use and safekeeping of both the hand car and the key until he returns them.

412. A motor car must not, under any circumstances, be run except in charge of an employe holding a certificate of competency. The employe in charge is responsible for its care and proper use, and must see that it is properly equipped with chain, lock, and key; and used only for Departmental purposes, and not by any unauthorised employe. When not in use each motor car must be removed clear of the line and road approaches; placed under shelter, if available; and properly locked.

413. No person other than an employe of the Department in the execution of his duty, shall be carried on a motor car or hand car without the authority of the Head Office.

414. A motor car or hand car must not be run if its use will involve risk of accident, and must not be overloaded. The axles must be examined frequently, and the wheels tapped with a hammer, to ascertain whether they are sound. Each car must be kept in proper order, and any broken or defective axle or wheel must be replaced by a sound one.

**415.** The Workmaster must make any minor repairs to the woodwork of any motor car or hand car, and any general repairs will be carried out at the Tool Repair shop, Spencer Street; but a car must not be sent to the shop for repairs except at the direction of the Workmaster, Roadmaster, or Inspector of Signals and Interlocking, as the case may be. Every tool or loose part forwarded to the Tool Repair shop must be enumerated on the advice note, which must be placed between the plates of the metal label.

**416.** The Metropolitan Workmaster must be requisitioned upon for trolley sticks.

**417.** No person shall use a private or semi-private tricycle, jigger, or other machine on the Railway line.

**418.** Each tricycle and trolley must be distinguished, in accordance with the diagrams on pages 199 and 201, by neatly painted black letters, two (2) inches long, placed on one side of the frame midway between the wheels of trollies, and under the seat of tricycles. The letter "N" in one inch letters must be added for narrow gauge tricycles and trollies. To ensure delivery of the correct class of wheel the description and letter, in accordance with the diagrams, must be given in each requisition for trolley wheels.

**419.** Trackmen and other employes must run on a tricycle or trolley with or for the staff, when required to do so by a responsible officer of the Transportation Branch.

**420. CANCELLED.**

See instructions contained in Circular C. 54/12.

**421.** Any tricycle may be lent to a District Superintendent, Traffic Inspector, Travelling Auditor, Engineer, or Surveyor, for Departmental purposes, provided that it can be spared for the time required.

**422.** Instructions for the protection of motor cars and hand cars, are included in General Appendix. Directions for the use of motor cars are issued with each car. The following directions for the use of hand cars must be complied with:—

**TRICYCLES.**

Each tricycle as it is supplied is supposed to be properly adjusted to run on a track of 5ft. 3in., or 2ft. 6in. gauge, as the case may be.

The flange of the driving wheel should run, say, a quarter of an inch from the rail.

When the driving wheel is in position, as above, the forward wheel should stand in the exact line of the track.

Both wheels are adjusted in this particular by moving backwards or forwards the axle-boxes on the right hand of the machine.

The small or guide wheel, which is governed by an adjusting brace having screw eyes at each end, and also by the slotted holes in the axle at its junction with the truss-rod, should run in an exact line with the track.

In any instance in which a tricycle is provided with a chain, it may be adjusted as follows:—

- (1) Slack the lock nut of the stretching screws to the driving wheel bearings.
- (2) Slack the nuts of the bolts securing the driving wheel bearings.
- (3) Move the driving wheel bearings towards the rear of the machine by means of the stretching screws, taking care to move both bearings parallel, and to keep the wheels in the exact line of the track.
- (4) When the chain is tightened sufficiently, screw up the bolts of the bearings, and lock the stretching screw by means of the lock nut.
- (5) When the driving wheel bearings have been moved the length of the slot in the bearing, take out a link of the chain and re-adjust the machine by moving the bearings back to the opposite end of the slot, and adjusting as before.

The following general directions must be observed:—

- (1) Oil the chain by means of an oiled rag to give sufficient lubrication, but avoid an excess of oil on the chain, which will gather grit and dirt, and thus be destructive to the machine.
- (2) Do not run the machine backwards.
- (3) Do not attempt a high speed unless used to the machine.
- (4) Lean well towards the guide-wheel when running around a curve.
- (5) Keep all nuts screwed tight.

Every tricycle must be kept in good working order, well oiled and cleaned, and protected from the sun and rain as much as possible, and any defect must be reported without delay. Any repairs required as the result of carelessness will be carried out at the expense of the employe at fault.

#### QUADRICYCLES.

Each quadricycle, as it is supplied, is supposed to be properly adjusted to run on a track of 5ft. 3in. or 2ft. 6in. gauge, as the case may be.

The machines are made about  $\frac{5}{8}$ -in. narrow to gauge, and are intended to run forward or backward.

Three classes of quadricycles are now in use, as follows:—

Class 1, with short axles, ball bearings, and chain gearing.

Class 2, with short axles, plain bearings, and toothed gearing.

Class 3, with through axles, ring lubricators, and toothed gearing.

#### Alignment of Short-axled Quadricycles.

If, when run in either direction, on a straight piece of track, the flange of any wheel grinds against the rail, the wheels are out of alignment. The wheels may be

knocked out of alignment if the machine leaves the track, or by rough usage when lifting it on or off the track. The grinding may be caused by one of the wheels having a slight lead towards the rail on which it runs; or by the wheel on the opposite side of the car being set with a slight lead away from its rail, pushing the car bodily over, thus forcing the flange against the rail. To remedy this, the wheel which is out of line must be brought into alignment, by loosening the nuts holding the axle bracket to the frame, and moving the bracket backwards or forwards the required amount, and then tightening up the nuts. Special care must be taken that the wheels are true to position after adjusting the driving wheels for wear of the driving chain.

#### Alignment of Through-axled Quadricycles.

The diagonal tie rods must not be made too tight, and the car must be quite free on its axles.

#### Ball Bearings.

The flanged wheels only are provided with ball bearings. The ball cups, lock nuts, and small sprocket wheel are all screwed right-handed, except the locknut of the small sprocket wheel, which is screwed left-handed.

There are 10 balls in each bearing, 20 in each wheel.

If the ball bearings are taken apart for any reason, great care must be exercised in preventing their loss. In putting the balls back into place, a little vaseline or tallow must be smeared over the ball races to help to keep the balls in position.

#### Adjusting Ball Bearings.

The wear in the ball bearings should be small, and the bearings should run for about twelve months without any adjustment for wear. In taking up for wear, the bearings are correctly adjusted when there is the smallest amount of play between the wheel and its axle. The cups must not be screwed up tight enough to jamb the balls between the cups and the cones, as this may cause the balls to break, with considerable damage to the bearings. Special spanners are provided for the purpose.

Care must be taken when the bearings are adjusted, that the wheels are left in alignment, and to exactly the same gauge. No difficulty should be experienced in maintaining the gauge, if the bearings are all adjusted from the one side—say the left-hand side

#### Bearings Fitted with Ring Lubricators.

The bearings of cars fitted with ring lubricators are self-lubricating, provided there is some oil in the bottom of the lubricator. When once oiled, these bearings should run satisfactorily for a few hundred miles without further oiling. The other working parts of the car should be oiled frequently.

#### Adjusting for Wear of Chain.

To adjust the chain to the proper degree of tightness, the following directions must be observed:—

- (1) Slacken the lock-nut of the stretching screws to the driving wheel bearings.
- (2) Slacken the nuts of the bolts securing the driving wheel bearings.
- (3) Move the driving wheel bearings towards the rear of the machine by means of the stretching screws, taking care to move both bearings parallel, and to keep the wheels in the exact line of the track.
- (4) When the chain is tightened sufficiently, screw up the bolts of the bearings, and lock the stretching screw by means of the lock-nut.
- (5) When the driving wheel bearings have been moved the length of the slot in the bearings, take out a link of the chain, and re-adjust the machine by moving the bearings back to the opposite end of the slot, and adjusting as before.

The following general directions must be observed:—

- (1) Oil the chain by means of an oiled rag, to give sufficient lubrication, but avoid an excess of oil on the chain, which will gather grit and dirt, and thus be destructive to the machine.

- (2) Frequently examine the machine thoroughly, and see that all nuts are screwed up tight.
- (3) Do not load the tray with more than 3cwt., distributed over the two cross-bars.

#### Care of Machine.

A tarpaulin is provided with each machine, and must always be carried on the tray, when the car is in use. During the day's work, when the machine is placed alongside the line, it must be covered with the tarpaulin, and the wheels securely padlocked. At the termination of each day's work, the machine must be safely housed, if a shed is available, and the door of the shed padlocked. If no shed is available, the machine must be placed on the most suitable site obtainable, the cover securely fastened, and the wheels padlocked.

Every care must be taken to protect the machine from undue wear and tear, and from deterioration due to exposure; and it must always be kept thoroughly clean, and free from oil and dirt.

Every defect must be reported.

#### Lubricants.

The best lubricant for trollies is anti-friction grease. For tricycles and quadricycles, special pale machine oil must be used. 2cwt. of grease, and 10 gallons of special pale machine oil should meet a Roadmaster's requirements for twelve months.

INSTRUCTION NO. 423.—The following instructions in regard to the carriage of Departmental Motor Cars, and of Petrol or Naphtha for use in Departmental Motor Cars, must be strictly complied with:—

#### CARRIAGE OF DEPARTMENTAL MOTOR CARS.

Departmental Motor Cars with Petrol or Naphtha in the tanks may be carried in the van of Passenger, Mixed, or Goods trains subject to the following conditions:—

- (A) The Motor Car must be accompanied by and be in the care of a Way and Works Branch employe holding a Departmental Motor Certificate of competency.
- (B) The van of a Passenger or Mixed train must not be used for the carriage of any such Motor Car if a Goods train is available, or if there is room available on a Mixed train in a suitable truck which has at least one truck or van between it and the Passenger cars.

Before having the Motor loaded, the certificated Way and Works Branch employe must inspect the Motor Car and be prepared to certify:—

- (A) That the Petrol or Naphtha is at least one inch below the top of the Petrol tank.
- (B) That the Petrol or Naphtha stop-cock and the drain-cock beneath the tank of the car are both securely closed, and that no Petrol or Naphtha is escaping; and
- (C) That the Carburetter is empty of Petrol and Naphtha.

Every van used for the carriage of a Motor Car must be provided with a chemical fire extinguisher, which must be in good order, and fully charged for immediate use.

The Way and Works Branch employe will be responsible for the loading, transport and discharging of the Motor Car. He must at frequent intervals en route examine the tank, and if any Petrol or Naphtha be escaping, the Motor Car must be removed from the train at or before reaching the next stopping station, as the necessities of the case may determine. All reasonable assistance will be given to this employe by the Station Staff and the Guard.

All windows in the van in which the Motor Car is being carried must be kept open to the fullest extent consistent with the protection of luggage, parcels, etc., from damage by rain or loss by falling out.

After unloading the Motor Car, the van must be immediately inspected by the Way and Works Branch employe, who, in the event of any Petrol or Naphtha having escaped by leakage, etc., must direct the attention of the Guard to the matter.

#### CARRIAGE OF PETROL OR NAPHTHA FOR USE IN DEPARTMENTAL MOTOR CARS.

Petrol or Naphtha required for use in Departmental Motor Cars (when not carried in the tank of a Motor Car as specified in the foregoing instructions) must not be carried by a Passenger train, but if a Goods train is not available, a limited quantity as specified hereunder may be forwarded in the van of a Mixed train, subject to the following conditions:—

- (A) The Petrol or Naphtha must be contained in a two-gallon brass tank fitted with a tight screw cap and washer. The tank must be securely packed in an approved metal case, fitted with a wooden frame, and with a close-fitting wire gauze lid, and conspicuously labelled on each side "Petroleum Spirit, Highly Inflammable."
- (B) Not more than one such tank shall be forwarded in the van of a Mixed train at any one time.

All windows in the van of any Goods or Mixed train in which a tank containing Petrol or Naphtha is being carried must be kept open to the fullest extent consistent with the protection of luggage, parcels, etc., from damage by rain or loss by falling out.

*Petrol or Naphtha vapour is heavier than air, and sinks and lies close to the floor of a van or to the ground as the case might be. Petrol or Naphtha vapour when mixed with air in certain proportions is very inflammable and is therefore highly dangerous, and may be ignited by fire or a flame some distance away from where the Petrol or Naphtha may have been spilled.*

#### Ballast and Work Trains.

433. In any instance in which a ballast or work train is required the Roadmaster must, at least seven (7) days in advance (except in a case of emergency) make application therefor to the Head Office, stating:—

- (a) the class of engine required;
- (b) the point at which the engine is to stable;
- (c) the number and class of trucks required;
- (d) the portion of the line upon which the train is to be employed;
- (e) the length of time for which the train will be required; and
- (f) the approximate daily running hours.

434. Every ballast or other work train must be worked strictly in accordance with the regulations and instructions in the General Appendix, and must be under the personal control of the Roadmaster, unless the safety of the track or other special circumstance requires his presence elsewhere, in which event he must place an experienced and reliable Ganger in charge of the train, and give him explicit instructions how to act. The Roadmaster, or the Ganger acting for him, as well as the guard, must confer with Station-masters concerned, so as to be acquainted with the running of any special train which may be arranged, and also to arrange mutually for the running of the ballast or work train. In any instance in which the Roadmaster considers that a ballast or work train has been delayed unnecessarily, from any cause, he must report the circumstances to the Head Office.

435. Every ballast or other work train must, if practicable, have the full tonnage shown in load tables, and must be used for conveying back loading for the Transportation Branch, provided that the Roadmaster or Ganger considers that this can be done without interfering with the work of the train, or causing loss of time to the men employed in connection therewith.

**436.** In any instance in which small quantities of material require to be loaded or discharged between stations, the Roadmaster must select a suitable goods train and apply for arrangements to be made with the Transportation Branch to supply or pick up the trucks, and stop while the material is being handled. If a suitable goods train cannot be obtained, the work must be performed with a local engine, if available. Trolleying of sleepers or other material for long distances must be avoided as much as possible.

**437.** Care must be taken not to overload trucks, especially in wet weather when the weight of ballast is likely to be affected. If trucks are loaded with gravel, and there is a weighbridge available anywhere on the route of the ballast train, a truck-load must be weighed from time to time. If a weighbridge is not available, the measurements must be checked, and the truck springs observed, to avoid overloading.

WEIGHTS OF MATERIALS.

Gravel	...	...	...	1.3 tons per cubic yard
Sand...	...	...	...	1.08 " "
Metal, 1½ in., 2½ in., and Screenings	...	...	...	1.1 " "
Earth	...	...	...	1 " "
Spalls	...	...	...	1.06 " "
Scoria	...	...	...	.7 " "
Ashes	...	...	...	.6 " "
Sleepers, 9 ft. x 10 in. x 5 in.	...	...	...	10 Number per ton
Sleepers, 9 ft. x 9 in. x 4½ in.	...	...	...	12 " "
Fence Rails, 9 ft. x 7 in. x 2½ in. to ½ in.	...	...	...	52 " "
Fence Posts, 6 ft. 6 in. x 8 in. x 3½ in.	...	...	...	26 " "
Bricks (machine pressed)	...	...	...	286 " "

**438.** The screw couplings of every ballast truck must be kept cleaned and oiled. Oil will be supplied at the nearest engine depot.

**439.** Every truck used for ballasting must be swept out and thoroughly cleaned before it is returned to the Transportation Branch.

**Floods.**

**450.** The Roadmaster and the Ganger must report to the Head Office, and to the Workmaster, any damage by floods, and, if required, must assist the Works Branch in effecting the necessary repairs.

**451.** The Workmaster and the Roadmaster must personally inspect any damage by floods, and report to the Head Office any instance in which they consider additional waterway should be provided.

**452.** The Ganger must mark on the piers of every bridge, and with pegs driven in suitable places; the flood-level on both sides of the line.

**453.** In any instance in which a flood seems likely to rise as high or higher than any flood previously recorded, the Head Office must be advised by telegram, so that, if possible, an Engineer may be sent to see the flood at its maximum.

**454.** Trackmen must remove any drift from any bridge and keep every culvert, box drain, and other waterway free from obstruction.

### Workmasters and Foremen.

**465.** The Workmaster must make personal and careful inspection of the whole of the works in his charge, at least once in each half-year, or more often if required, and must enter the date and result of each inspection in his diary, and always keep the diary written up to date; and must furnish a half-yearly report of the condition of each bridge, pier, wharf, culvert, platform, fuel stage, retaining wall, and cattle guard, on dates as may be fixed; and return therewith to the Head Office all correspondence and authorities respecting works, with a brief statement showing how each work stands. In any instance in which renewals are required so urgently that they cannot be allowed to wait for authority in the usual course, but not otherwise, the Workmaster must furnish a separate report, with an estimate of cost; and in a special case, he must, without waiting for instructions, promptly do everything to prevent an accident, and obtain covering authority as early as possible.

Once in every three (3) years, the Workmaster will be accompanied on the half-yearly inspection by an officer appointed by the Head Office, who will make a careful examination, and report on the general condition of each bridge, culvert, cattle guard, beam, etc., in addition to the detailed report of the Workmaster.

**466.** The Workmaster must supply a hose for discharging any water tank on a truck, upon requisition therefor by the Roadmaster.

**467.** The Workmaster must effect any necessary repairs to any barrow or plank.

**468.** The Workmaster must provide by-law notices at every station, pier, wharf, shop, etc., and must see that the frames and boards are kept in proper repair, and that the printed matter is renewed when necessary.

**469.** The Workmaster must make careful and prompt inquiry into the cause of, and report fully, any accident to an employe or structure under his charge.



470. The Workmaster must be prepared to furnish on the proper form by the 1st of May in each year an estimate of the Maintenance and Renewals expenditure for the following financial year, and on the 1st of July must furnish a statement showing the quantities of bridge and cattle guard beams, piles, and crossheads required for the ensuing year.

471. Every Foreman is under the control and direction of the Workmaster, and is responsible to the Workmaster for the proper care of the shops, machines, and plant under his control, for the efficient performance of all duties in connection therewith, and for the economical disposition of all stores and material. Every Foreman is also responsible to the Workmaster for the safe, efficient, and economical maintenance of the works, outlined in Instruction 2, on his section, except any work of which he may be relieved by the Workmaster, and must personally supervise all work in his charge, and see that each workman under him performs his duties faithfully.

472. The Foreman must promptly report to the Workmaster any damage to any structure by decay, flood, fire, or other cause, and is authorised to make repairs to any structure which is in such a dangerous condition as to interfere with the safe passage of trains, and must advise the Workmaster thereof as soon as possible.

473. The Foreman must see that each employe under him has the necessary tools to perform economically and properly the work assigned to him.

474. The Foreman must see that any sleeping car used by a gang under his control is kept clean, neat in appearance, and in good repair.

475. Every bridge, pier, wharf, culvert, platform, fuel stage, retaining wall, and cattle guard must be examined quarterly by the Foreman, or, under his direction, by an employe, expert in work of this kind, and a report of the result must be forwarded to and filed by the Workmaster, so that the information will always be available.

### Bridges.

486. The following are the most important points to be observed in the examination of a bridge:—

Each pier and abutment must be examined carefully as to any settlement, crack, leaning, bulging, imperfect stone, weeping, drainage, or other defect. It must be noted whether the work needs pointing up, or whether any crack has opened since last pointing. Each pier must be kept free from rubbish, dirt, gravel, cinders, etc., especially about any girder, bed-plate, rocker, and roller.

The seat of each bedplate must be kept level and firmly bedded, and examined for any sign of crushing.

Iron and steel work, especially when in contact with ballast, etc., must be inspected closely for any flaw or rust.

Riveted work must be sounded frequently with a hammer to detect any loose rivet. Every bed-plate must be perfectly level, and every roller and rocker must move freely on its axis, and must always be at right angles to the line of the bridge. Examination must be made to ascertain if the expansion is working properly, if the girders are in true alignment, and if there is any excessive deflection.

The condition of each brick, stone, pipe, or concrete culvert and front must be examined as to any crack, settlement, or other defect.

Every pile, beam, decking, crosshead and other part of a timber bridge must be examined thoroughly by sounding with a hammer, or by boring in any suspicious looking place with an auger not more than three-eighths of an inch in diameter, and the results must be noted.

Every timber, and especially any timber in contact with other timber, ground, or water, must be inspected closely for any sign of decay or shrinkage. The general condition of packing must be noted, and whether any additional is required.

The state and efficiency of bracing, any loose bolt, and the action of each structure under a passing train must be noted.

The crossheads in any bridge having longitudinal planking, especially where decking does not break joint over piers, must be examined closely for any flaw, and in any such bridge, and in any timber culvert, special attention must be given to the four (4) planks beneath each rail, and, in any bridge having cross decking, to the planks beneath the sleepers. For the purpose of examining the general condition of the decking, the ballast between some of the sleepers must be removed, and replaced immediately, and care must be taken not to disturb the ballast supporting the track.

487. The position of any defect in a beam, pile, etc., must be located by white paint close to the defect—using one mark thus— / for any defect noted for future observation; two marks thus— // for any beam or pile, etc., condemned by the Foreman or other authorised employe; and three marks thus— X or a cross thus— X for any beam or pile, etc., condemned by the Workmaster or Engineer.

488. In effecting renewals to any bridge, care must be taken to preserve the mileage shown thereon, and which serves not only to identify the bridge, but as a point from which surveys for other purposes may be commenced, if required. In the event of it being necessary to remove the timber to which the mileage plate is attached, the plate must be replaced carefully in exactly the same position as it previously occupied, and in the event of it being necessary to change the position of the plate on account of alterations to the bridge, the Head Office must be advised, so that the correct mileage for the altered position can be given.

489. Each pier, except the last one, of every bridge, must be numbered with eight-inch figures, painted white, in the centre of the down crossheads in the case of a timber bridge, and in a corresponding position in the case of any other bridge, so that the number as seen from the ground will give the number both of the pier and of the span of the bridge. The pier or abutment at the Melbourne end must be called No. 1, and so on.

490. The length of every new pile, including any driven, planted, fender, or added pile, in any bridge, wharf and pier, must be registered thereon. "P" must be added in the case of a planted pile, "C" in the case of a pile with cradling.

491. Every beam, crosshead, or pile, when renewed, must be branded with the month and year in which it is put into the bridge: thus, if renewed in November, 1908, the brand will be "11/08," and in every instance the brand must be cut in a conspicuous place; in the case of a pile, the brand must be five (5) feet above the natural surface or summer water level.

492. In the event of any pile sinking not more than one inch, action need not be taken if further settlement be not anticipated; but if any further settlement take place up to three (3) inches, the superstructure must be lifted into line, and packing placed between the shoulders of piles and crossheads. The maximum amount of packing allowed is about three (3) inches, and when more is required, the circumstances must be reported to the Head Office, and instructions will be given as to the method of dealing with each such case.

A pile must not in any instance be lifted.

493. The following tables show the maximum spacing (centre to centre) of heads of piles in a pier.—(a) for various sized new crossheads, and (b) for various sized existing crossheads in 7ft., 11ft., 15ft., and 20ft. openings when there are no inside piles:—

NEW CROSSHEADS.

Sizes of Crossheads.	Maximum distances apart (centre to centre) of piles in piers of 7 ft., 11 ft., 15 ft. and 20 ft. openings.				
	7ft.	11ft.	15ft.	15ft. to 20ft.	20ft.
18in. x 6in., 17in. x 7in., 16in. x 8in., 15in. x 10in.	ft. in. 13 3	ft. in. 11 6	ft. in. 12 0	ft. in. 11 3	ft. in. 11 0
17in. x 6in., 16in. x 7in., 15in. x 8in., 14in. x 9in.	12 6	10 9	11 6	10 9	10 6
17in. x 5in., 16in. x 6in., 15in. x 7in., 14in. x 8in.	11 6	10 0	10 9	10 3	10 0
16in. x 5in., 15in. x 6in., 14 in. x 7in., 13in. x 8in.	10 9	9 6	10 3	10 0	9 9
15in. x 5in., 14in. x 6 in., 13in. x 7in., 12in. x 8in.	10 0	9 0	9 9	9 6	9 3
14in. x 5in., 13in. x 6in., 12in. x 7in., 11in. x 8in.	9 6	8 6	9 6	9 3	9 0
13in. x 5in., 12 in. x 6in., 11in. x 7in., 10in. x 9in.	8 6	8 0	9 0	8 9	8 9

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Sizes of Crossheads.	Maximum distances apart (centre to centre) of piles in piers of 7 ft., 11 ft., 15 ft. and 20 ft. openings.				
	7 ft.		11 ft.	15 ft.	15 ft. to 20 ft.
	Longitudinal Planking.		Beams.		
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
18in. x 6in., 17in. x 7in., 16in. x 8in., 15in. x 10in.	9 6	8 6	9 9	9 6	9 3
17in. x 6in., 16in. x 7in., 15in. x 8in., 14in. x 9in.	9 0	8 3	9 6	9 3	9 0
17in. x 5in., 16in. x 6in., 15in. x 7in., 14in. x 8in.	8 9	7 9	9 0	9 0	8 9
16in. x 5in., 15in. x 6in., 14in. x 7in., 13in. x 8in.	8 3	7 6	9 0	8 9	8 6
15in. x 5in., 14in. x 6in., 13in. x 7in., 12in. x 8in.	8 0	7 6	8 6	8 6	8 3
14in. x 5in., 13in. x 6in., 12in. x 7in., 11in. x 8in.	7 6	7 0	8 6	8 6	8 0
13in. x 5in., 12in. x 6in., 11in. x 7in., 10in. x 9in.	7 3	7 0	8 3	8 0	7 9

Sizes of Crossheads.	20 ft. openings.				
	7ft.	11ft.	15ft.	15ft to 20ft.	20ft.
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
18in. x 6in., 17in. x 7in., 16in. x 8in., 15in. x 10in.	16 0	13 6	13 6	12 9	12 3
17in. x 6in., 16in. x 7in., 15in. x 8in., 14in. x 9in.	14 6	12 6	12 9	12 0	11 6
17in. x 5in., 16in. x 6in., 15in. x 7in., 14in. x 8in.	13 6	11 6	12 0	11 6	11 0
16in. x 5in., 15in. x 6in., 14in. x 7in., 13in. x 8in.	12 6	10 9	11 6	10 9	10 6
15in. x 5in., 14in. x 6in., 13in. x 7in., 12in. x 8in.	11 6	10 0	10 9	10 6	10 0
14in. x 5in., 13in. x 6in., 12in. x 7in., 11in. x 8in.	10 6	9 6	10 3	9 9	9 6
13in. x 5in., 12in. x 6in., 11in. x 7in., 10in. x 9in.	10 0	9 0	9 9	9 6	9 3

NOTE.—In existing work, if the outside piles are spaced further apart than given above, new crossheads must be put in, or inside piles added to take the load. When the spacing of piles just reaches the limits given above, existing crossheads may be left in provided they are of first-class quality.

494. The following table shows the minimum number and maximum length of rails, serviceable or unserviceable, to be used under each running rail for temporary work, during which the speed of every train must be reduced to ten (10) miles per hour.

NO. OF RAILS UNDER EACH RUNNING RAIL.

Weight per yard.	Description of Rail Serviceable.					Spans in Feet from Centre to Centre of Reliable Areas of Support.															
	Class.	Depth.	Width of Head.	Width of Flange.	General Length.	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
100	P	6	3	5 1/2	31 9	2	2	3	3	3	3	4	4	4	5	5	6	6	7	8	
80	O	5 1/2	2 1/2	5	31 9	3	3	3	4	4	4	5	5	6	6	7	7	8	8	10	
75	H	4 1/2	2 1/2	4 1/2	23 0	3	3	3	4	4	4	5	5	6	6	7	8	9	10	11	
75	I	4 1/2	2 1/2	4 1/2	23 0	3	3	3	4	4	4	5	5	6	6	7	8	9	10	11	
65	F	4 1/2	2 1/2	4 1/2	22 6	4	4	4	5	5	6	6	7	7	8	9	10	10	10	11	
60	E	4 1/2	2	5	23 10	4	4	4	5	5	6	6	7	7	8	9	10	10	10	11	
60	C	4 1/2	2	4 3/4	22 6	4	4	4	5	5	6	6	7	7	8	9	10	10	10	11	
60	D	4 3/4	2 1/2	4 3/4	22 6	4	4	4	5	5	6	6	7	7	8	9	10	10	10	11	
60	N	4 1/2	2 1/2	4 1/2	31 6	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	5

Minimum number of sleepers under each end of temporary rails grouped together at the reliable areas of support

NOTE.—The span given is not the clear span, but the distance centre to centre of reliable areas of support. These rails must be placed, if possible, centrally under each running rail, the outer rails of the group being not more than 36 inches apart, centre to centre. Any rails that cannot be got in to this space must be placed head down between the others.

The sleepers, particularly those near mid spans, are relied upon to distribute the load uniformly amongst the rails, and, if they are not thoroughly reliable for this purpose, sound timber must be put in. Special care must be taken by putting in packing from time to time to ensure that every rail takes its share of the load.

this space must be placed head down between the others.



495. In order to admit of proper inspection and ventilation around timber, filling must not be tipped within three (3) feet of the timbers at the end of any bridge, or in any bridge opening. Trackmen must see that all surplus earth is cleared from the end of every bridge, and that the slopes are trimmed, as far as possible, clear of all timber, and must remove any undergrowth or combustible material liable to endanger a bridge in the event of fire.

496. In any instance in which rabbits are troublesome and burrow about the end of any bridge, trackmen must spread ashes at least one foot deep.

497. Before filling in any bridge or portion of a bridge the Workmaster must satisfy himself that it will remain safe for carrying the traffic until the new filling has consolidated, and, if necessary, he must make it safe by propping or otherwise, and remain responsible for its safety, until it has been removed. The filling must be deposited in thin layers, and consolidated by ramming or otherwise as the work proceeds. It must be brought up to formation level, and for the purpose of getting the filling well in under the decking, some of the latter must be removed. In the case of longitudinal decking, two or three planks down the centre of the "5ft." must be removed, and in the case of cross decking, one or two planks between sleepers wherever practicable, care being taken that the packed ballast under each sleeper is not disturbed. The filling must be allowed to settle until, in the opinion of the Roadmaster, it has sufficiently consolidated to carry the traffic. In the meantime any settlement must be made good from time to time by trackmen, and the filling rammed well under the decking.

During the removal of the beams and decking the Roadmaster will be responsible for the safety of the traffic, and must take such precautions, give such notices, and slow down trains, etc., as may be necessary. Before the timbers carrying the track are removed, any bridge sleeper which is short or otherwise defective must be replaced by a full sized and perfect one, and as many other sleepers must be put in temporarily as may be considered necessary to obtain a good bearing on the new ground, and if on a grade a small French drain must be made a short distance from the bridge, on the

high side across the track, with its bottom below the original formation, so as to intercept any drainage which may flow down the grade under the ballast after rains.

The bridge openings must be removed completely in a face one or more at a time according to the interval between trains, and for this purpose the bearing timbers may be cut to waste if necessary. The surface of the filling must be rounded, and drains cut if necessary, so as to drain the surface of the new filling, and any subsidence of the filling must be made good with ashes, sand, gravel, or ballast, or any similar filling material which will not soften with water, and which will drain efficiently. Sufficient men must be employed to carry out the work expeditiously. Dry weather must be selected as far as possible, and every precaution taken to ensure the safety of the trains.

### Painting.

**508.** Uniform colours must be used in painting station and other buildings in accordance with the authorised standards. In any instance in which rain water is used for domestic purposes, the roofs of the buildings must not be painted.

**509.** The ironwork of every bridge and water tank, etc. (except the inside of the tank, for dealing with which special instructions will be issued), must be painted with red oxide or other approved paint. The paint must be obtained from the Works Depot, Spencer-street.

**510.** The name of every station must be painted on the name board thereat, in ten-inch letters; and on every platform seat in four-inch letters.

**511.** Every lever and footplate of interlocking apparatus must be properly painted. The standard colours for the gear are as follows:—

Lever working signals—Red.

Lever working points or gates—Black.

Lever working lockbars—Light Blue.

Lever working crosslocks—Top half, Light Blue; bottom half, Black.

Lever working platform indicators—Top half, Red; bottom half, Black.

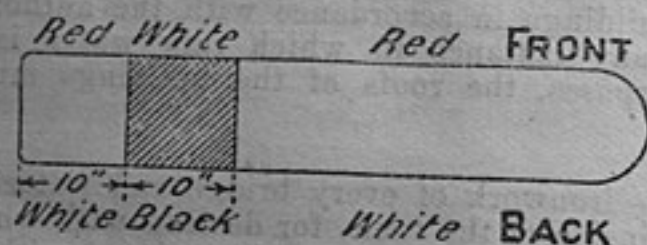
Pilot lever—Top half, White; bottom half, Black.

Spare lever—White.

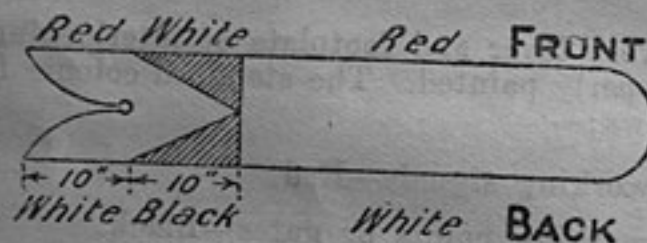
Footplate—Black.

**512.** The paint work of every semaphore arm, disc, and indicator must be kept bright and clean. Every semaphore arm must receive, after painting, two coats of varnish, so that it may be cleaned readily at any time, and after cleaning it must be re-varnished when necessary.

513. The "bar" on the front and back of an ordinary arm must be 10 inches wide and 10 inches from the end of the arm, thus:—



and the bar on a distant semaphore arm must be fishtailed, thus:—



514. Every semaphore mast must be painted white from a line 5 feet above the ground to the top, and black from that line to the ground, unless special instructions are given to paint it dark grey. All fittings, such as lever plates, rod guides, down rods, brackets, cranks, and blinders must be painted black.

515. Care must be taken to avoid splashing any signal glass during the painting of any semaphore, disc, or indicator.

516. Every semaphore at an interlocked place must be numbered in accordance with the litho. diagram in the signal box; and every such number must be 12 inches long, and painted black on a white ground on tin, and secured on the front and the back of masts, 8ft. above the ground. Every such number must be replaced promptly, when a mast is renewed or altered.

### WATER SUPPLY.

528. Trackmen must make an inspection of every reservoir embankment, and of every pipe track from a spring, stream, or reservoir, at the beginning of each month, and report to the Roadmaster if any leakage is observed. They must see that the head of the pipe line is kept clear of obstruction, and where special instructions are issued, that the scour valves of pipe tracks are opened so as to remove any floating matter. The gauging of each reservoir must be taken during the inspection, and reported on the proper form. This instruction will not in any way relieve the Workmaster of his responsibilities in connection with water supply works.

529. Every Trackman employed as a Pumper must keep the tanks full, the pumping machinery clean, the nuts tight, and the pump house and surroundings tidy. In the event of any defect or failure, he must advise the nearest Station-master, and forward particulars promptly to the Roadmaster.

530. The following instructions respecting the fixing, supervision and reading of Water Meters must be strictly observed by all concerned:—  
Every meter must be handled with care, as any rough usage is likely to disarrange the internal mechanism.

In selecting the site for a meter, consideration must be given to convenience of access for repairing and reading the dials, freedom from interference by traffic, etc., possible future extension and drainage.

Each meter must be fixed perfectly level on a solid foundation, and together with the dirt box and retention valve (if the latter is provided) must be enclosed in a red gum box provided with hinges, staple, padlock and keys for same, and the whole kept in proper repair.

Where a dry sight is not available, a brick pit must be built and provision made for drainage, if practicable.

Each box or pit must be of such a size as will admit of the meter being unbolted and lifted out without interfering with the sides of the pit.

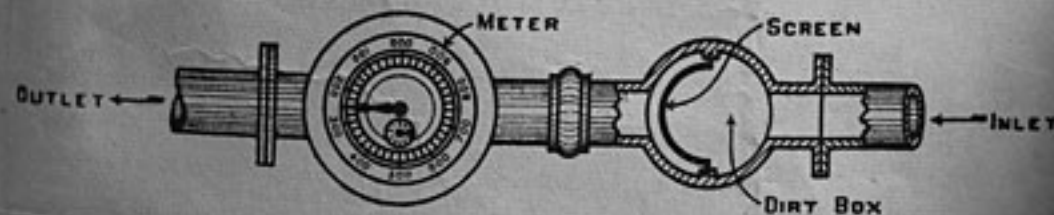
Stop valves must be provided within a short distance of, and on each side of the meter. The inlet pipe must be connected to the filter or dirt box end of the meter, or the end of the meter marked "Inlet." Care must be taken to see that the pipes are free from dirt, etc., before connecting up.

In suitable situations, small meters, say up to 1½ inches, should be fixed approximately level with the natural surface, four bends being used to effect this. These bends afford a certain amount of spring, which facilitates removal, replacing, etc.

In every instance after fixing a meter, the water must be turned on and the dial observed to ascertain if the meter is registering.

The perforated screens of each meter provided with outside or separate dirt boxes must be taken out and cleaned once in every six months and more frequently where the water passing through is of a muddy nature, or where debris, etc., is likely to get into the pipes. Special attention must be given to the above, as any neglect of this precaution is likely to cause a failure of the supply.

Where the screens are half-round care must be taken to fix them in the correct position, thus:—



The meter box or pit must be examined periodically and any obstruction removed therefrom.

The Workmaster must keep a complete list of every meter in his district measuring water supplied to, or obtained from, the Department.

Any meter seriously damaged or ceasing to register must be removed for repairs as soon as it can be replaced by a substitute meter. Meters smaller than 2 inches require no substitute. Head Office must be promptly advised on docket W.W. 229, of every such exchange of meters. Under no other circumstances must a meter be removed without Head Office instructions.

If any meter is considered to be incorrectly registering, a report must be furnished to the Head Office. Arrangements will then be made, if practicable, to have a test made of the meter.

When removing a meter or installing a substitute, arrangements must be made for the representative of the Trust, other public body, or person concerned to be present to take the registration of the meter to be removed, and also that of the meter substituted.

On installing a new meter, or removing an existing one, docket W.W. 229 must be filled in and forwarded to the Head Office.  
 When instructions are issued for the removal of a bye-pass combination, i.e.—one large and one small meter on the same main, both must be taken out and forwarded at the same time.  
 In consigning a meter, its inlet and outlet openings must be protected either with wooden blank flanges or corks according to the size of such meter.  
 Employees concerned in the maintenance of meters should examine them whenever possible, and at once report any noticeable defect.  
 The Works Foreman must forward to the Chief Mechanical Engineer monthly docket, No. R S. 181, of the reading of every meter at the following Stations:—  
 Seymour, Wangaratta, Shepparton, Korumburra, Geelong, Ballarat, Warrnambool, Bendigo, Ararat, Hamilton, Echuca and Horsham.  
 Meter readings should always be taken the last working day of each month, if possible, in conjunction with the representative of the Trust or other body concerned.

Each meter is supplied with a large dial and pointer (C) and two smaller dials and pointers (A and B as in fig. 1). In addition, a small pointer (C) in fig. 1) projecting inwards as far as the outermost circle of the large dial is fixed to the casing.  
 The large dial and all pointers or hands, excepting the pointer fixed to the casing, rotate, but not all in the same direction.  
 The accompanying figures illustrate various types of meter dials, and the method of reading each will be described.

Figure 1

**ONE MILLION GALLONS CAPACITY**  
 — USUALLY 1½", 2", 3" AND 4" —



The Hands of the above indicate a consumption of **764,250 Gallons**

In Figure 1 each division of the outer circle of the large dial corresponds to 100,000 gallons, and a complete revolution to 1,000,000 gallons. Each division of the inner circle of the large dial corresponds to 10,000 gallons and a complete revolution to 100,000 gallons. On the smaller dial each division corresponds to 1,000 gallons, and a complete revolution to 10,000 gallons.

The consumption indicated by the pointers in Fig. 1 above should read as follows:—  
 The pointer marker A on the "1,000,000 gallons" dial is seen to be between the figures 7 and 8, and as the lesser quantity is always taken pointer A registers 700,000 gallons since each division indicates 100,000.

The pointer marker B on the inner or 100,000 gallons circle is seen to be slightly past the 64th division, and as each division corresponds to 10,000 gallons it registers 64,000.

The pointer marker C on the outer casing of the meter is seen to be on the 5th division past the figures "200" or the 25th division from zero or "000," and as each division corresponds to 10 gallons the reading should be taken as 250 gallons.

In writing down the total consumption showing on the above example the figures should be written thus:—

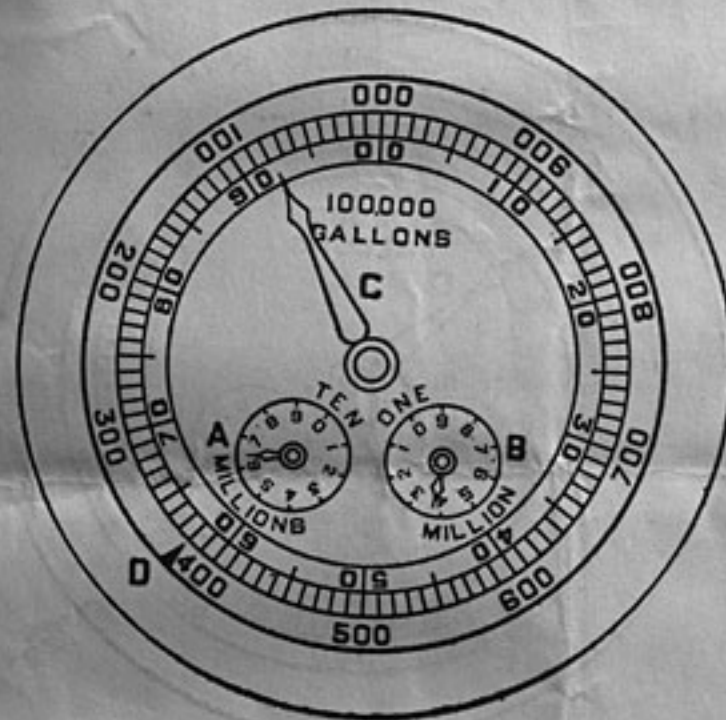
POINTER A.	Gallons.
" B.	700,000
" C.	64,000
	250
Total Registration	764,250

As explained further on, the consumption should be reckoned as 764,000, the 250 gallons to be dropped.

Figure 2

**TEN MILLION GALLONS CAPACITY**

— USUALLY 1½", 2", 3" AND 4" —



The Hands of the above indicate a consumption of **6,392,380 Gallons**

In Figure 2 the large dial and the small inner dial are read in a similar manner to the previous example, but as this meter has a capacity up to 10,000,000 gallons it is provided with an additional small dial, every division of which corresponds to 1,000 gallons or the complete revolution 10,000,000 gallons.

In writing down the total consumption it should read as follows:—

POINTER A.	Gallons.
" B.	6,000,000
" C.	300,000
" D.	92,000
	380
Total Registration	6,392,380

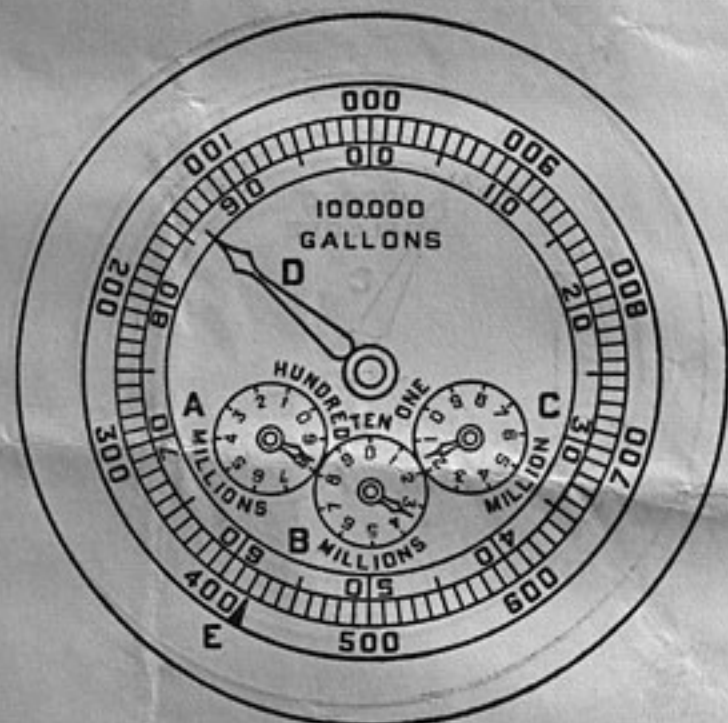
or written 6,392,000, the 380 to be dropped.



Figure 3.

**ONE HUNDRED MILLION GALLONS CAPACITY**

— USUALLY 4" AND 5" —



The Hands of the above indicate a consumption of  
83186420 Gallons

In Figure 3 the dials are read in a similar manner to the dials on the previous meters shown, but an additional dial is shown indicating up to 100,000,000 gallons.

In writing down the total consumption it should read as follows:—

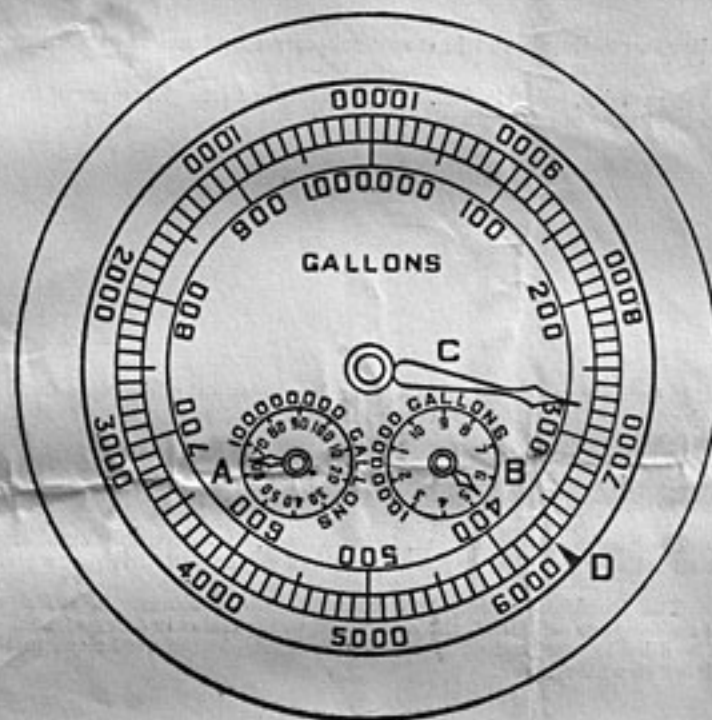
POINTER	Gallons.
A.	80,000,000
B.	3,000,000
C.	100,000
D.	86,000
E.	420
Total Registration	83,186,420

or written 83,186,000, the 420 to be dropped.

Figure 4

**ONE HUNDRED MILLION GALLONS CAPACITY**

— USUALLY 5" 6" AND UPWARDS —



The Hands of the above indicate a consumption of  
65276300 Gallons

In figure 4 the dials are read as before but this example shows that each division of the outer circle on the large dial corresponds to 100 gallons in place of 10 gallons as in the previous examples and each division on the inner circle of the same dial corresponds to 10,000 gallons in place of 1,000 gallons as in previous examples.

The total consumption should read as follows:—

POINTER	Gallons.
A.	60,000,000
B.	5,000,000
C.	270,000
D.	6,300
Total Registration	65,276,300

or written 65,276,000, the 300 to be dropped.

After some practice it will not be found necessary to write down separately the quantities indicated by each pointer but the total registration may be written down directly.

In reading Departmental meters quantities less than 1,000 gallons should be discarded, such small quantity being accounted for at the subsequent registrations, but when an account is to be closed the exact reading of the meter must be given.

A meter after recording the measurement of water up to its full capacity will again start registering from zero or "000." To arrive at the quantity registered by the dials previous to the fresh start from zero, the last reading must be deducted from the meter's total capacity and the result added to the quantity registered after starting again.

Where water is paid for by meter measurement a representative from each side must be present. This should be arranged in every case whether the Department is the supplier or a consumer.

Proper attention to the above will save much correspondence and time now wasted over disputed readings and accounts.

Damage to the meter, box, pit, etc., or any doubt as to the accuracy of the meter must be at once reported to the proper authority.

**532.** In tapping any water main, a Plumber must not allow more than one-quarter of an inch projection of the ferrule stop cock into the main, as anything beyond that causes trouble in cleaning the mains.

**533.** Trackmen must keep the drip dish at every water crane and every drain in confection therewith, clear of obstruction.

**534.** The Works employes must, twice a year, by thoroughly scrubbing the inside and removing all sediment, clean out each station tank from which drinking water is obtained.

**535.** The Roadmaster must see that the water storage is sufficient at every Departmental residence so as to limit the number of water trains in a dry season. Every tank which cannot be filled by gravitation, must, if practicable, be removed close to the line so as to minimise delay to water trains.

**Interlocking.**

546. Every Inspector of Interlocking is under the control and direction of the Engineer of Signals and Interlocking, and is responsible to him for the safe, efficient, and economical maintenance of all semaphores, interlocking apparatus and connections in his district. He must make a personal and careful inspection of the whole of the gear in his charge, at least once in every half-year, or more often if required, enter the date and result of the inspection on the forms supplied for the purpose, and forward such forms at the end of every month, to the Engineer of Signals and Interlocking.

547. Every Inspector of Signals and Interlocking must supervise personally all work in his charge, and see that each workman under him performs his duties in a proper and efficient manner.

548. Every Inspector of Signals and Interlocking must report promptly to the Engineer of Signals and Interlocking any accident to rolling stock which occurs at an interlocked station and also any damage to or derangement of interlocking connections.

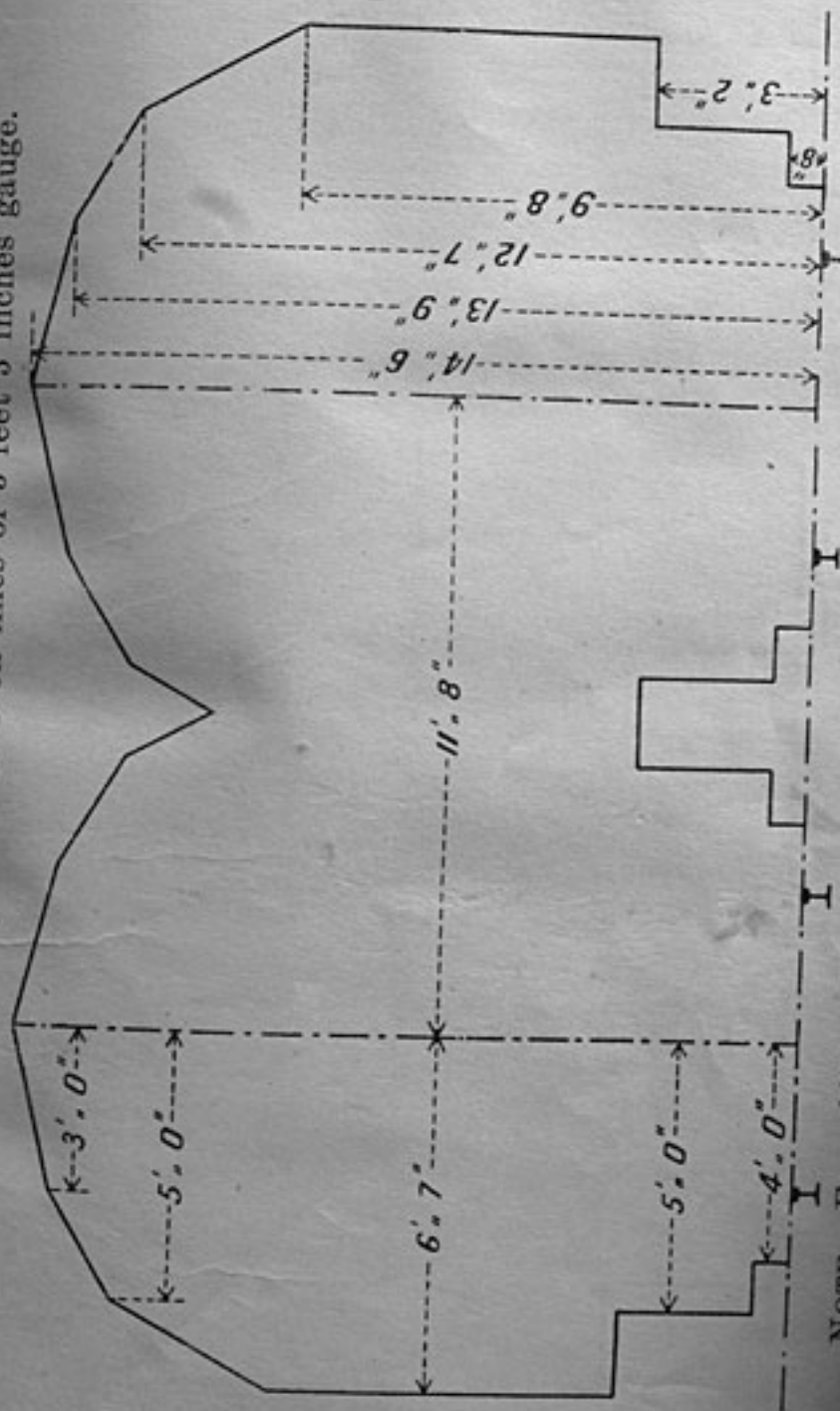
549. Trackmen, when applied to, must render assistance in the handling of any semaphore mast, and must supply any filling required by any Signal Adjuster or Interlocking Ganger for packing roller boxes, etc.

550. Trackmen must keep all connections, such as point rods, cranks, and rails, clear of ballast, ashes, grass, etc., so that the working of points will not be interfered with. Ballast or other loose material must not be allowed to touch the rails to which electric wires or bonds are attached. Ashes thrown on interlocking gear must be promptly removed, and a report giving full particulars furnished by the Track Ganger, so that the offender can be dealt with.

551. Material of any description must not be discharged on any point rod or signal wire.

552. Timber coverings over point rods must be provided only at such places as are mentioned specially in instructions from the Head Office.

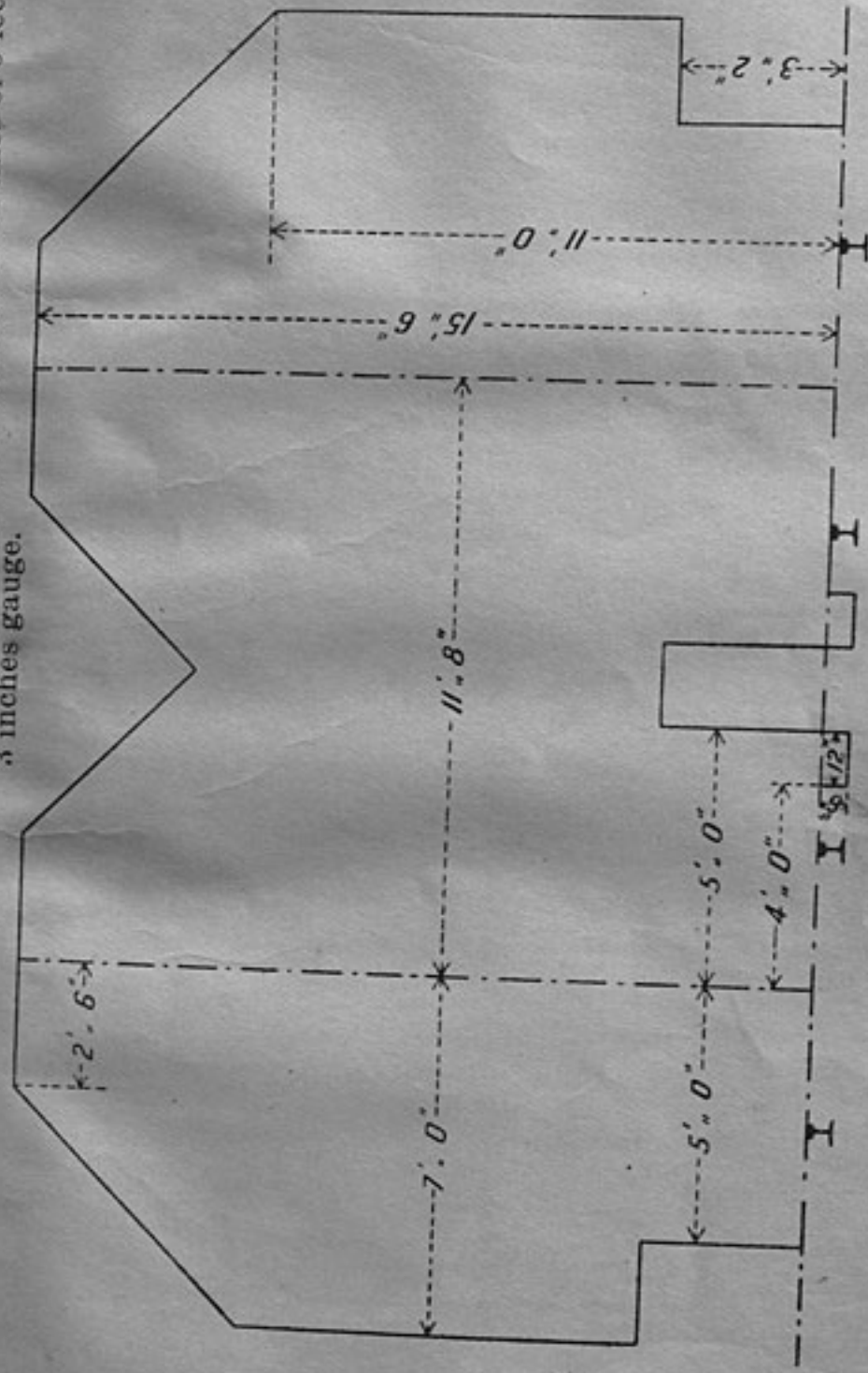
Minimum Structures prior to 1905 on lines of 5 feet 3 inches gauge.



NOTE.—For additional horizontal measurements on curves see letter press.

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

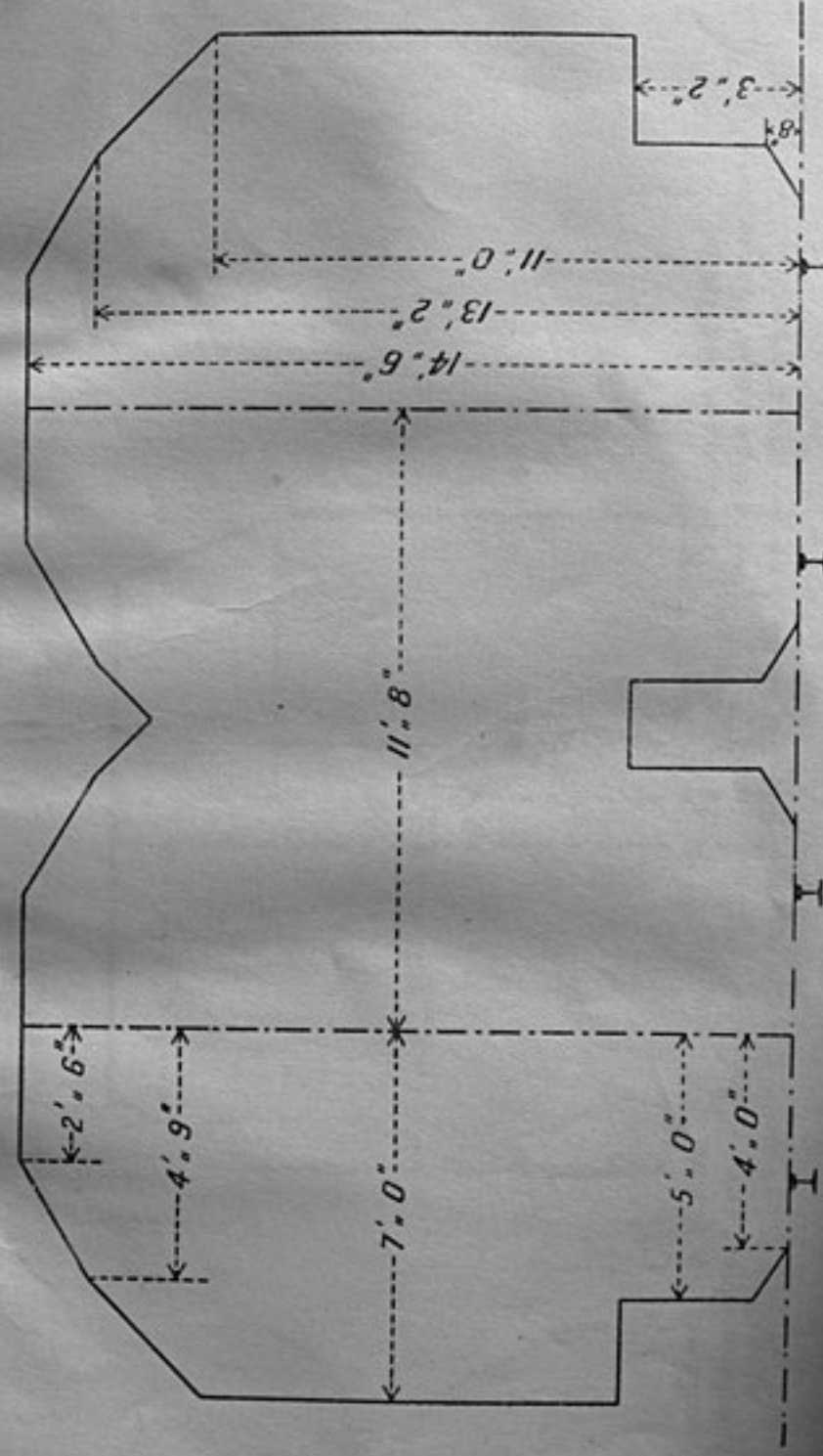
Future Minimum Structures within the Melbourne Suburban Radius on lines of 5 feet 3 inches gauge.



NOTE. On single tracks the space reserved below rail level for third rail may be on either side of track.

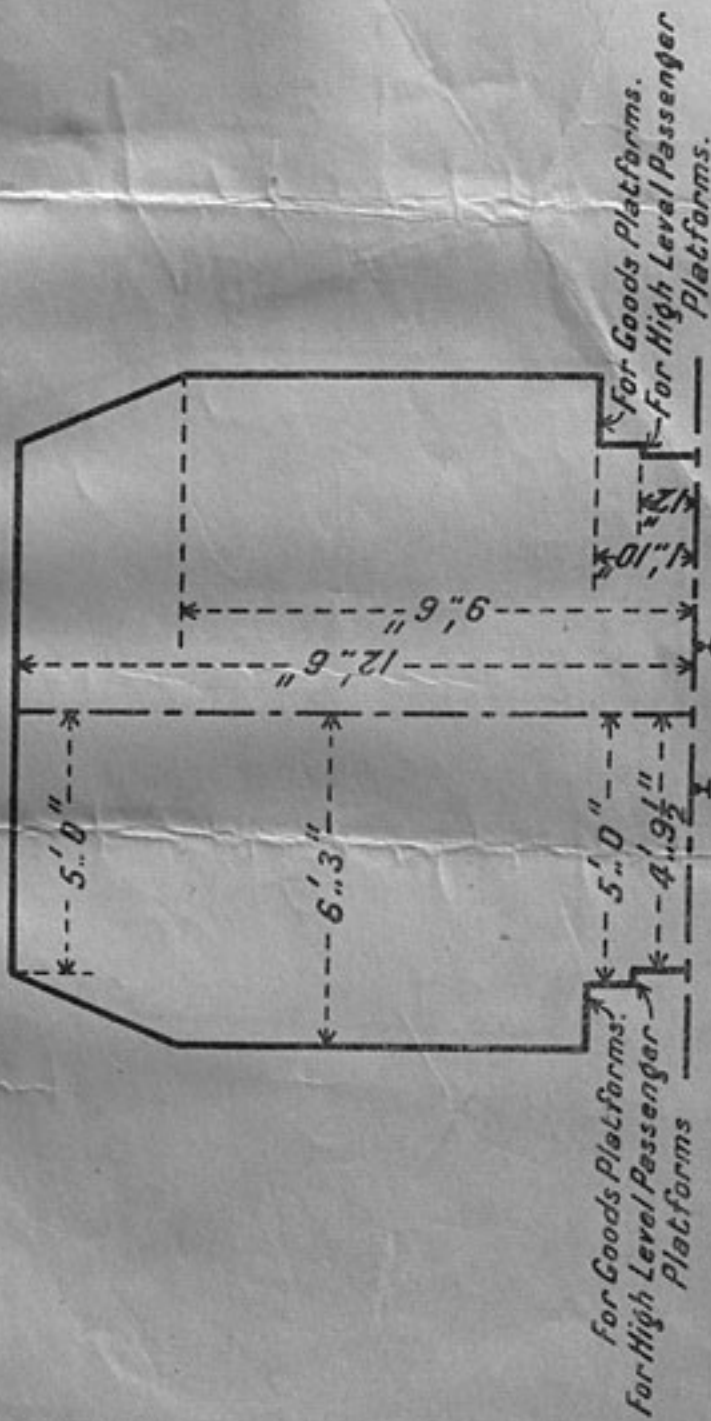
NOTE.—For additional horizontal measurements on curves see letter press.

Future Minimum Structures outside the Melbourne Suburban Radius on lines of 5 feet  
3 inches gauge.



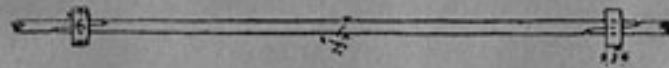
NOTE.—For additional horizontal measurements on curves see letter press.

Minimum Structures on lines of 2 feet 6 inches gauge.

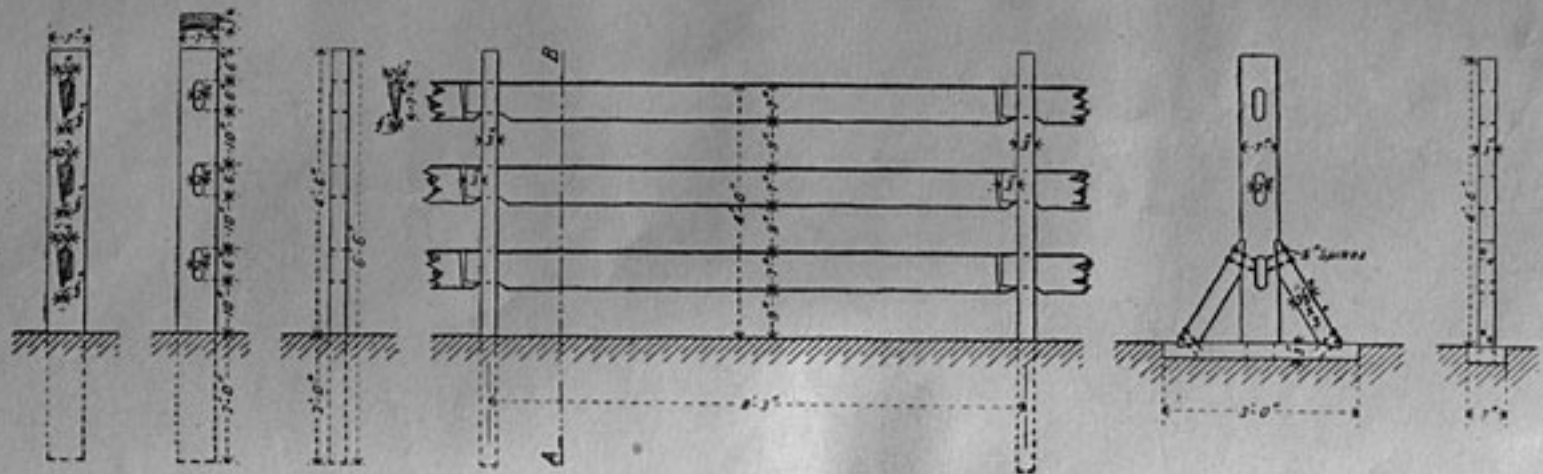


NOTE.—For additional horizontal measurements on curves see letter press.

STANDARD POST AND RAIL FENCE



Plan of Fence

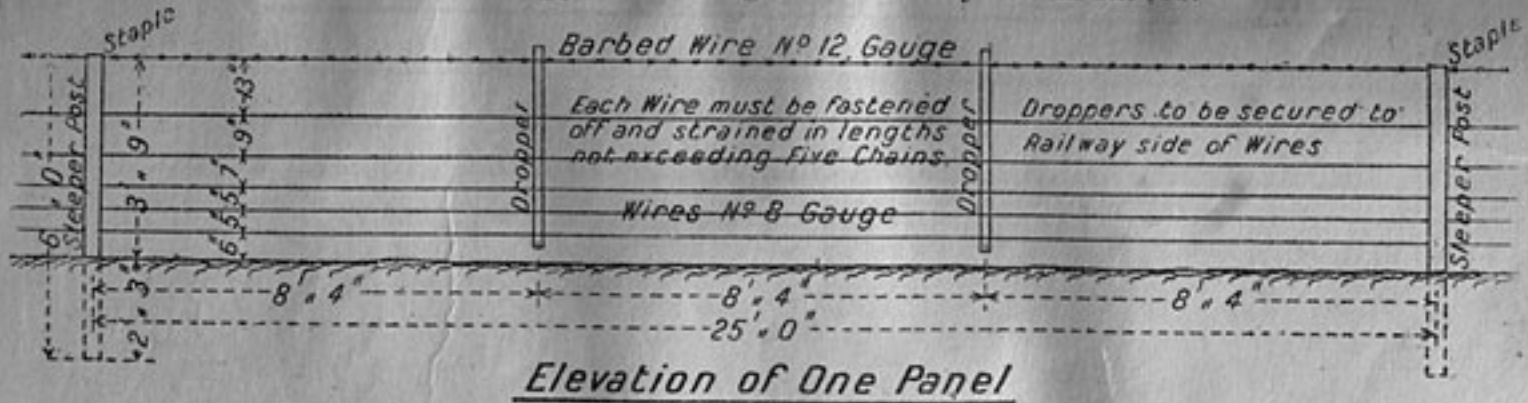


Section A.B - Elevation of Posts

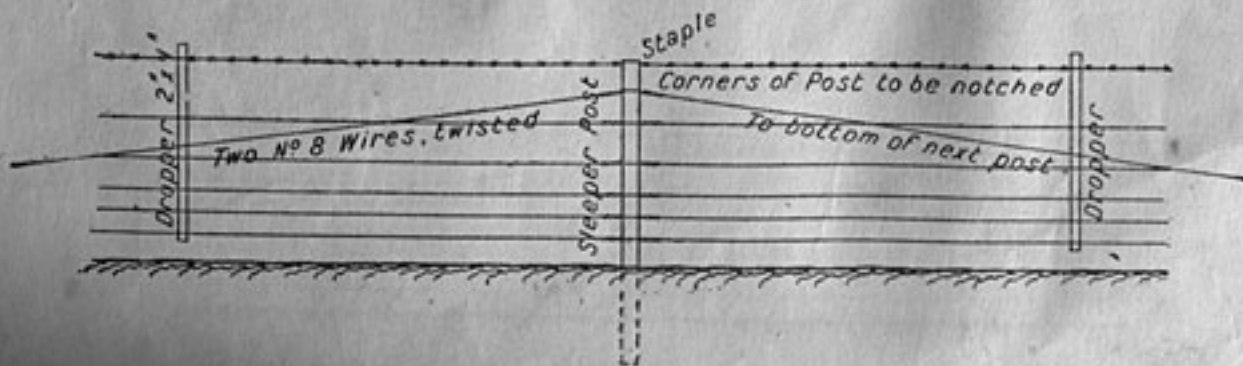
Elevation of Fence

Posts with Sills and Struts where ordinary posts cannot be used

Standard Dropper Fencing for Railway Boundaries.



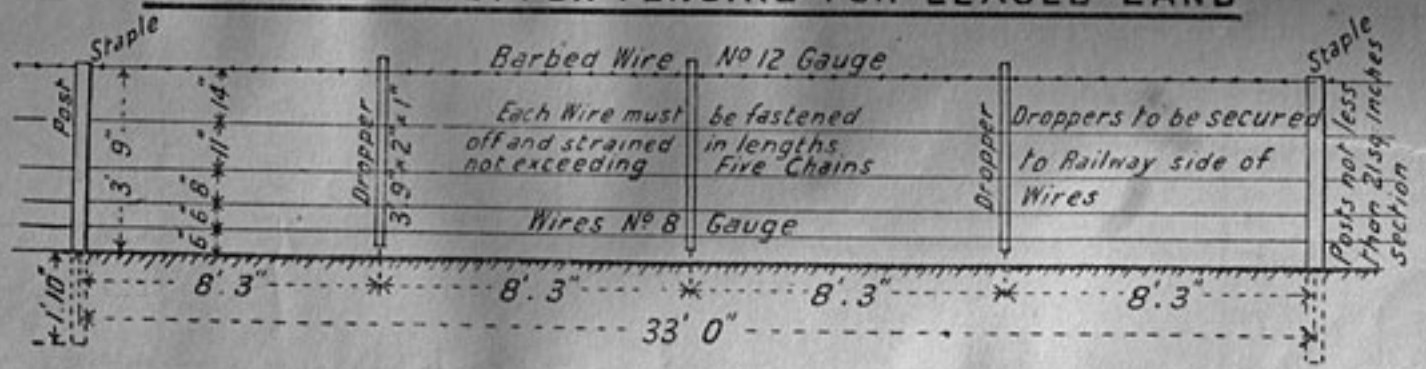
Elevation of One Panel



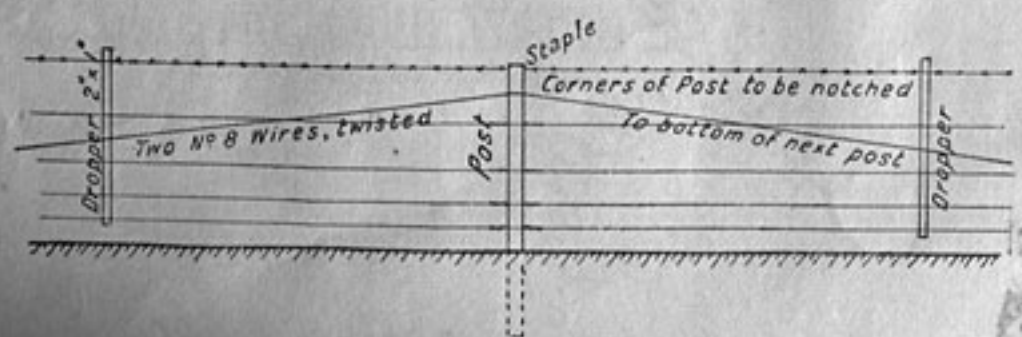
Elevation showing Straining Post



### STANDARD DROPPER FENCING FOR LEASED LAND



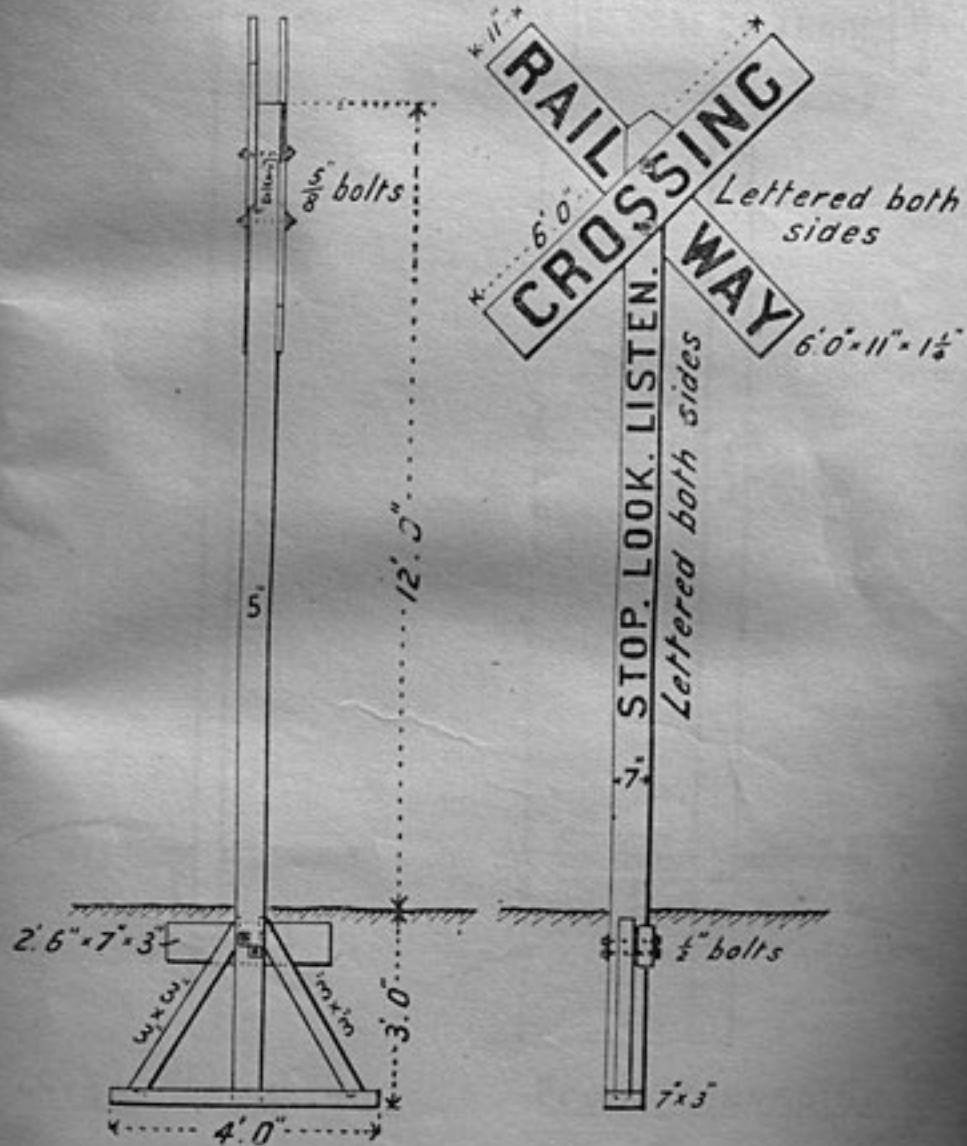
Elevation of One Panel



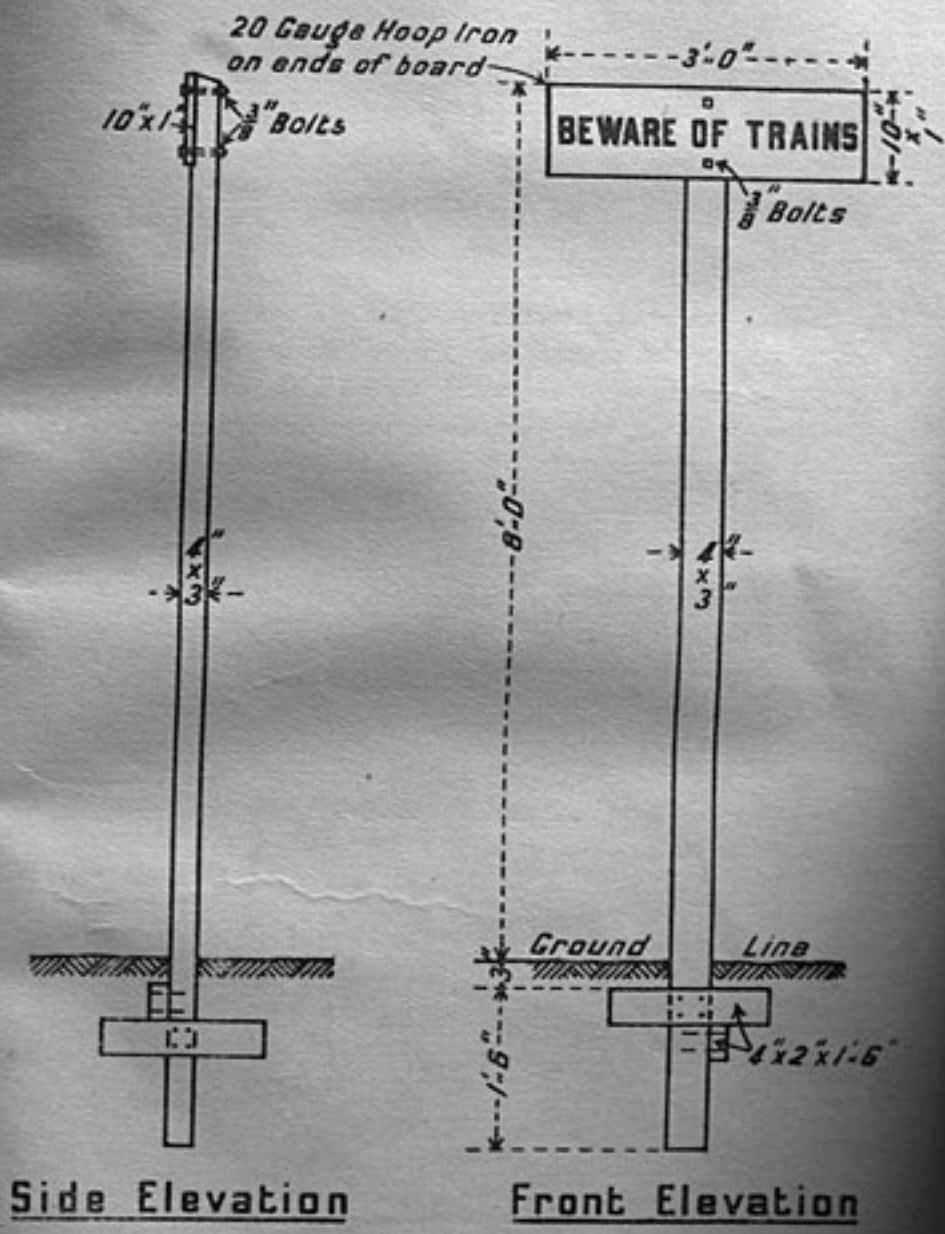
Elevation showing Straining Post

NOTICE BOARD  
 FOR  
CATTLE GUARD CROSSINGS

*20 gauge hoop iron  
 on ends of boards*

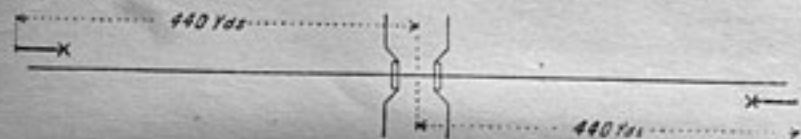


# NOTICE BOARD — FOR — FOOT CROSSINGS

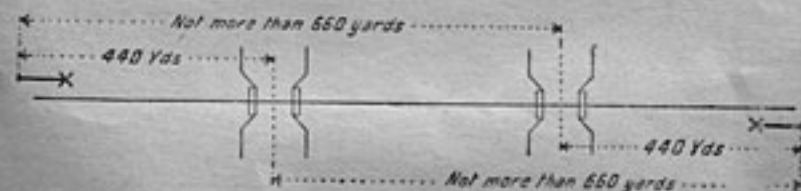


### Diagram showing position of Whistle Posts at Cattle Guard Crossings

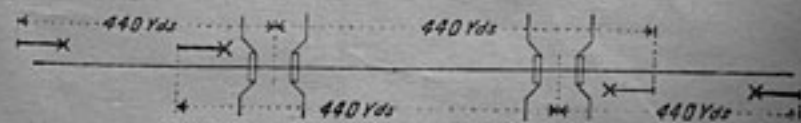
*At isolated crossings two whistle posts are to be erected each 440 yards from centre of crossing, thus:—*



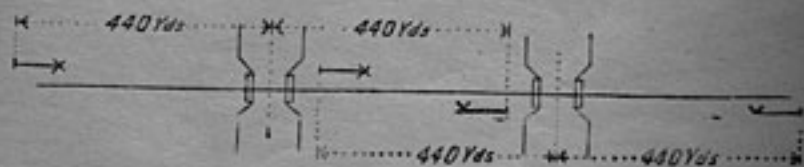
*At places where the distance between adjacent crossings does not exceed 220 yards, two whistle boards are to be erected, each 440 yards from centre of nearer crossing (and consequently not more than 660 yards from further crossing) thus:—*



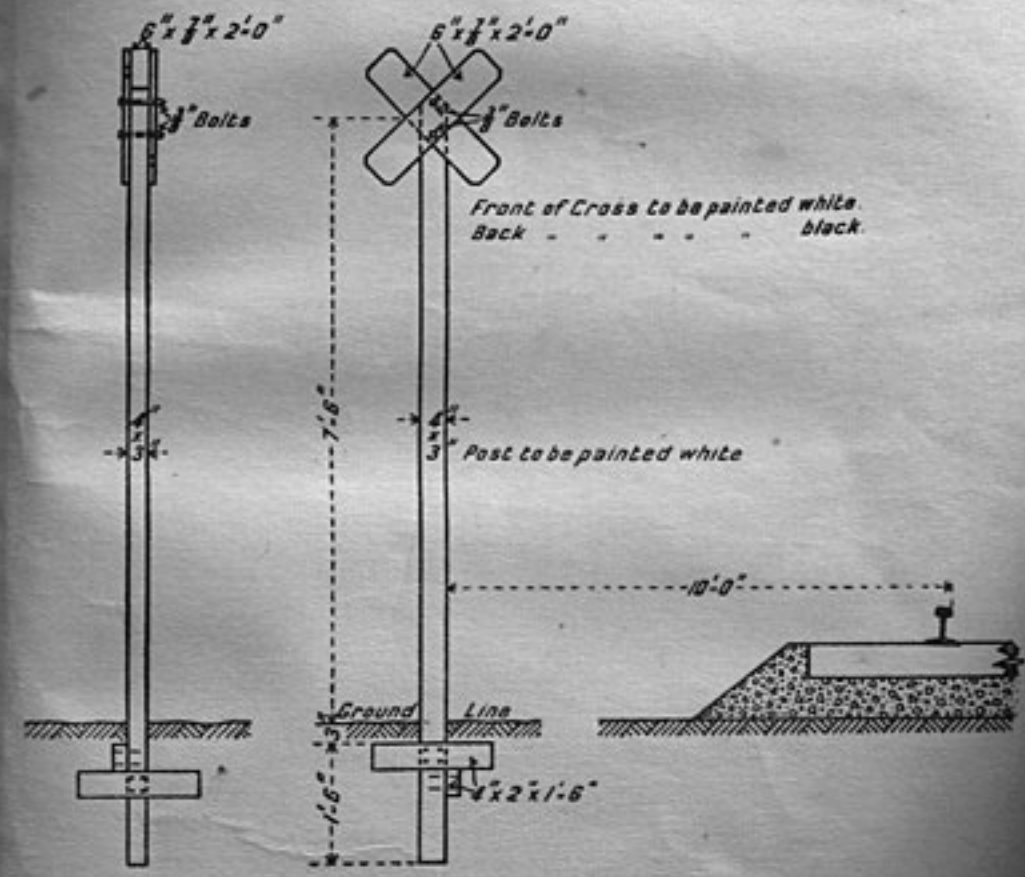
*At places where the distance between adjacent crossings exceeds 220 yards, each crossing is to be dealt with as an isolated crossing, thus:—*



*or thus:—*



### WHISTLE POST

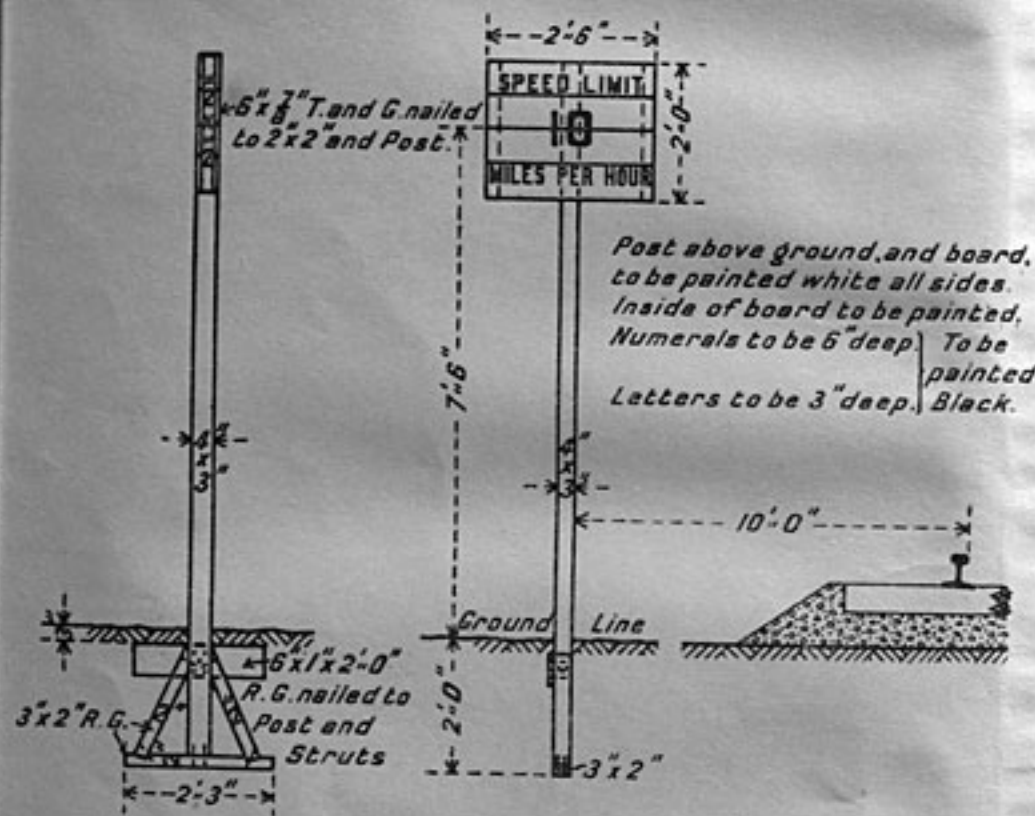


Side Elevation

Front Elevation

## SPEED RESTRICTION BOARD

On Lines of 2'-6" Gauge

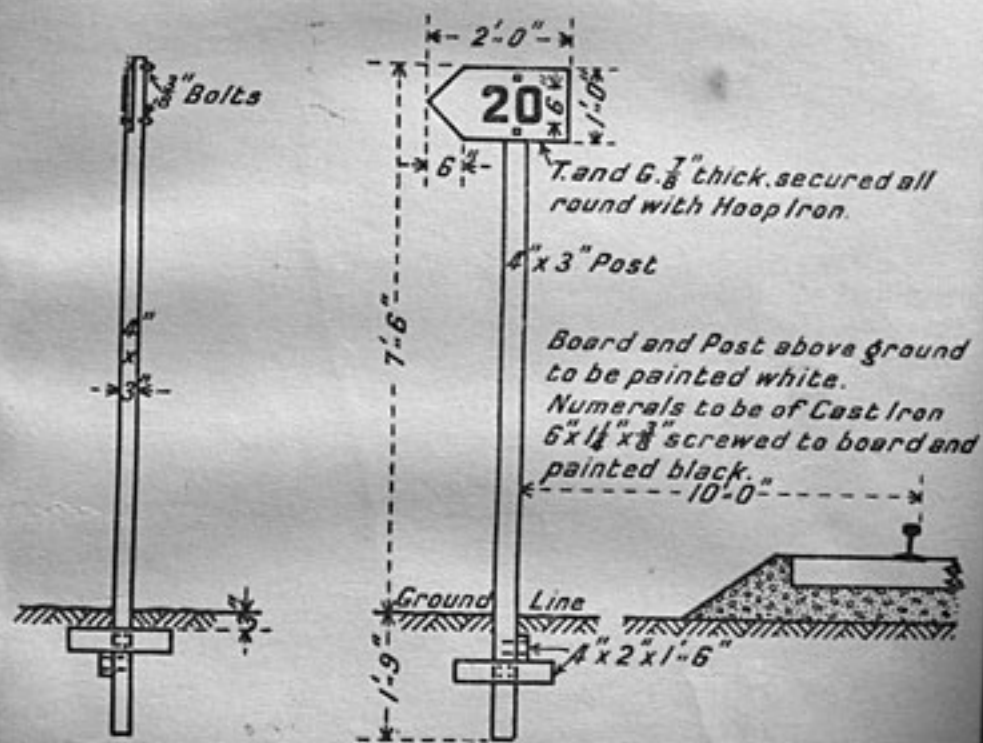


Side Elevation

Front Elevation

## CURVE BOARD

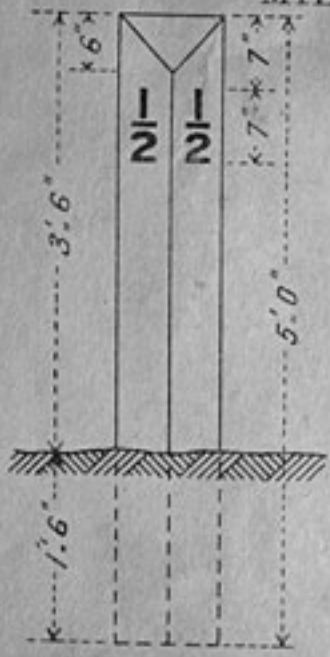
On Lines of 5'-3" Gauge



Side Elevation

Front Elevation

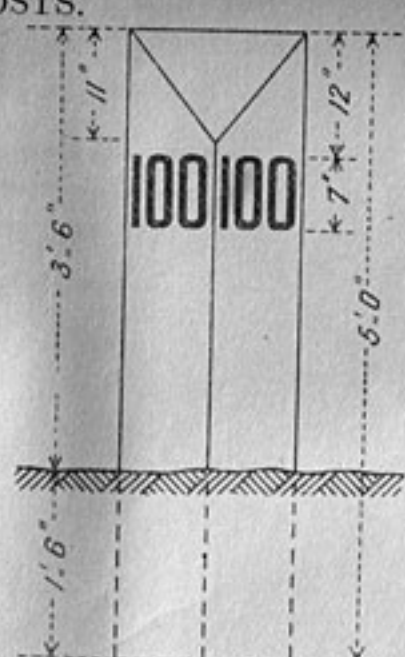
MILE AND HALF MILE POSTS.



Half Mile Posts

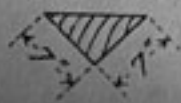


Mile Posts up to 99



Mile Posts From 100

ELEVATION FACING TRACK

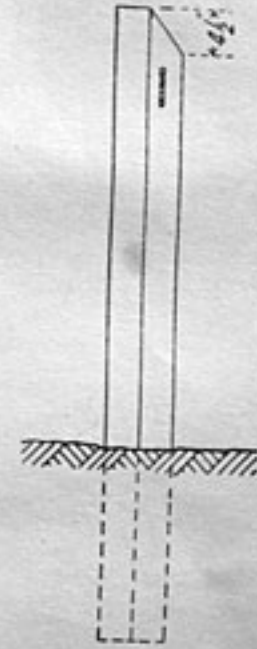


SECTIONS

GANG POST.



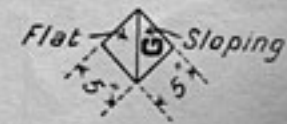
ELEVATION  
FACING TRACK



SIDE ELEVATION



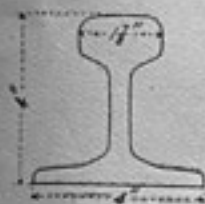
SECTION



PLAN



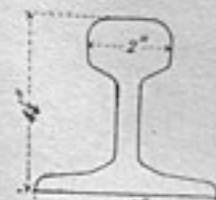
— RAIL SECTIONS —



50 lb Iron A



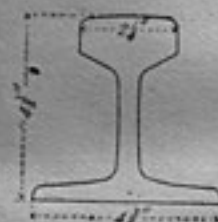
50 lb Steel B



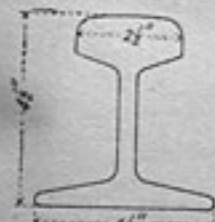
60 lb Iron and Steel C



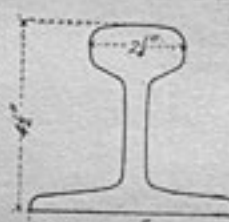
60 lb Steel D



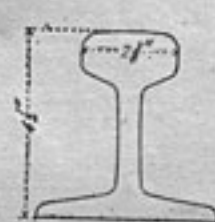
60 lb Steel D'



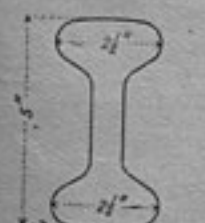
60 lb Steel N



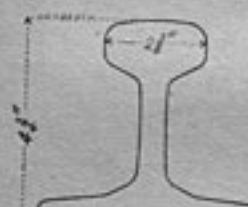
66 lb Steel E



66 lb Steel F



72 lb Iron and Steel J



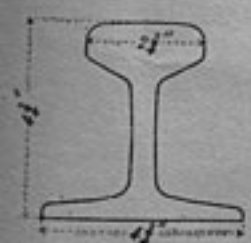
75 lb Iron G



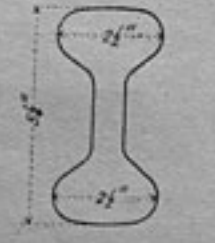
75 lb Steel H



75 lb Steel H'



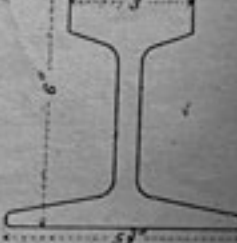
75 lb Steel I



80 lb Iron and Steel K

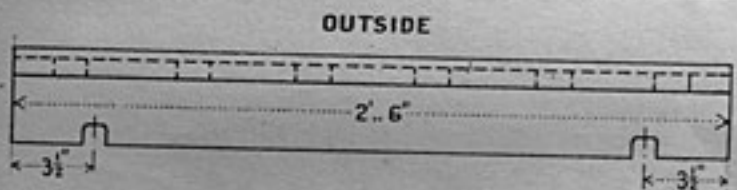
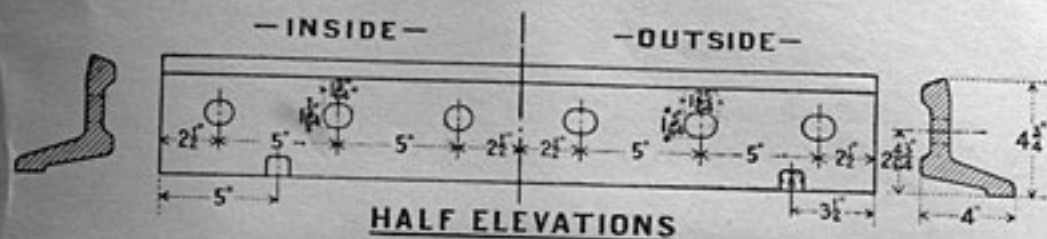


80 lb Steel O Standard

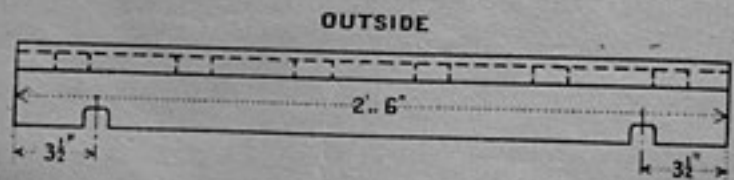
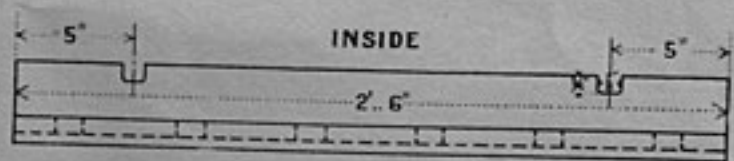
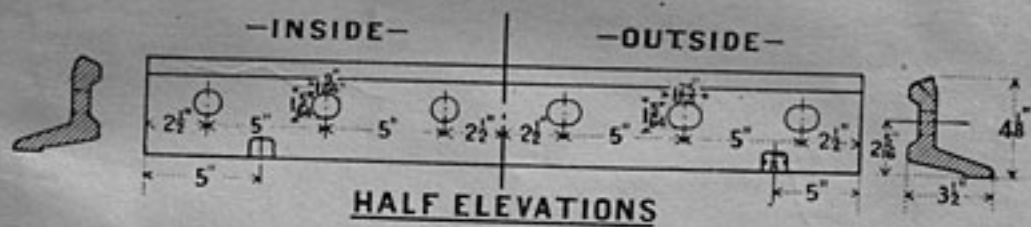


100 lb Steel P Standard

STANDARD FISHPLATES  
**FISHPLATES FOR 100 L<sup>B</sup> RAILS**

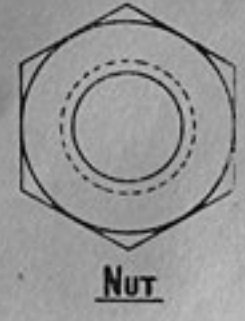
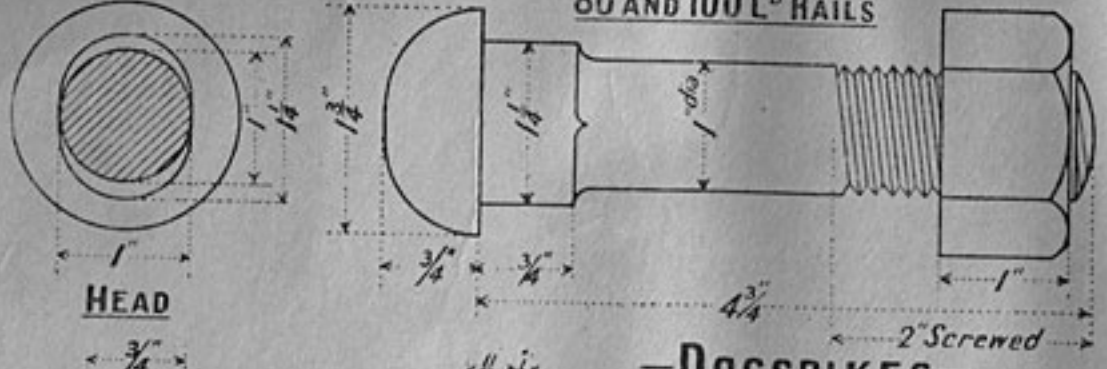


**FISHPLATES FOR 80 L<sup>B</sup> RAILS**

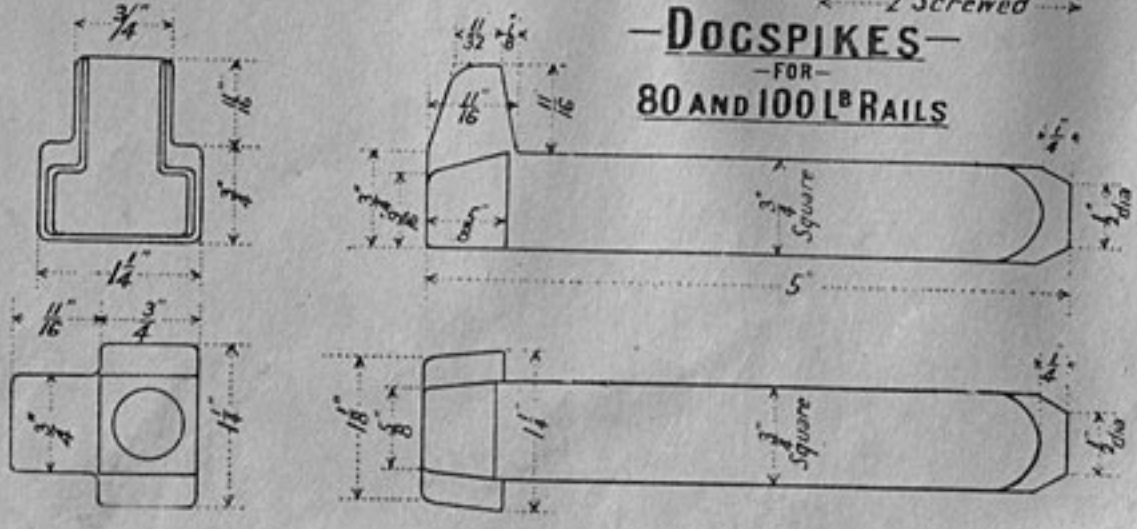


STANDARD FASTENINGS.

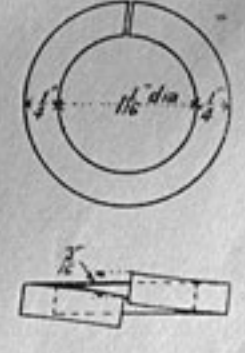
**- FISHBOLTS -**  
- FOR -  
**80 AND 100 L<sup>B</sup> RAILS**



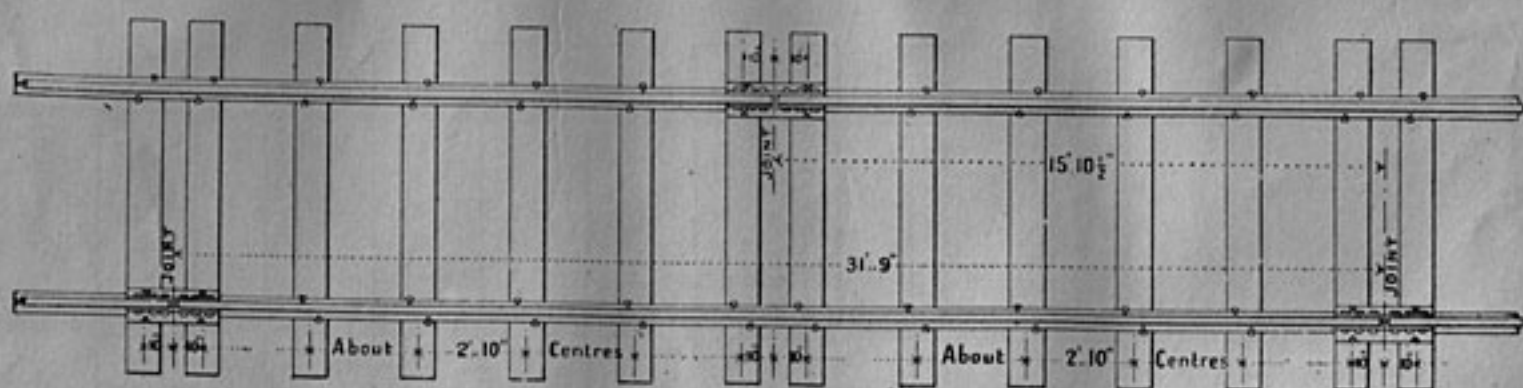
**- DOG SPIKES -**  
- FOR -  
**80 AND 100 L<sup>B</sup> RAILS**



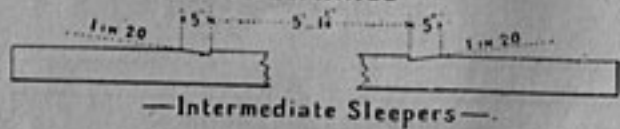
**SPRING WASHER**  
- FOR -  
**FISHBOLTS**



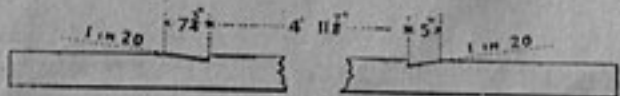
— BROKEN JOINTS —



— 80 LB. RAILS —

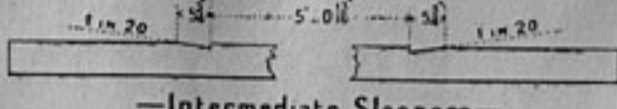


— Intermediate Sleepers —

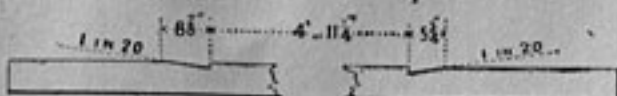


— Joint Sleepers —

— 100 LB. RAILS —

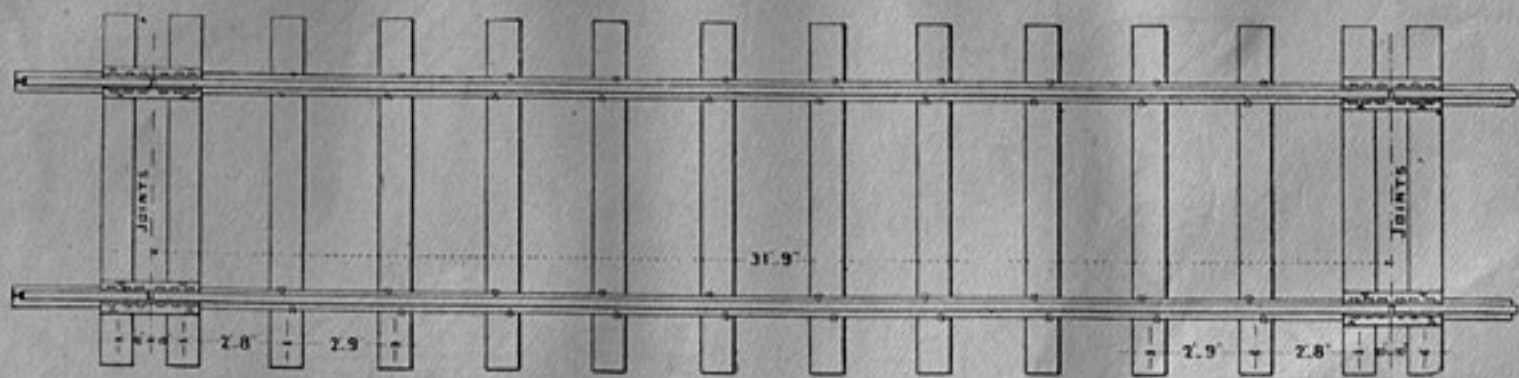


— Intermediate Sleepers —

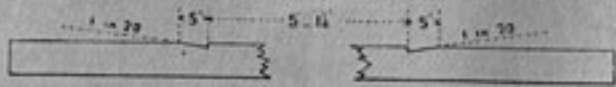


— Joint Sleepers —

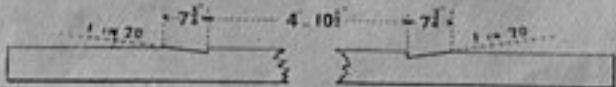
**SQUARE JOINTS**



— 80 LB. RAILS —

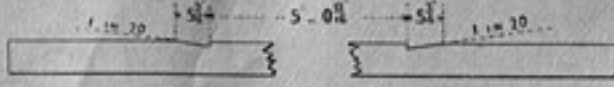


— Intermediate Sleepers —

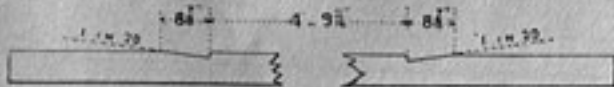


— Joint Sleepers —

— 100 LB. RAILS —



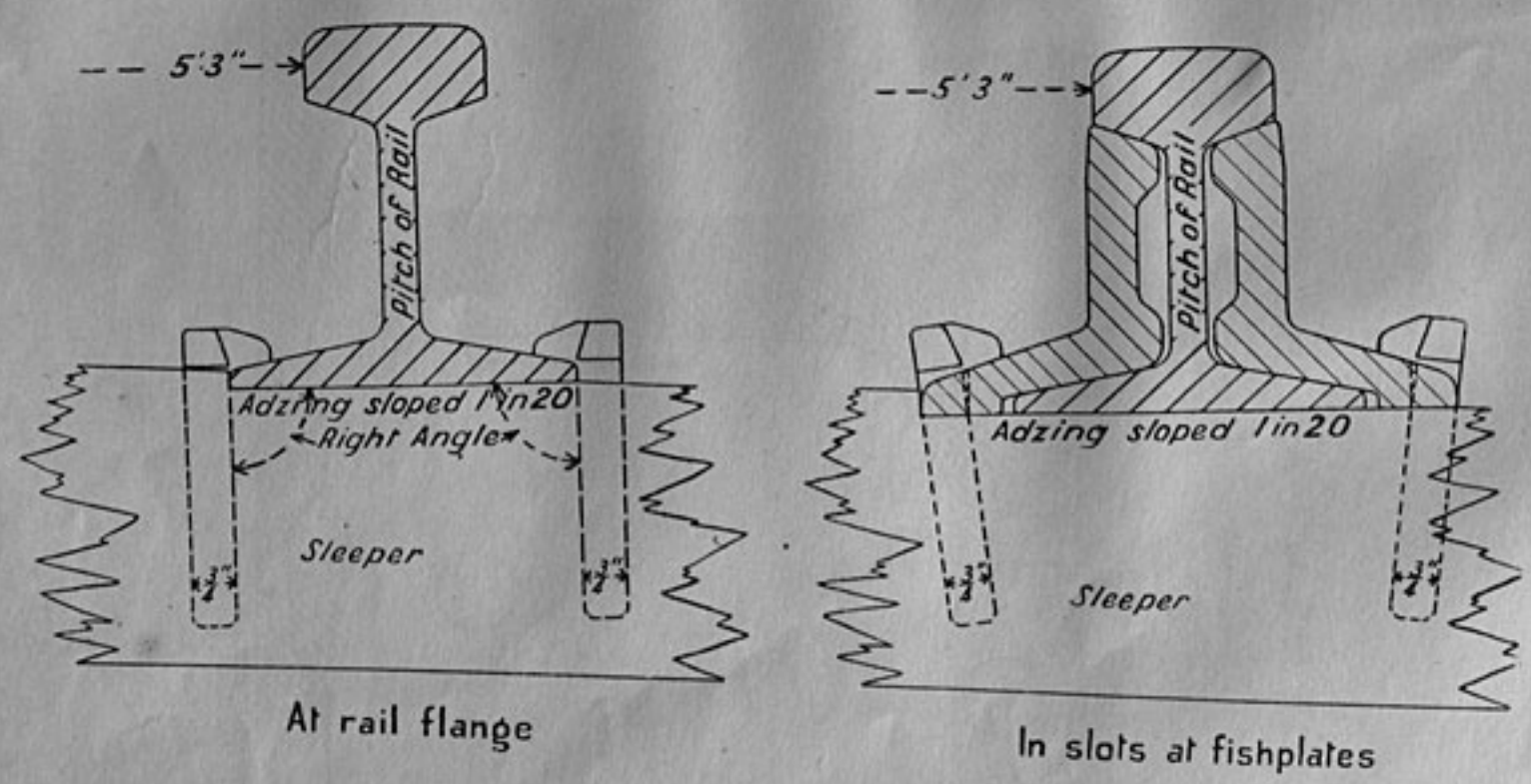
— Intermediate Sleepers —

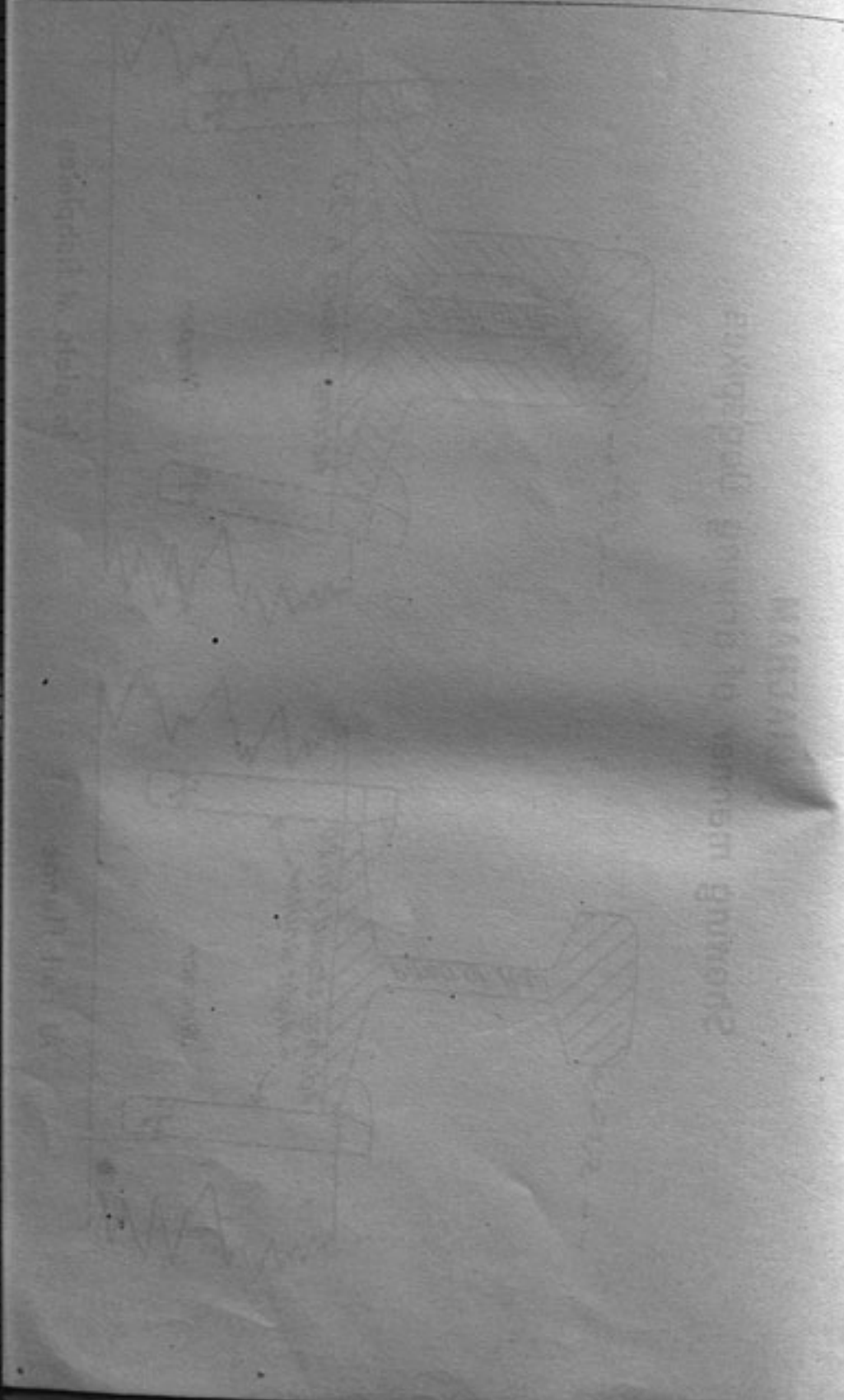


— Joint Sleepers —

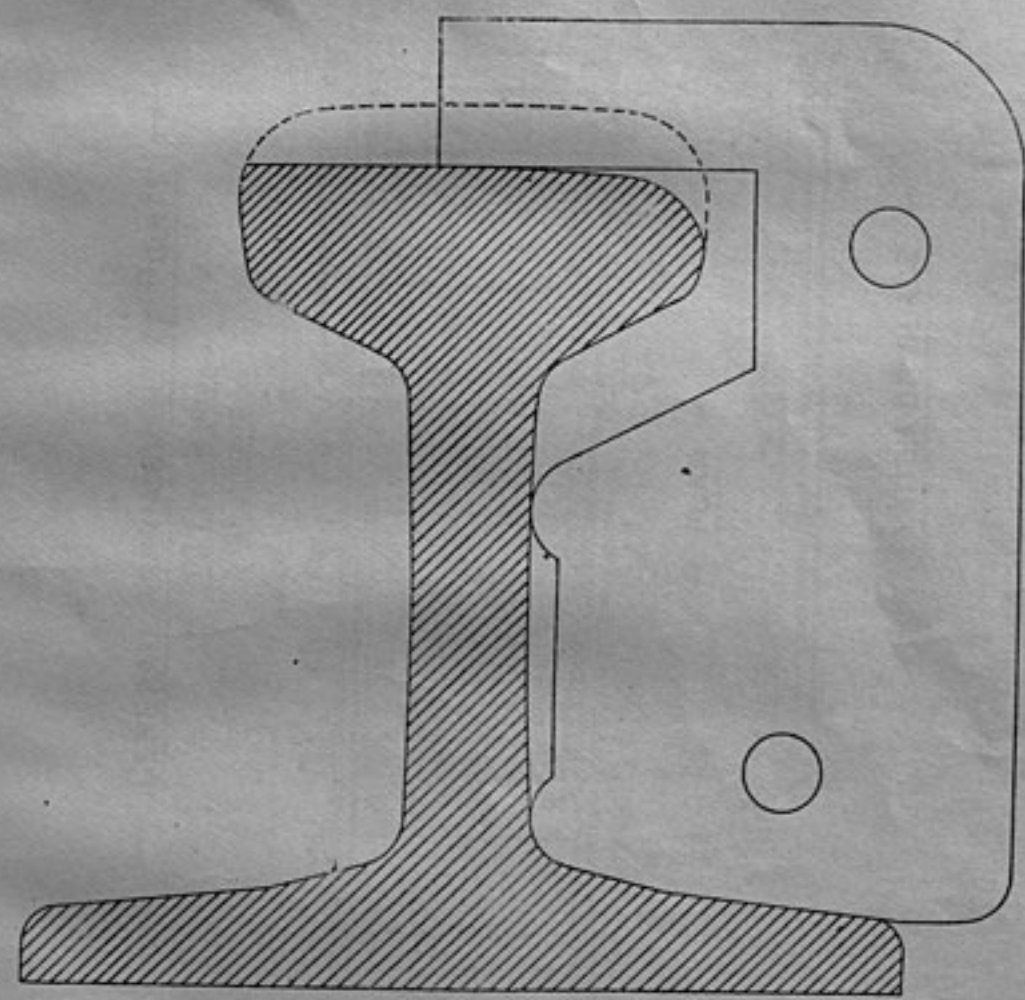
### DIAGRAM

#### Showing manner of driving Dogspikes

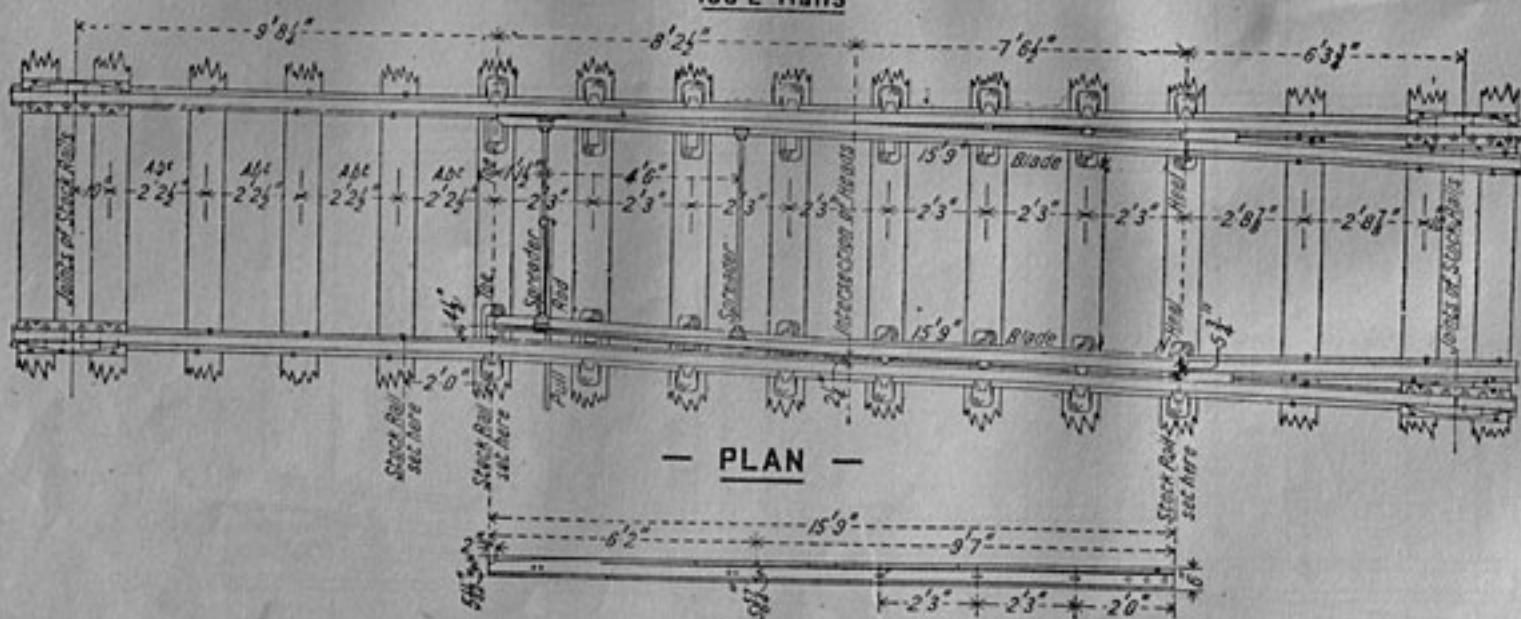




Maximum Permissible Wear of Top of Rail Head.



— GENERAL ARRANGEMENT OF POINTS —  
 800 Feet Radius  
 100 L<sup>b</sup> Rails

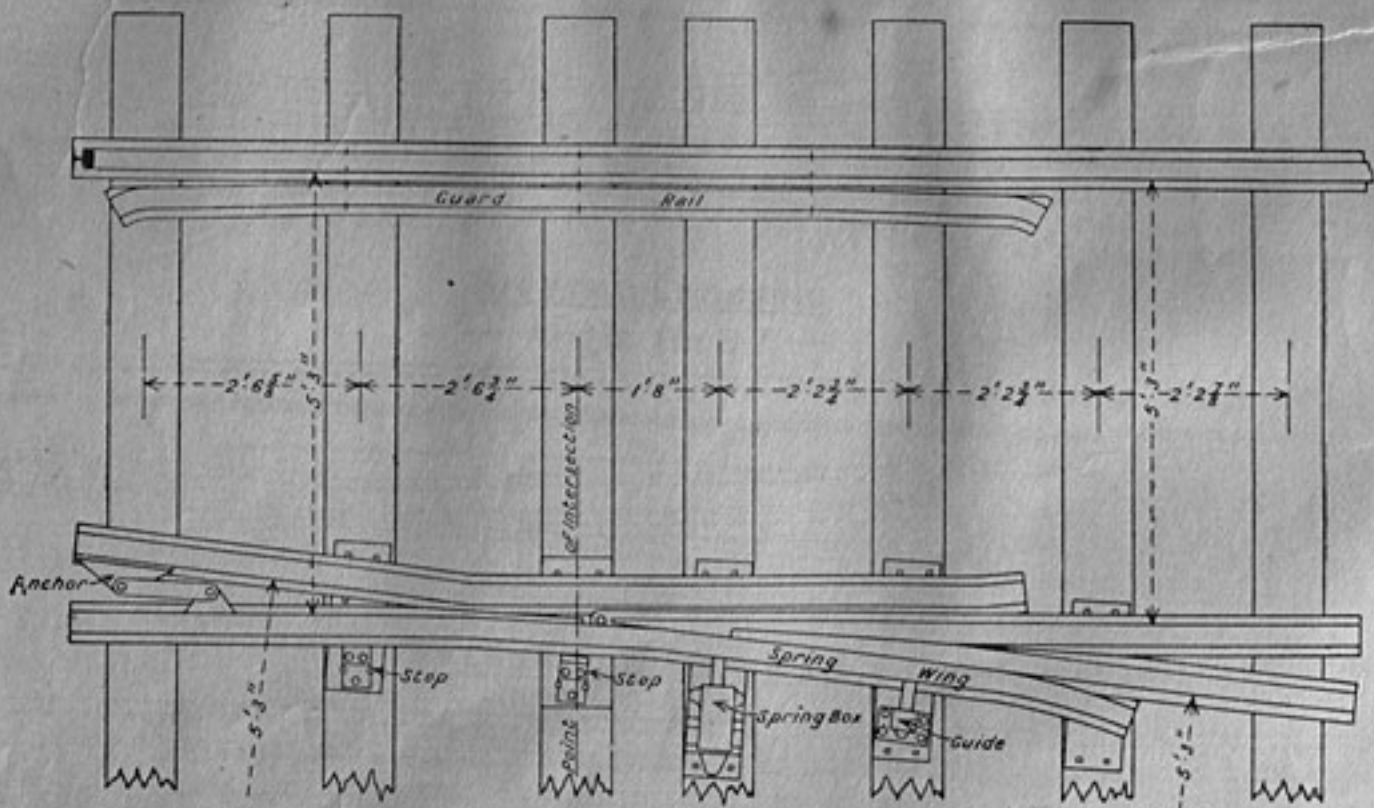


— PLAN —

— ELEVATION OF BLADE —

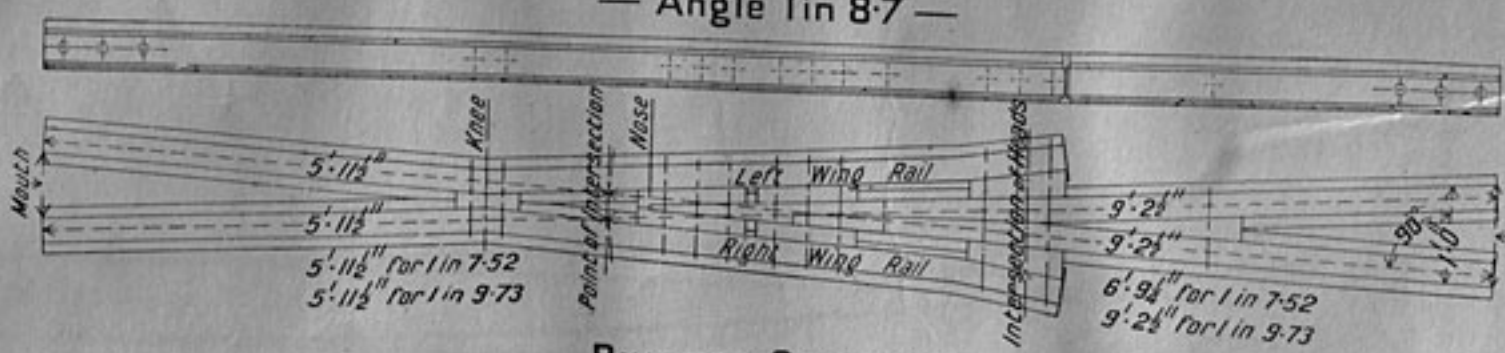


— SPRING CROSSING AND GUARD RAIL —  
(Right Hand)

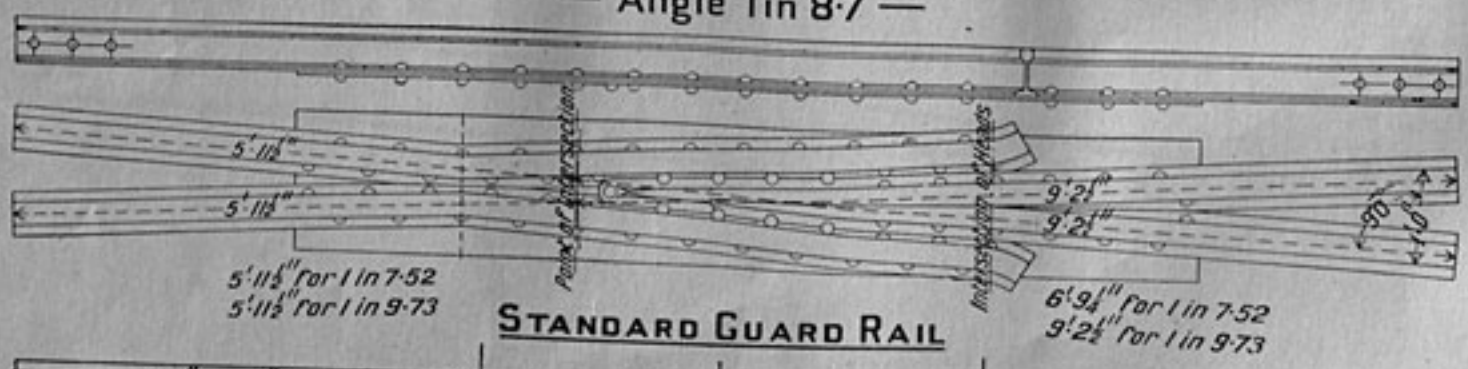


— CROSSINGS FOR STANDARD ANGLES —

**BLOCKED CROSSING**  
— Angle 1 in 8.7 —



**RIVETED CROSSING**  
— Angle 1 in 8.7 —



**STANDARD GUARD RAIL**



— DIAGRAM —

To Distinguish Right and Left Hand Spring Crossings  
and Right and Left Hand Turnouts

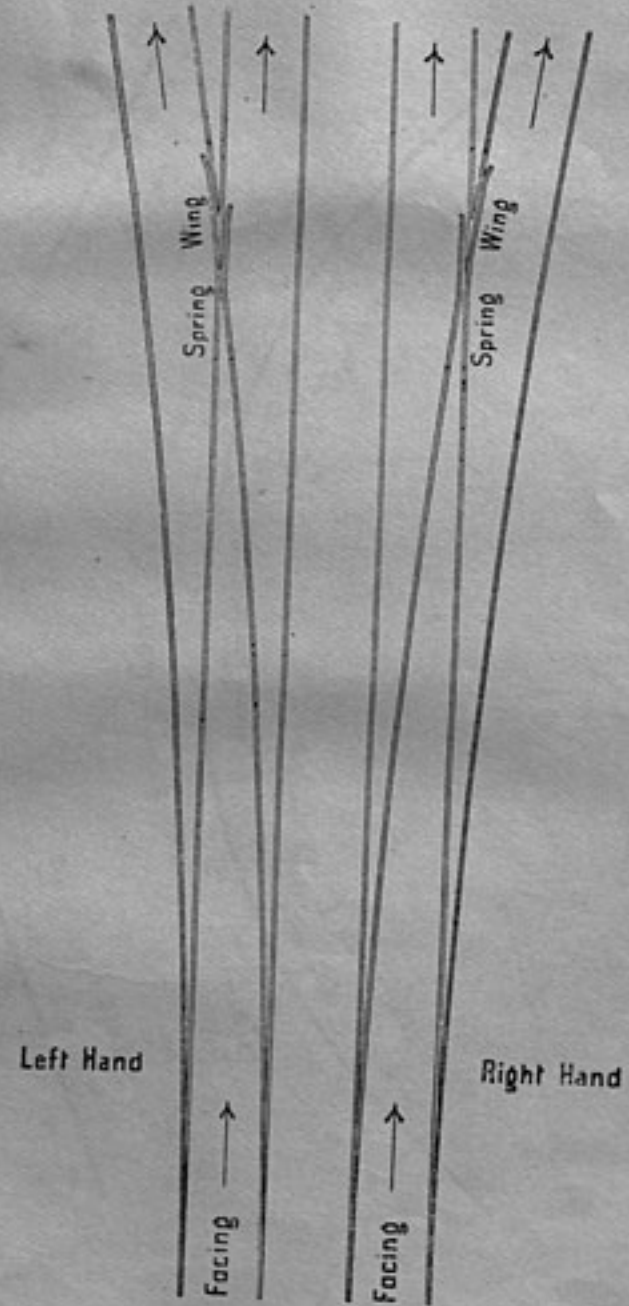
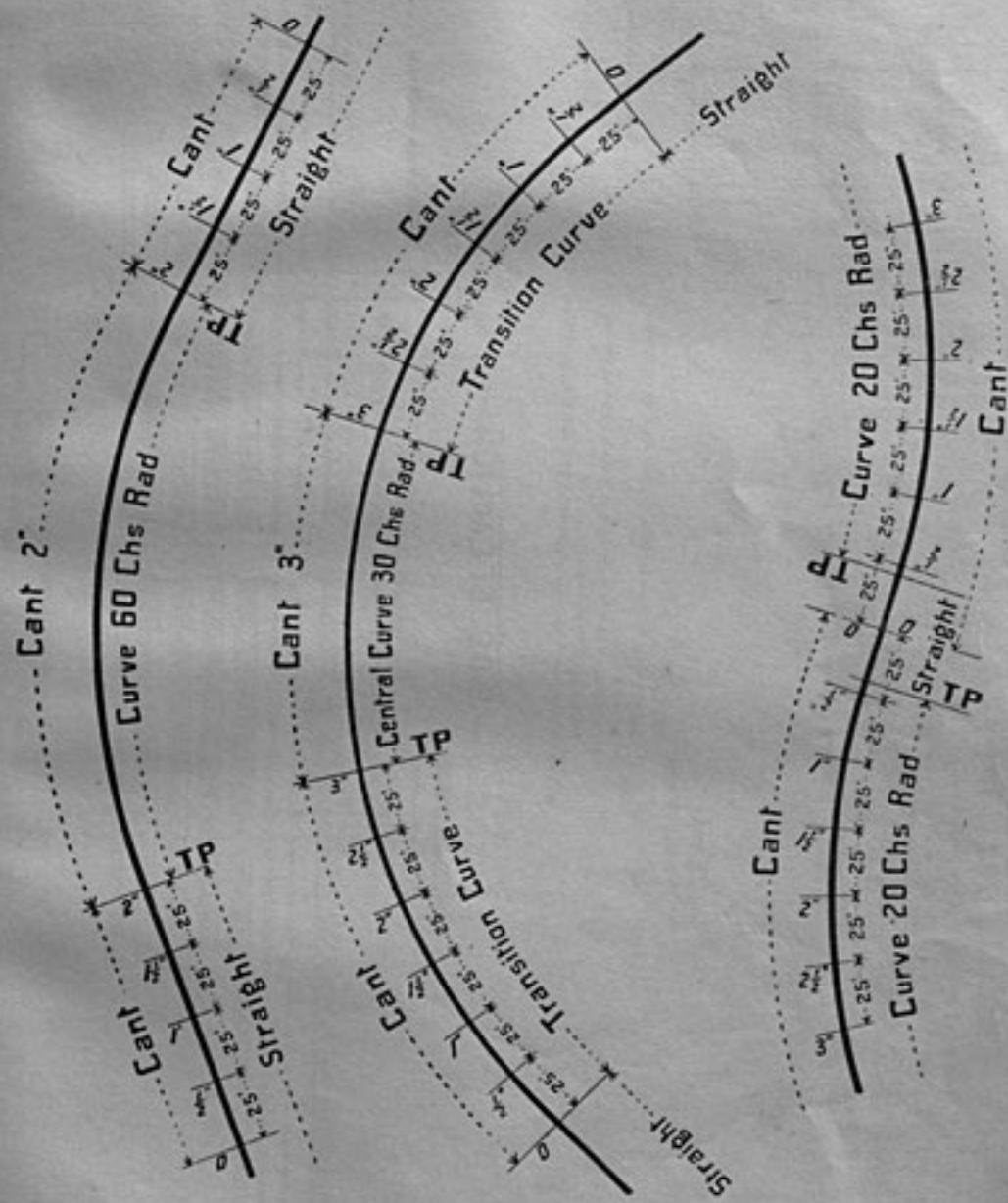
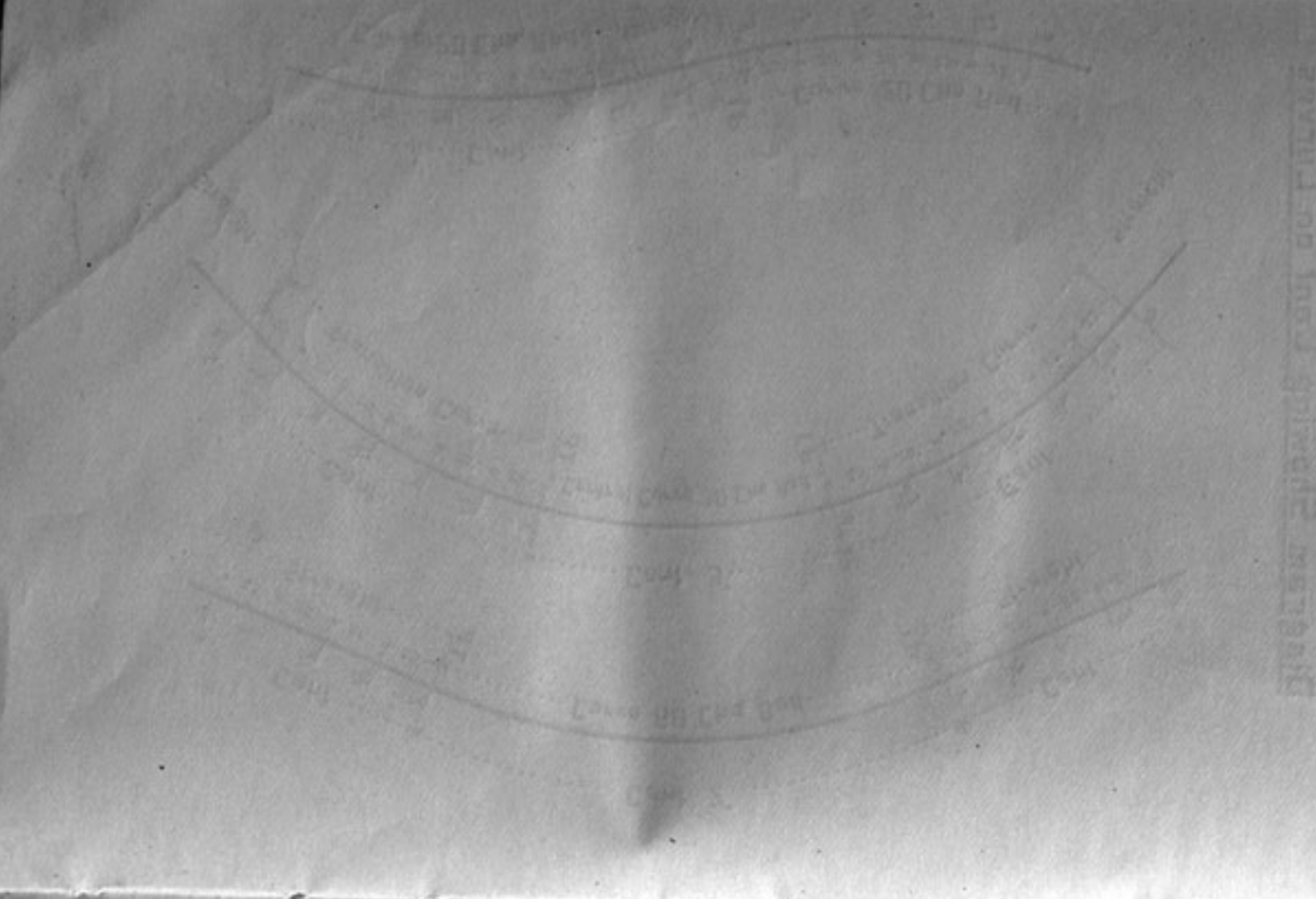
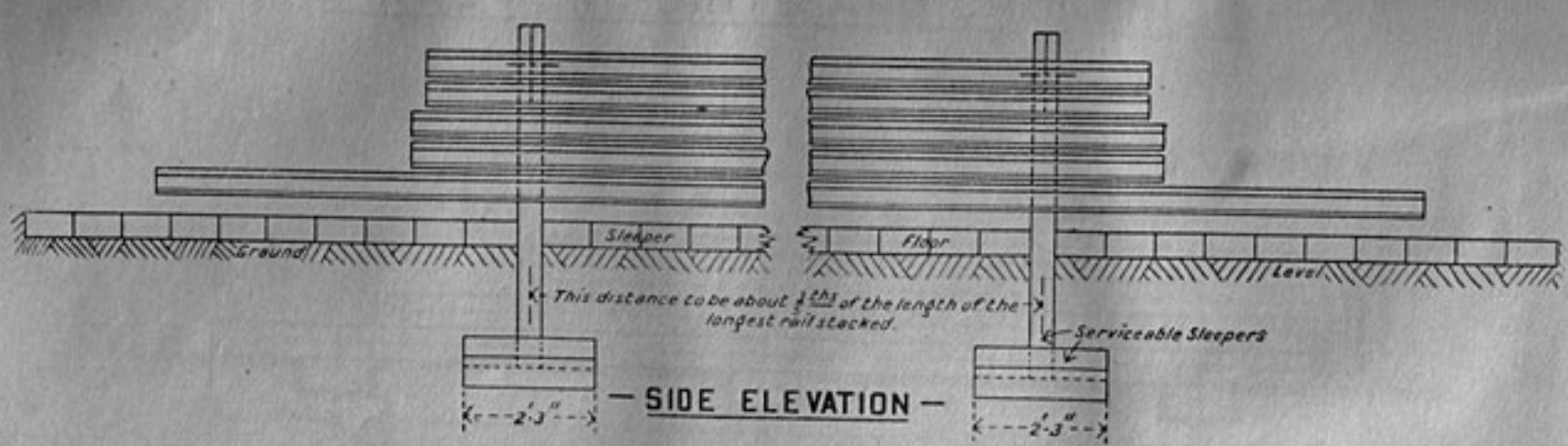


Diagram Showing Cant on Curves

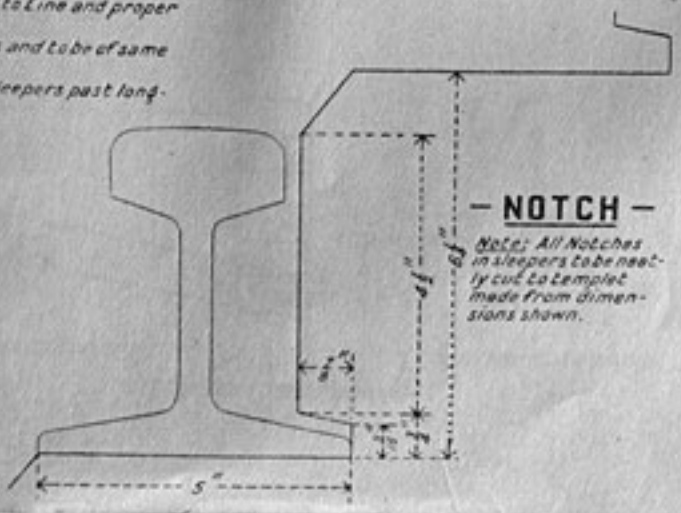
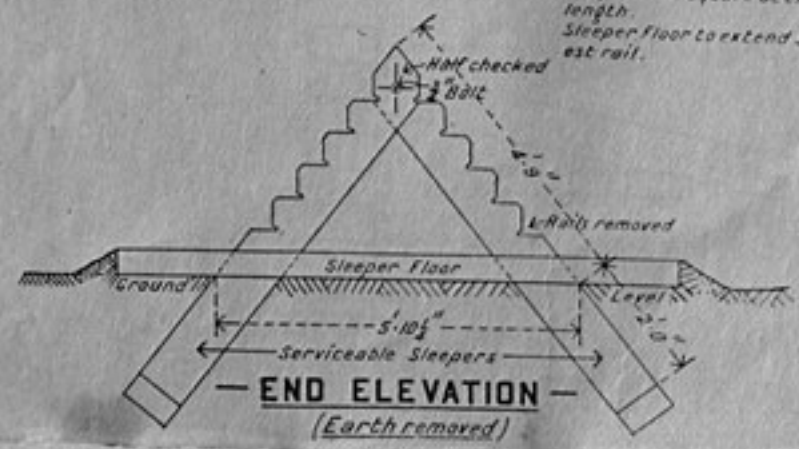




### — RAIL STAND —

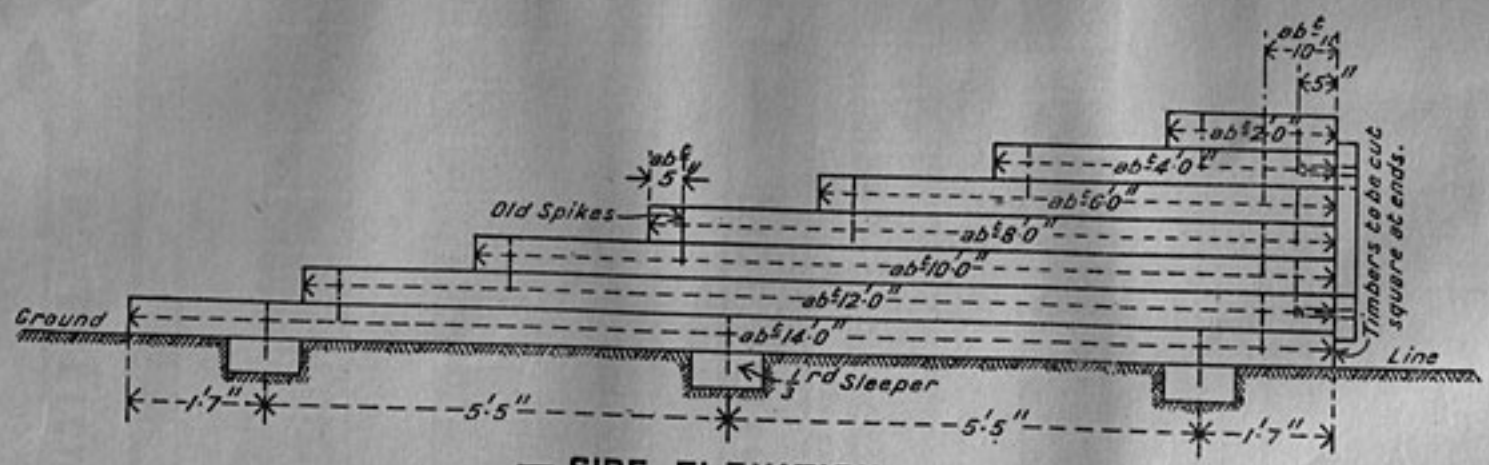


Notes: Stand to be erected parallel to Line and proper clearance observed.  
 Sleepers cut square at ends and to be of same length.  
 Sleeper floor to extend 3 sleepers past longest rail.

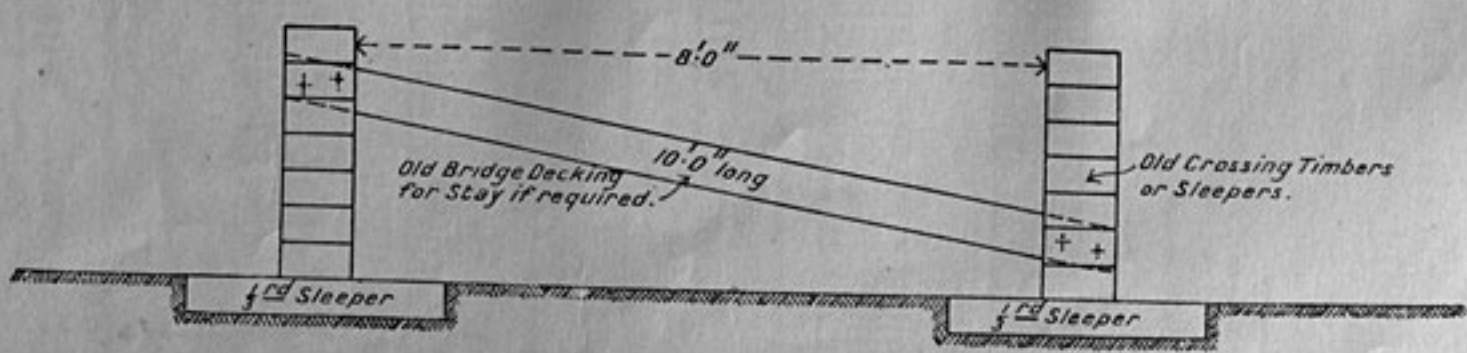


Notes: All Notches in sleepers to be neatly cut to template made from dimensions shown.

### STAND FOR POINTS AND CROSSINGS

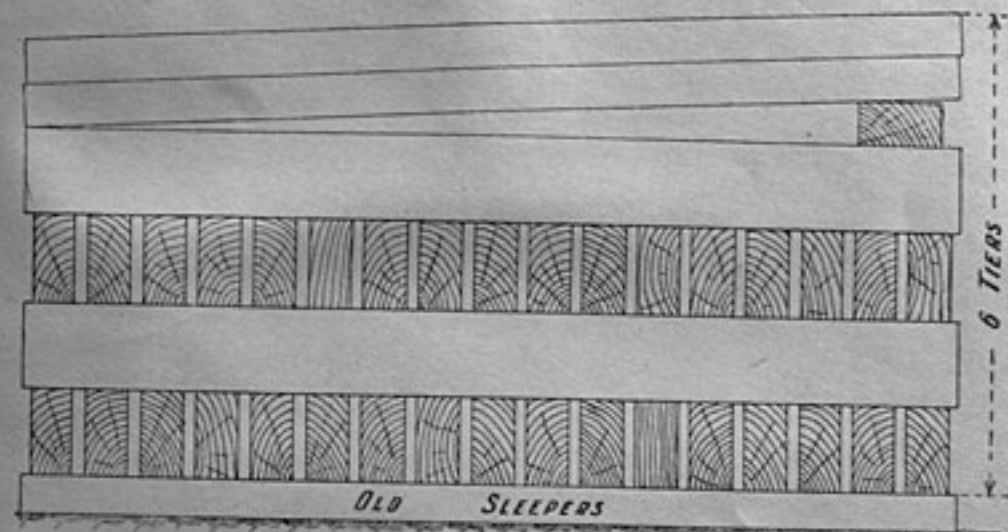


— SIDE ELEVATION —

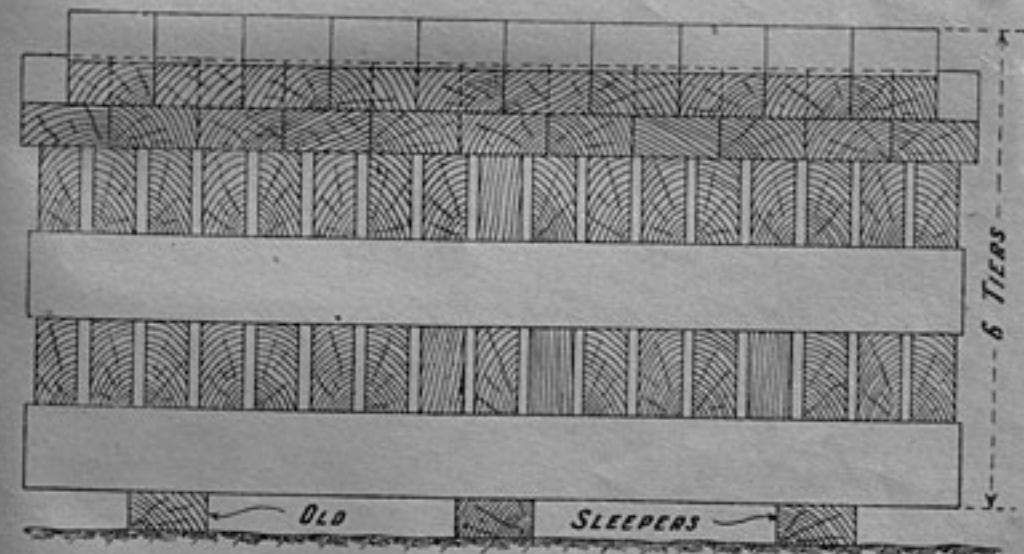


— FRONT ELEVATION —

SLEEPER STACK (90 SLEEPERS.)

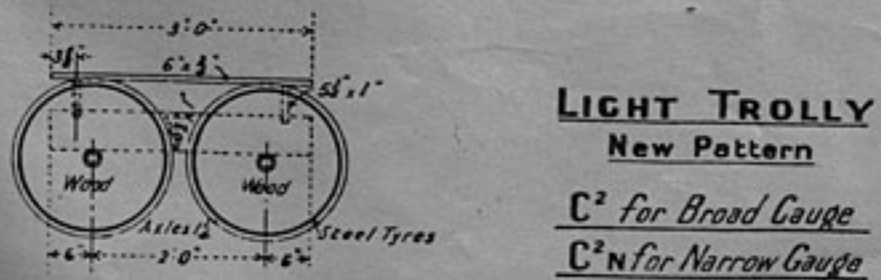
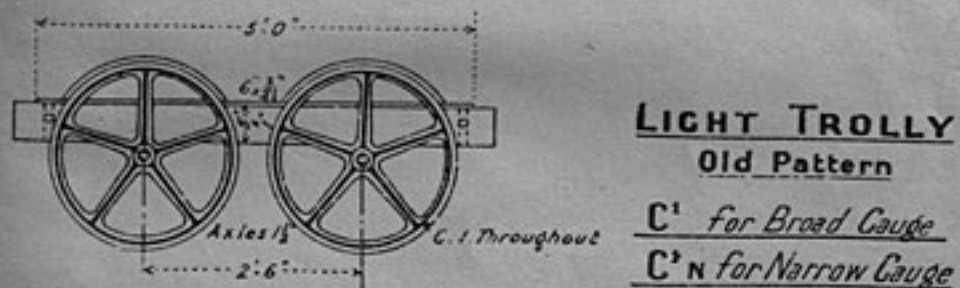
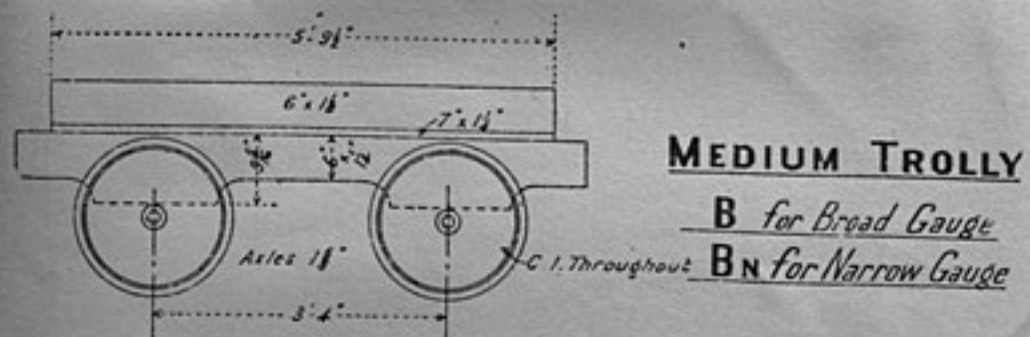
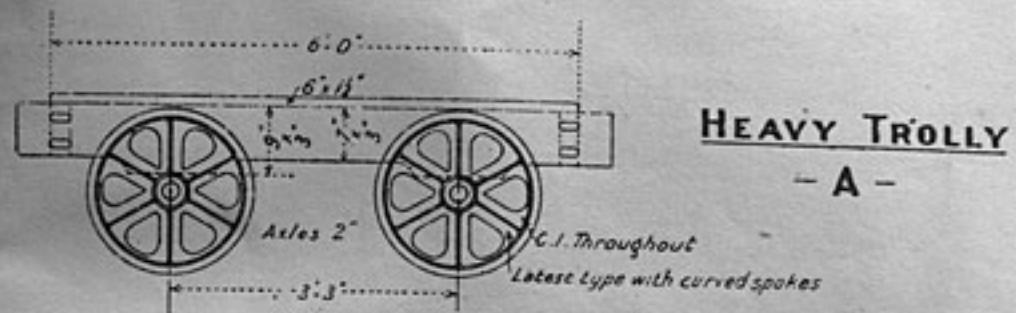


SIDE ELEVATION



FRONT ELEVATION

## TYPES OF TROLLIES.





HEAVY TRICYCLE



MEDIUM TRICYCLE



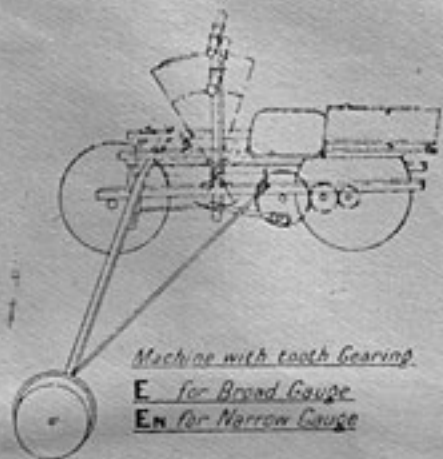
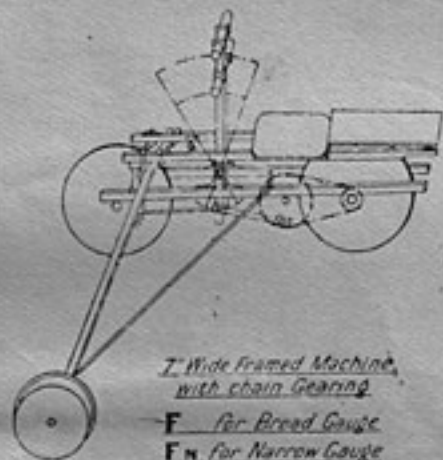
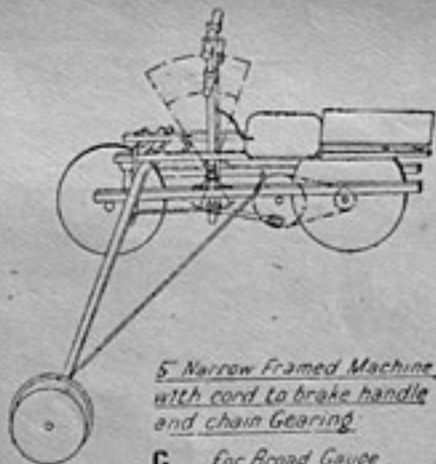
LIGHT TRICYCLE



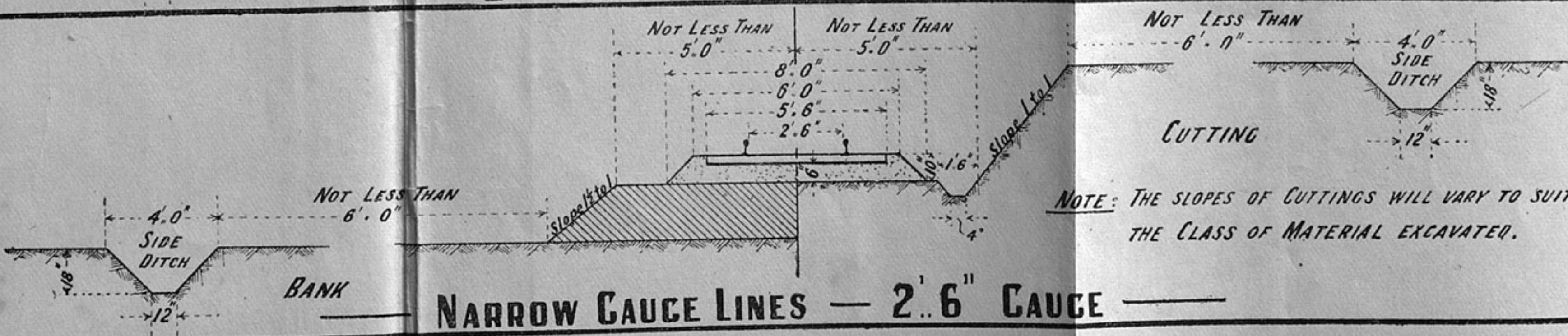
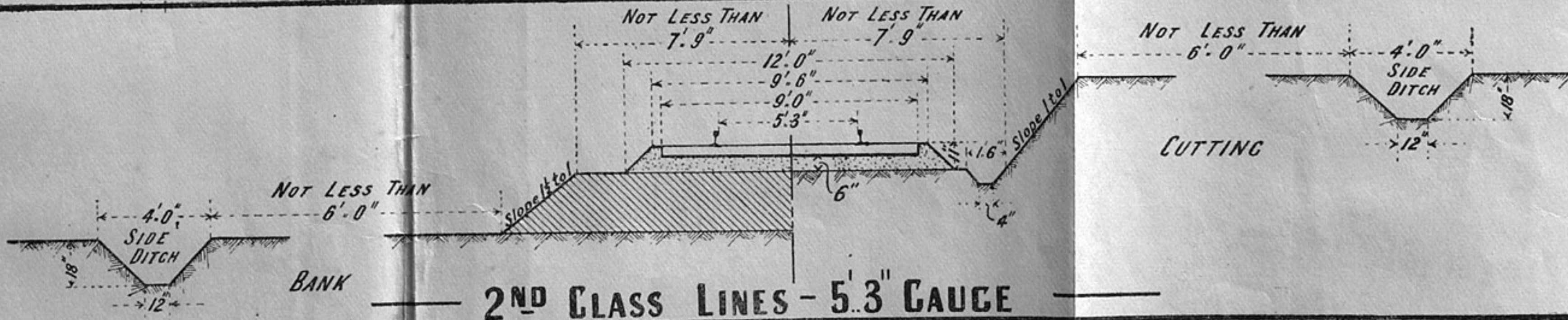
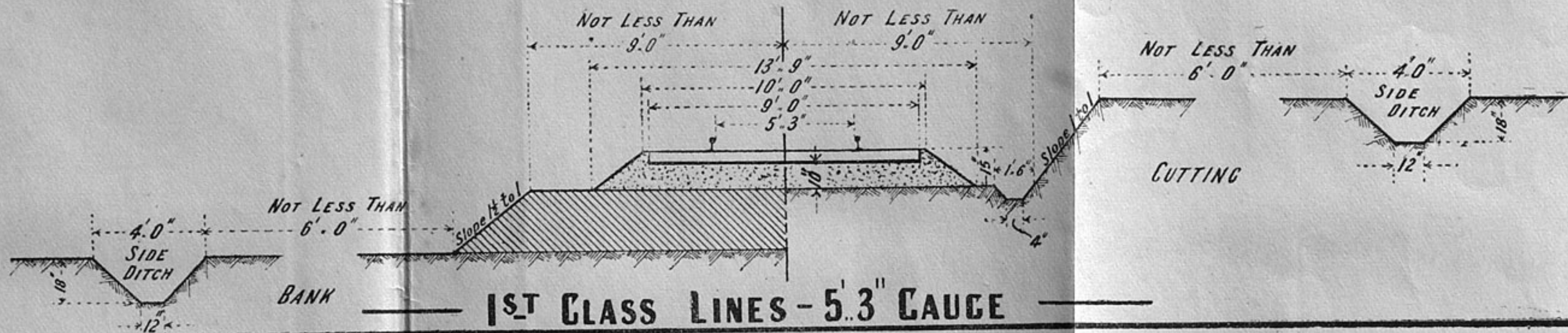
LIGHT TRICYCLE



## TYPES OF TRICYCLES.

*Machine with tooth Gearing***E** for Broad Gauge**EN** for Narrow Gauge*Wide Framed Machine,  
with chain Gearing***F** for Broad Gauge**FN** for Narrow Gauge*Narrow Framed Machine,  
with cord to brake handle  
and chain Gearing***G** for Broad Gauge**GN** for Narrow Gauge**NOTE** *All other types to be classed under letter H*

# DIAGRAM OF EARTHWORK BALLAST AND TRACK



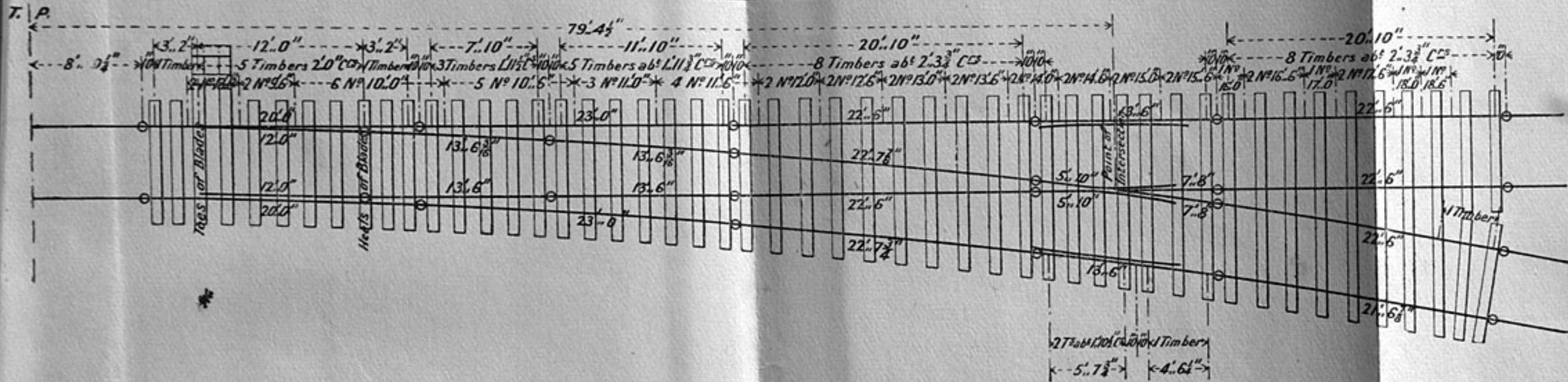
NOTE: THE SLOPES OF CUTTINGS WILL VARY TO SUIT THE CLASS OF MATERIAL EXCAVATED.

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

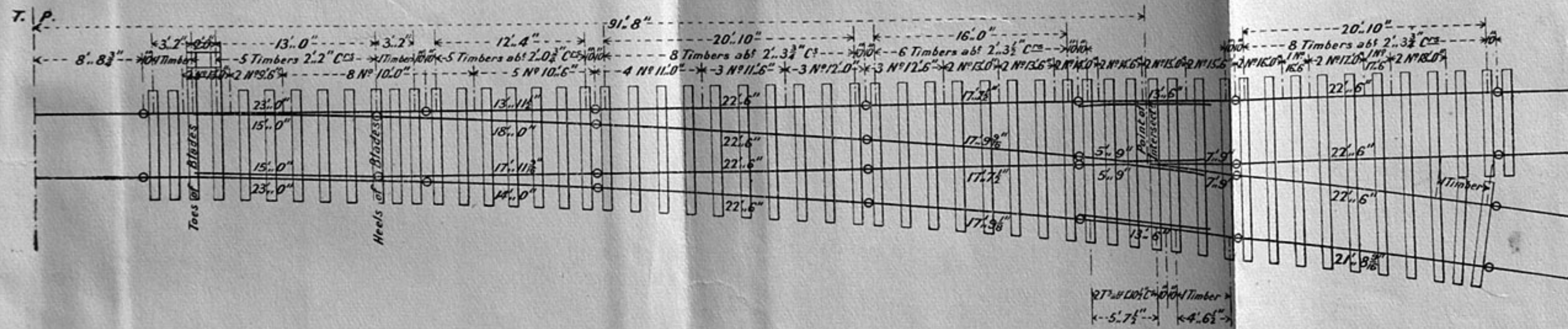
# GENERAL ARRANGEMENT OF TURNOUTS FOR CURVES OF 600, 800, AND 1000 FEET RADIUS

For 60 Lb "D" Class Rails

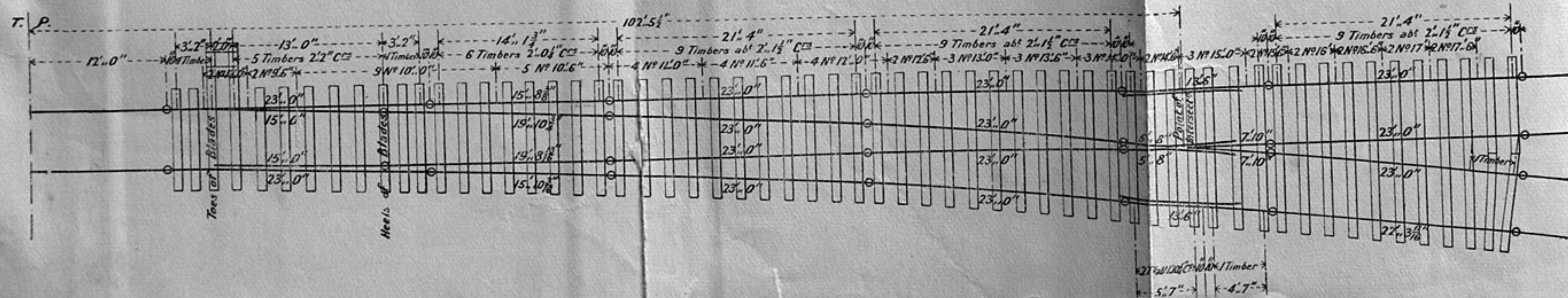
## 600 FT RADIUS



## 800 FT RADIUS



## 1000 FT RADIUS



The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown. 12" Timbers placed centrally under Heels and Toes of Blades.

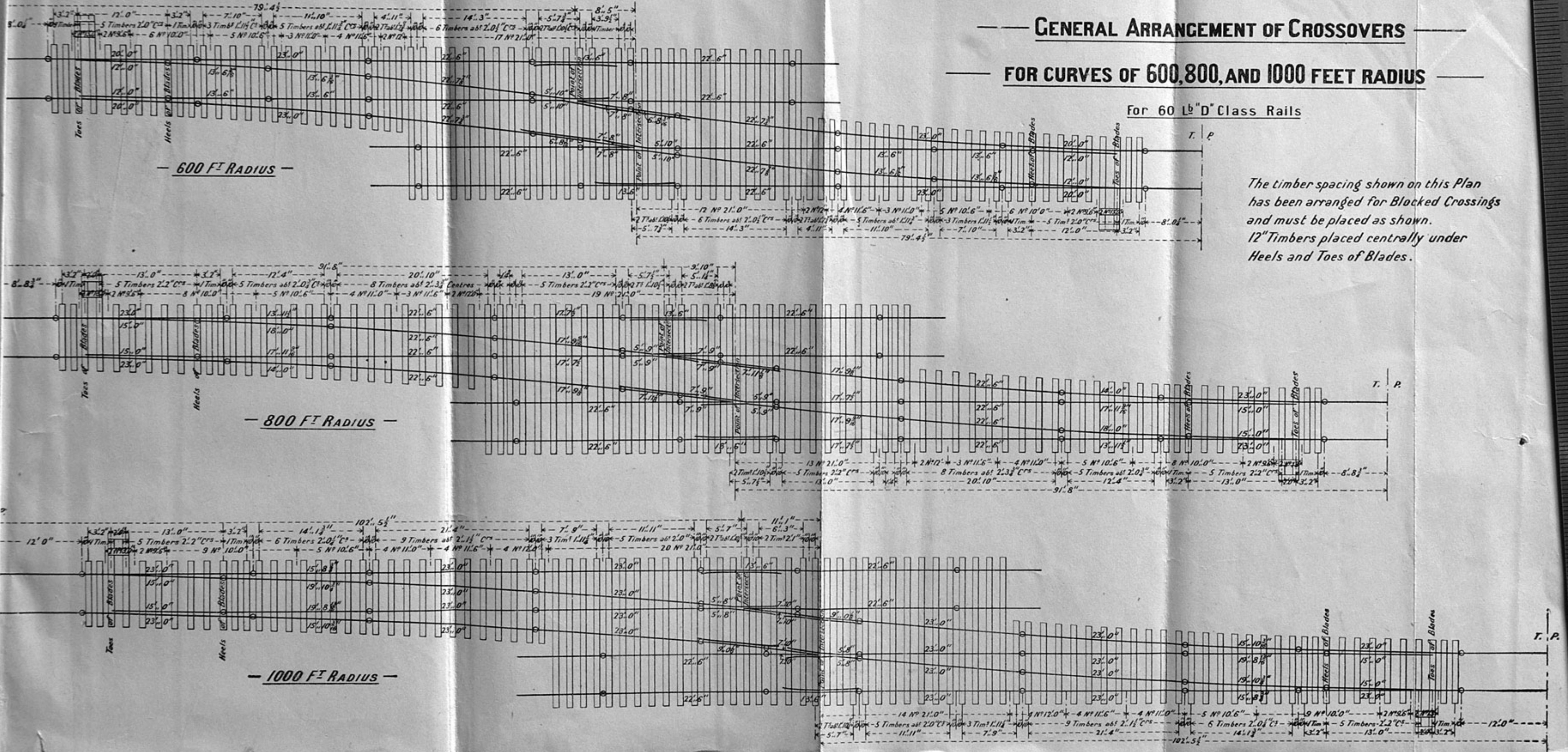
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28



# GENERAL ARRANGEMENT OF CROSSOVERS

## FOR CURVES OF 600, 800, AND 1000 FEET RADIUS

For 60 Lb "D" Class Rails

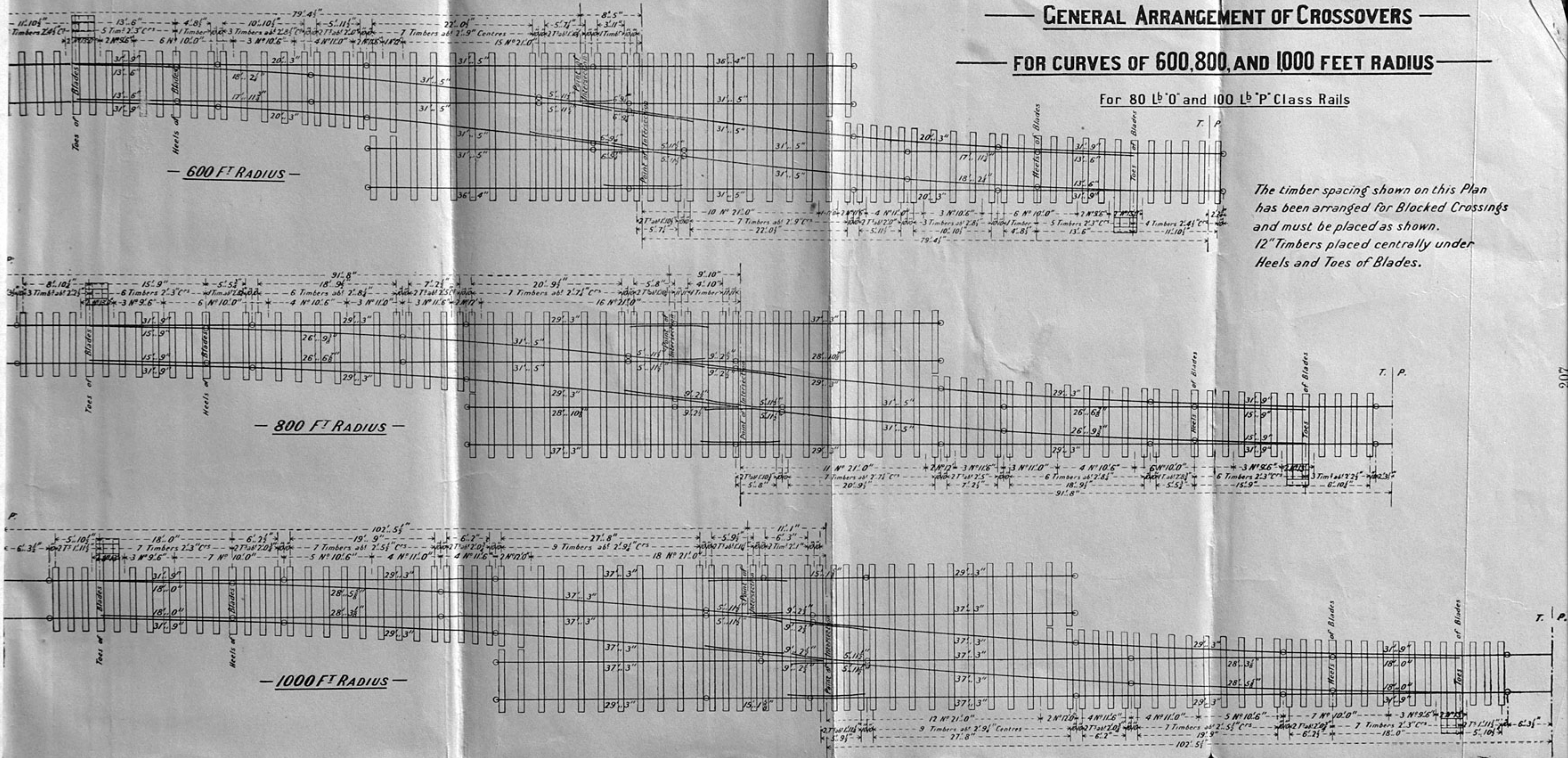


The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown. 12" Timbers placed centrally under Heels and Toes of Blades.

## GENERAL ARRANGEMENT OF CROSSOVERS

### FOR CURVES OF 600, 800, AND 1000 FEET RADIUS

For 80 Lb 'O' and 100 Lb 'P' Class Rails



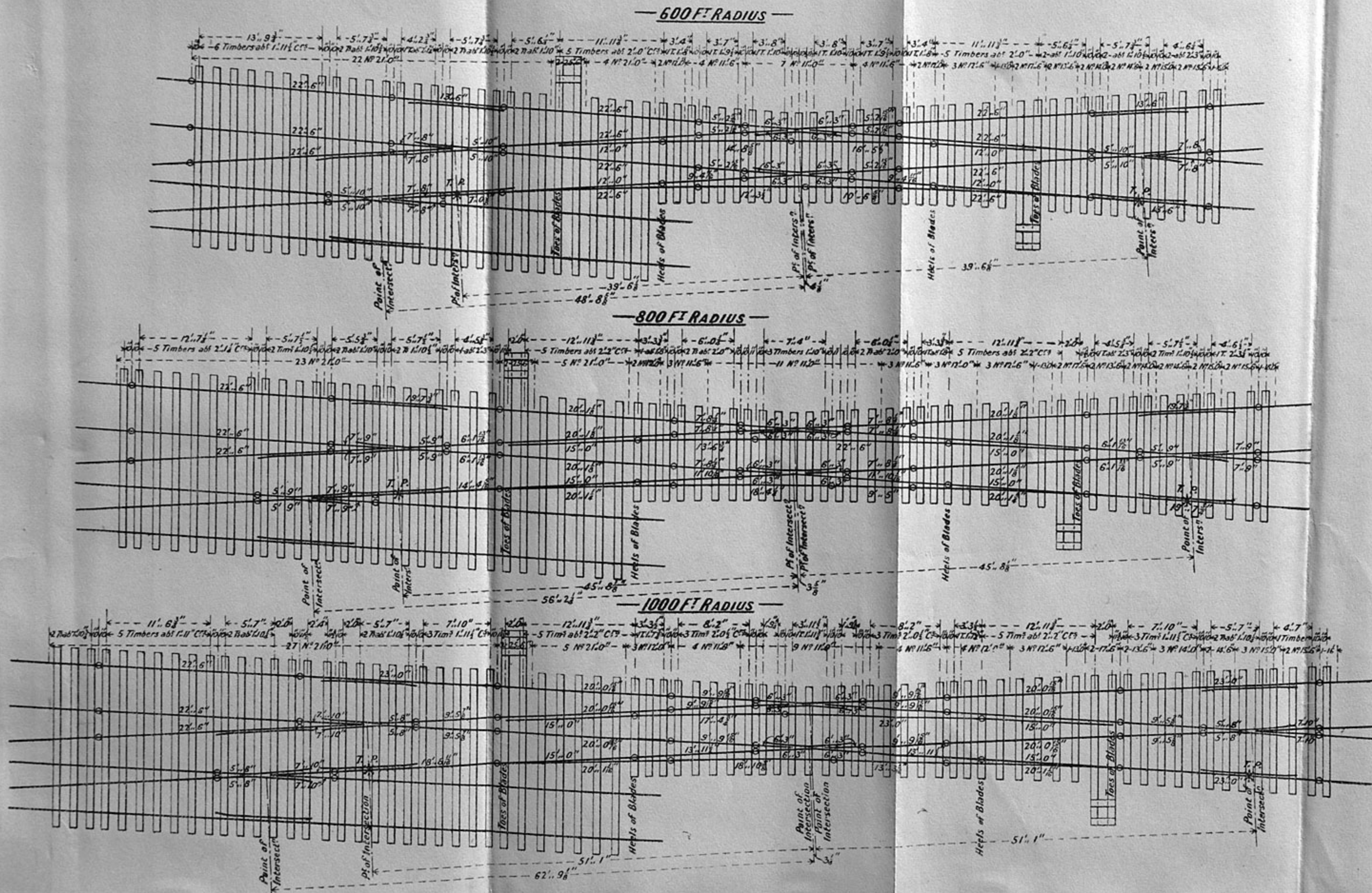
— 600 FT RADIUS —

— 800 FT RADIUS —

— 1000 FT RADIUS —

The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown. 12" Timbers placed centrally under Heels and Toes of Blades.

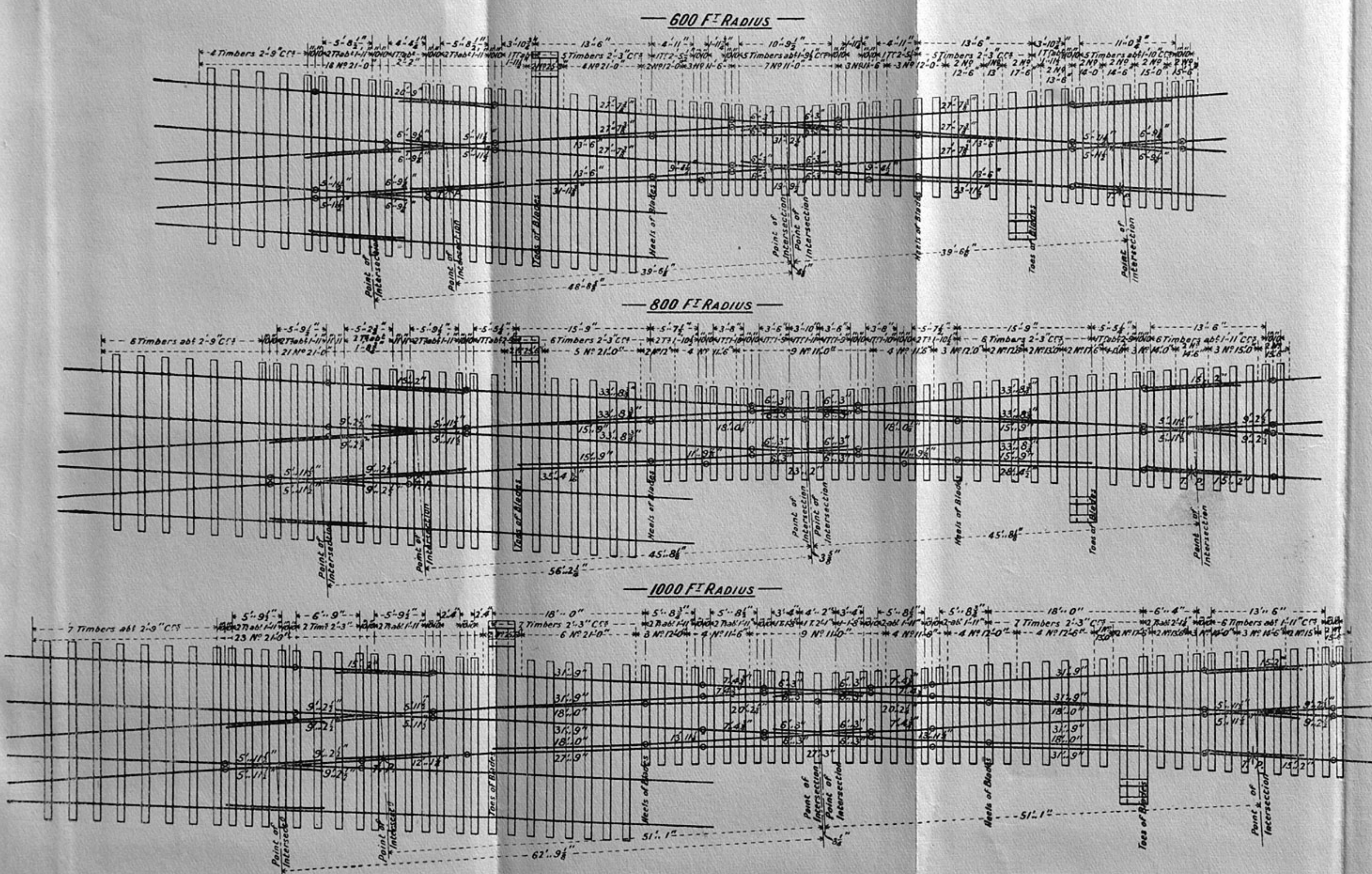
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



**GENERAL ARRANGEMENT FOR SINGLE COMPOUNDS  
FOR CURVES OF 600, 800, AND 1000 FEET RADIUS**

For 60 L<sup>b</sup> "D" Class Rails

The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown.  
12" Timbers placed centrally under Heels and Toes of Blades.



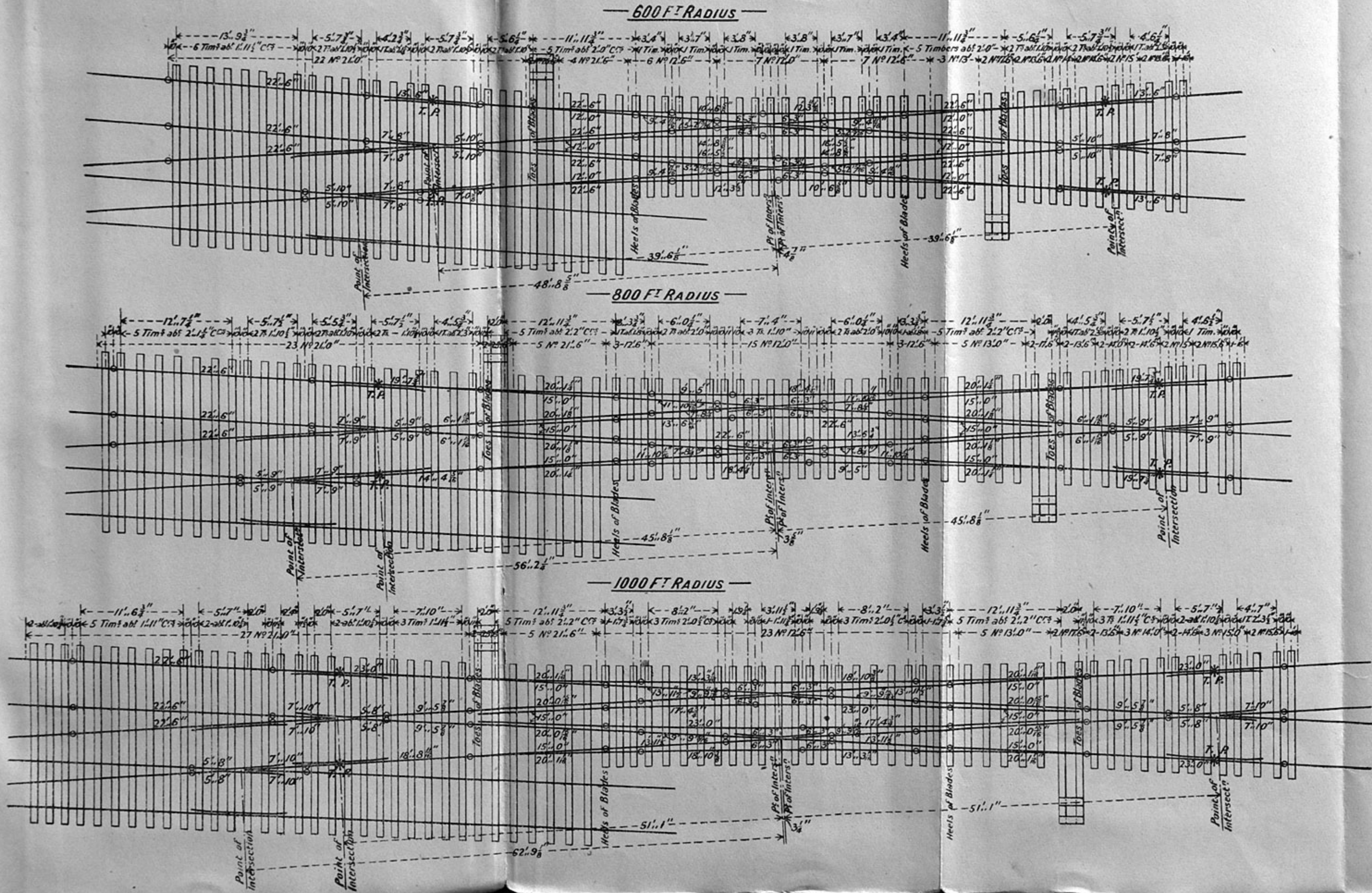
**GENERAL ARRANGEMENT FOR SINGLE COMPOUNDS  
FOR CURVES OF 600, 800 AND 1000 FEET RADIUS**

For 80 lb and 100 lb Class Rails.

The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown.  
12" Timbers placed centrally under Heels and Toes of Blades

5  
6  
7  
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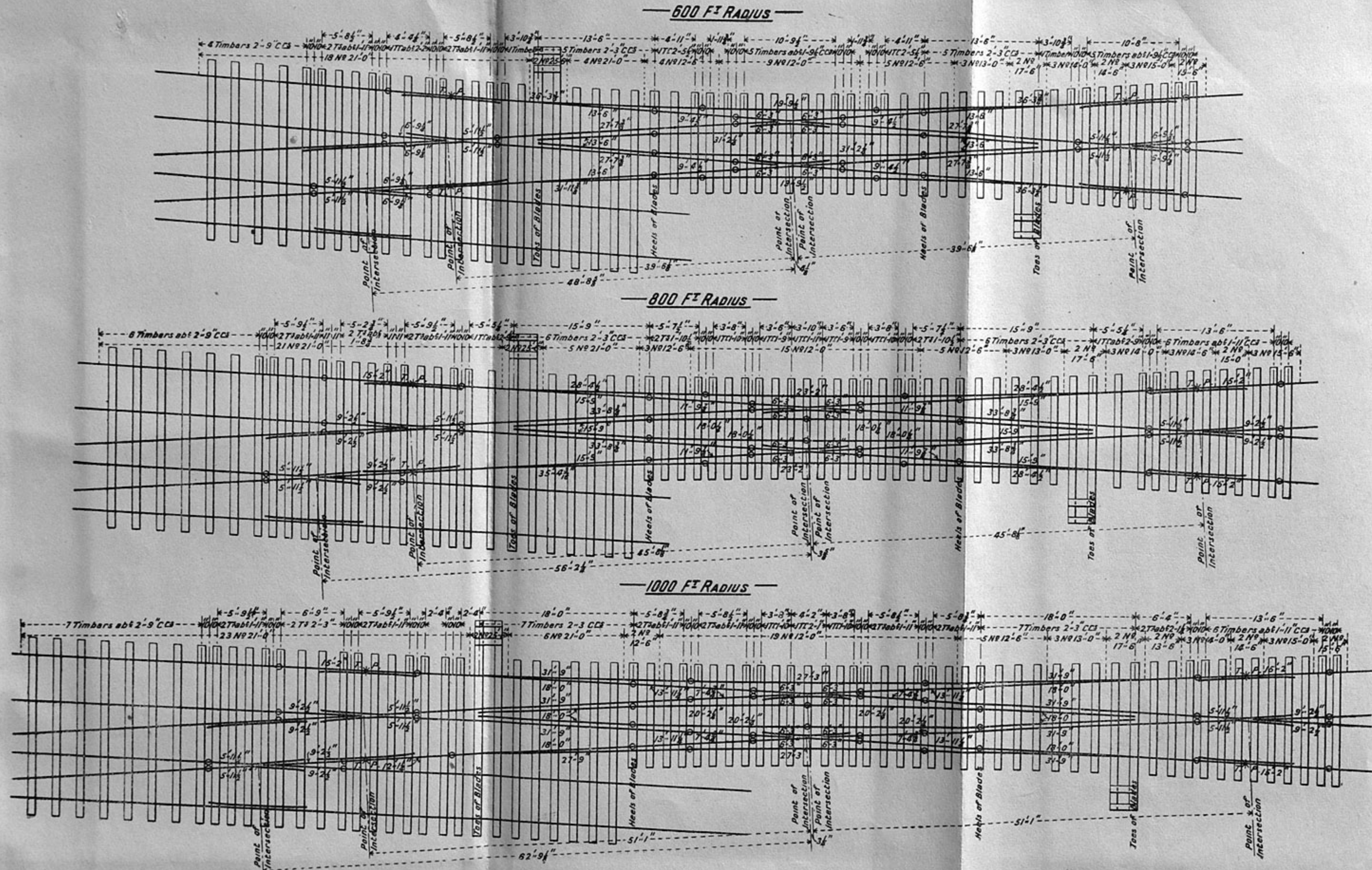


**GENERAL ARRANGEMENT FOR DOUBLE COMPOUNDS  
FOR CURVES OF 600, 800, AND 1000 FEET RADIUS**

For 60 lb "D" Class Rails

The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown.  
12" Timbers placed centrally under Heels and Toes of Blades.

7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30



**GENERAL ARRANGEMENT FOR DOUBLE COMPOUNDS  
FOR CURVES OF 600, 800 AND 1000 FEET RADIUS.**

For 80 L<sup>r</sup> 0" and 100 L<sup>r</sup> P" Class Rails.

The timber spacing shown on this Plan has been arranged for Blocked Crossings and must be placed as shown.

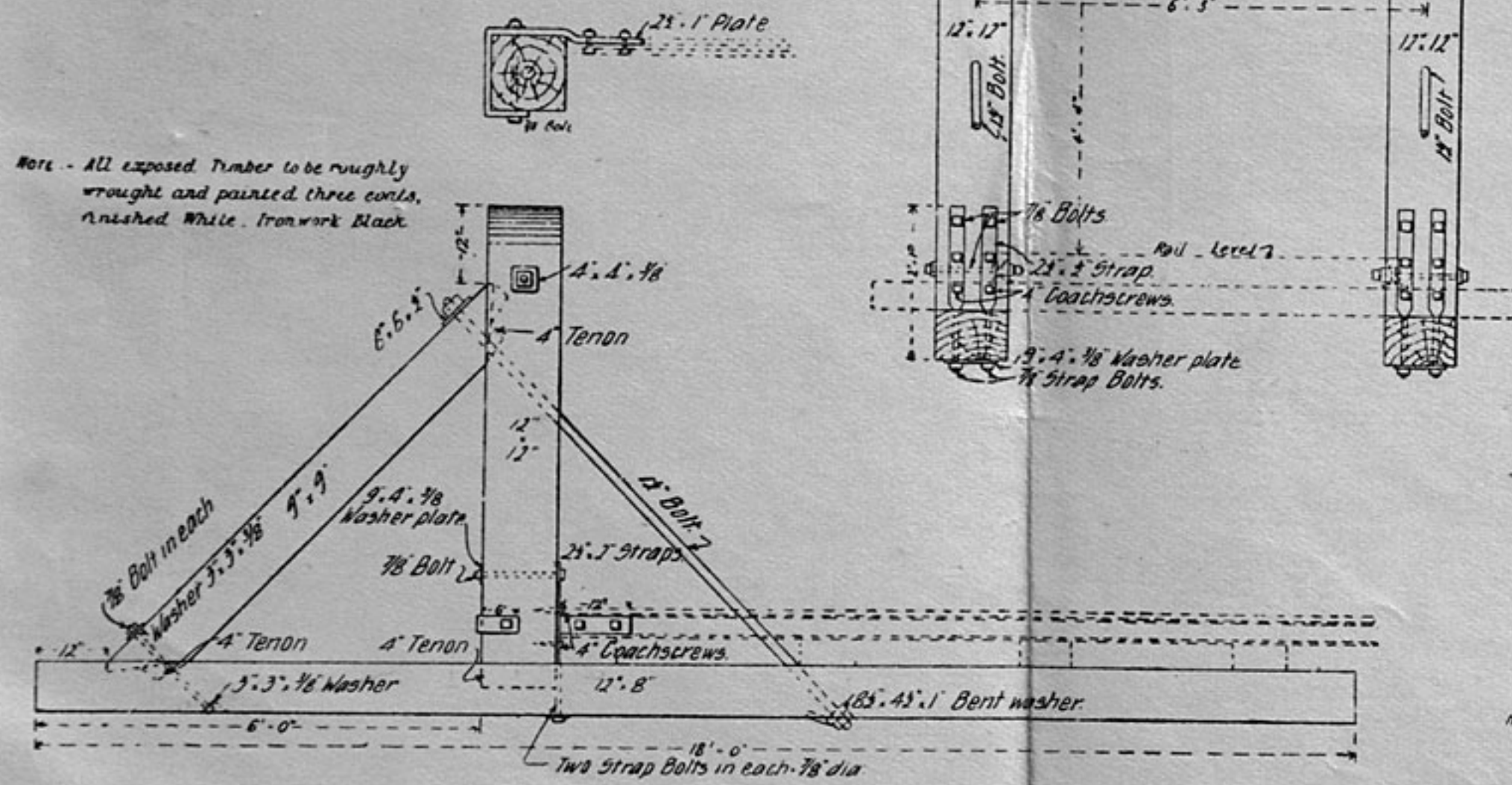
12" Timbers placed centrally under Heels and Toes of Blades.

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

# BUFFER STOP

To be used in Embankments  
or in soft ground

Scale  $\frac{1}{2}'' = 1'-0''$

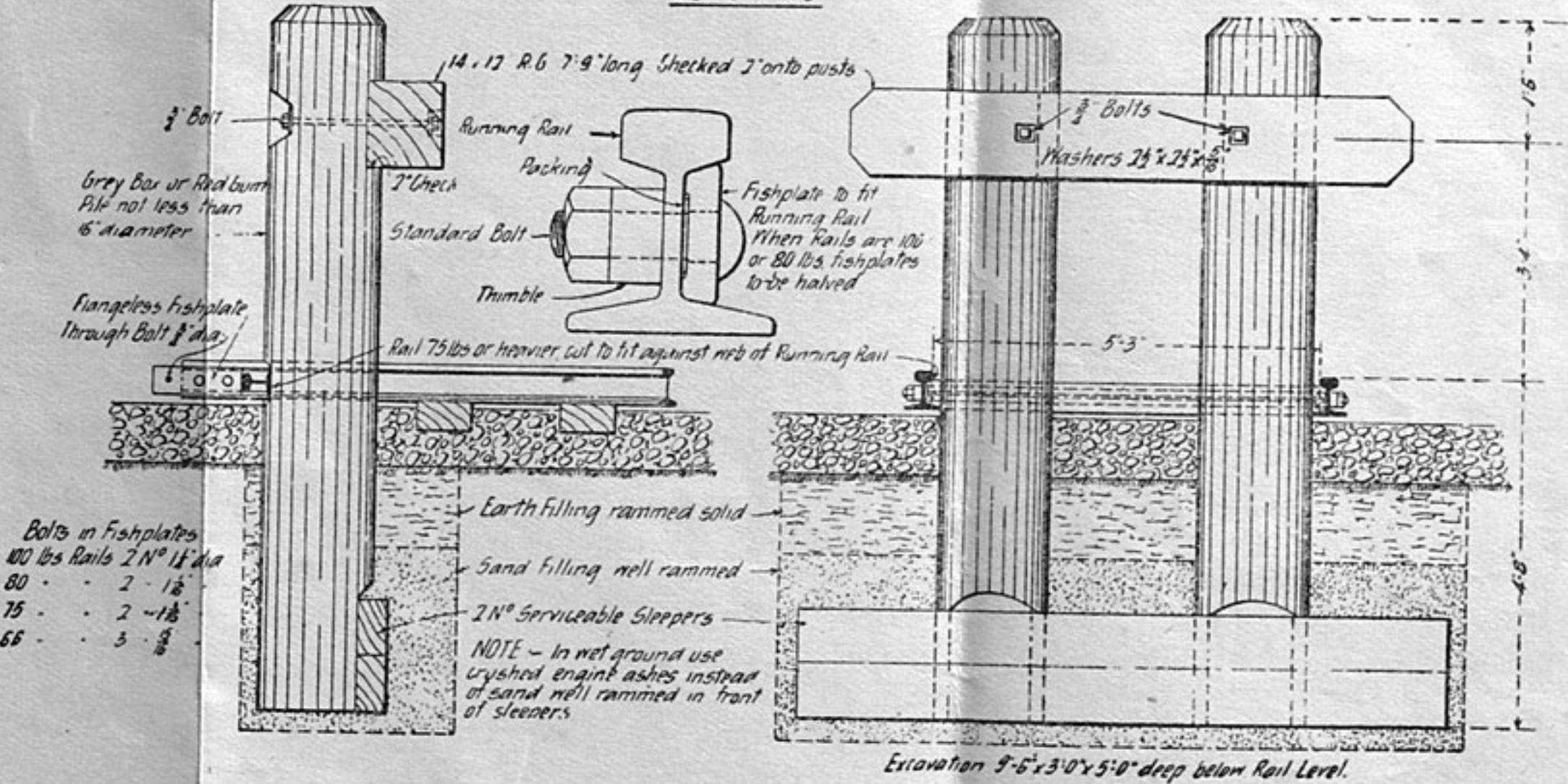


NOTE - If Buffer Stop be knocked out of plumb, jack it back to the vertical & insert packings between posts & rail at back. Before completion shunt a truck against it a few times in order to consolidate the sand filling.

# BUFFER STOP

Not to be used in Embankments  
or in soft ground

Scale  $\frac{1}{4}'' = 1'-0''$



Bolts in Fishplates	100 lbs Rails	2 N° 1 1/2" dia
80	2	1 1/2"
75	2	1 1/8"
65	3	3/8"

Section

Front Elevation