H. Marshall Hubert.

Nov. 96.

A HANDY

PLATELAYER'S GUIDE.

TABLES AND DIAGRAMS

OF

SWITCHES & CROSSINGS:

A HANDY

PLATELAYER'S GUIDE.

BY

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DARLINGTON.

THIRD EDITION.

BEMROSE AND SONS, LIMITED, PRINTERS, 23, OLD BAILEY, LONDON; AND DERBY.

PREFACE.

IT is sixteen years since the first edition of these tables was published by us. A second edition, enlarged and revised, appeared in 1885, and we now offer a third edition revised and further enlarged. Owing to the addition of extra tables and more matter, we have reluctantly been obliged to depart from the original handy form of simply two boards printed on the inside, by which the whole of the tables were presented to view at once, but we trust that the value of the added information and data will be found some compensation for the book form in which this addition appears. Our main object in these tables is to assist the platelayer when putting in sidings, by providing him with the distances, which too often he is left to work out empirically at the cost of much unnecessary labour.

We have also had in view the providing of a handy book of ready reference for engineers engaged in planning new sidings, where they will find useful data in a concise form.

In deference to numerous applications we have in this addition included tables referring to other eight gauges besides the 4 ft. $8\frac{1}{2}$ in., viz., the 1 ft. 6 in., 2 ft., 2 ft. 6 in., 3 ft., 3 ft. $3\frac{3}{8}$ in. or metre, 3 ft. 6 in., 5 ft. 3 in., and 5 ft. 6 in.

The alteration in the distances, contained in this edition of the tables, as compared with the previous one is due to our having taken inside or gauge dimensions as a basis instead of using centre lines as heretofore.

We shall always be glad to receive suggestions with a view to making future editions of these tables more useful, and we trust that the present one will meet with the same favour as its predecessors.

Albert Hill Foundry,
Darlington, June 26th, 1895.

GENERAL INFORMATION.

Gauge. The gauge of a railway is always measured inside and inside of the rails. The standard gauge, not only in this country, but on the Continent and in the United States, is 4 ft. 8½ in., the Irish gauge is 5 ft. 3 in., and in India there are two gauges, viz., the metre (3 ft. 3⅜ in.), and the 5 ft. 6 in. gauge.

The broad gauge (7 ft.), introduced by Brunel, which at one time contested the field with the present standard, was finally abandoned a few years ago. Narrower gauges than 4 ft. 8½ in. are, however, a good deal used both in this country and abroad for light traffic, where it would not pay to put down the standard gauge.

Weight of Rail. Having determined the load per axle, including weight of truck, the weight of rail most suitable can be found by the formula

$$W = \sqrt{L \times 375}.$$

(Multiply the load in tons on axle by 375 and extract the square root.)

W = Weight of rail in lbs. per yard.

L = Greatest load on any axle.

This rule is based upon the sleepers being pitched 3 ft. centres. The weight of the rail, roughly, may be reduced in direct proportion for shorter pitches. As the greatest load is generally that on one of the axles of the locomotive, this may be

arrived at approximately by multiplying the extreme load on a wagon axle by two.

In the following table the gauges named are those usually adopted for the corresponding weight of rail.

Greatest Load per axle, in tons.	Weight of Rail in lbs. per yard, suitable for supports, 3 ft. centres.	Approx. size of Fish Bolts.	Size of Dog Spikes for flange rails.	Approx. size of Round Chair Spikes.	Approx. Cross Section of Sleepers.	Gauge of Road.
		Ins. Ins.	Ins. Ins.	Ins.	Ins. Ins.	Ft. Ins. Ft. Ins.
½ Ton	12 to 14 lbs.	3/8 to 1/2	5/16 × 2½	3/8	4 × 2	1 6
1 ,,	18 ,, 20 ,,	3/8 ,, 1/2	3/8 × 2½	7/16	5 × 2½	1 6 to 2 0
2 Tons	25 ,, 30 ,,	1/2 ,, 5/8	7/16 × 3	7/16	6 × 3	1 6 ,, 2 0
4 ,,	35 ,, 40 ,,	1/2 ,, 5/8	1/2 × 3½	1/2	7 × 3½	2 6 ,, 3 0
6 ,,	45 ,, 50 ,,	5/8 ,, 3/4	9/16 × 3½	1/2 to 5/8	7 × 3½	3 0 ,, 3 6
8 ,,	56 lbs.	3/4 in.	5/8 × 4½	5/8 ,, 3/4	9 × 4½	3 6 ,, 4 8½
10 ,,	60 to 65 lbs.	3/4 to 7/8	11/16 × 5	3/4	9 × 4½	4 8½, 5 3 or 5 6
15 ,,	70 ,, 75 ,,	7/8 in.	3/4 × 5½	7/8	10 × 5	
20 ,,	85 ,, 90 ,,	7/8 to 1	13/16 × 6	7/8 to 1	10 × 5	

Curves Standard Gauge.

Curves as quick as 60 ft. can be worked by a four-wheeled locomotive with a wheel base of 9 ft. 6 in., and an ordinary truck can be screwed round a 30-ft. radius by widening the gauge, if there is no crossing to go through. With crossings, nothing less than 60 ft. should be attempted, but when laying out sidings for works, unless very much confined for space, we should fix the minimum at 120 ft. for four-wheeled locomotives with wheel base up to 9 ft. 6 in., or say twice the gauge.

In the case of sidings to be used by main line locomotives, it is necessary to make the curves in accordance with the regulations of the Railway Company to whose lines they are connected, for some companies require a minimum of 5, or even 6 chains (*i.e.*, 330 or 396 ft.) for curves where their locomotives have to enter.

*Recent practical tests go to show that a variation of the wheel base does not have a very marked influence on the resistance, until a very long wheel base is reached, but for safe working we think it is advisable to increase the radius of a curve in direct ratio of the wheel base.

In dealing with confined spaces, where it is necessary to minimize the sweep of the curves, they might, for wagons only, at slow speeds, be reduced to a radius equal to 10 times the wheel base, and for locomotives to 12 times the wheel base, always bearing in mind that long curves are a great advantage in working traffic, not only enabling it to

*See Article on "The Resistance offered by Curves on Railways," in the *Engineer* of July 6th, 1894.

be more quickly moved, but saving considerable expense by way of wear and tear, both to the roads and the vehicles, not to mention the trouble and annoyance due to derailment, interlocking buffers, &c., contingent upon sharp curves. The shortest radius given in Table No. 1, viz.: 29 ft., is only considered practicable for light trollies or wagons with a wheel base of 3 or 4 ft. worked by hand.

The buffers of double-bolster trucks 14 to 15 ft. wheel base are apt to interlock on curves below 100 ft. radius.

Curves for other Gauges. In the table on the following page, the basis of calculation is 120 ft. minimum for the standard gauge, the radii for the other gauges, being as the square of the gauge for similar wheel bases, that is wheel bases in the same ratio of the gauge. The shorter radii for hand or horse traffic may also be used for locomotives travelling at slow speeds, with a wheel base not exceeding 1½ times the gauge.

As we have found a certain amount of confusion in some quarters with reference to the meaning of the term "Wheel Base," we may as well explain that it is the measurement centre and centre of the rigid wheels farthest apart, belonging to any single locomotive or vehicle. In the case of one or more swivelling bogies, each bogie may be looked upon as a separate vehicle, and when bogies are used in conjunction with rigid wheels, the wheel base is the distance from the centre of the extreme rigid wheels to midway between the centres of the wheels under the bogie.

Table giving approximate minimum radii of curves suitable for wheel bases of about twice the gauge :

Gauge. ft. in.	Radius. ft. in.		ft. in.
1 6	12 6	may be reduced for hand or horse traffic to ..	10 0
2 0	22 0	,, ,,	15 0
2 6	34 0	,, ,,	25 0
3 0	50 0	,, ,,	40 0
3 $3\frac{3}{8}$ (metre)	59 0	,, ,,	45 0
3 6	67 0	,, ,,	50 0
4 $8\frac{1}{2}$	120 0	,, ,,	90 0
5 3	150 0	,, ,,	115 0
5 6	165 0	,, ,,	125 0

Addition to Gauge on Curves. To give more freedom on sharp curves, and to prevent the road being unduly strained by the wedging action of the wheel flanges, it is sometimes advisable to stretch the gauge a little. It is difficult to give rules for general application as to what this addition to the gauge should be, therefore a good deal must be left to the platelayer's judgment, only he should avoid widening it by more than the distance D (see Fig. 1), measured on the narrowest tyres in use.

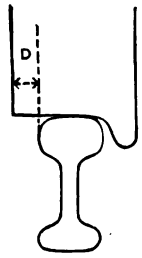


FIG. 1. D for the Standard Gauge runs from $\frac{7}{8}$ to 1 inch.

The following formulæ will be found useful as a basis in determining the addition to the gauge.

R = Radius of curve in feet.
G = Gauge in feet.
W = Addition to gauge in inches.

When the longest wheel base = G × 2 then $W = \frac{44}{R}$
,, ,, = G × 3 ,, $W = \frac{98}{R}$
,, ,, = G × 4 ,, $W = \frac{180}{R}$

Where there are crossings, care must be taken to give extra flangeway clearance to the check rails on the curved side to the extent of one half of the addition that is given to the gauge; otherwise the wheels will be deprived of bearance just at the place where it is most needed, that is in the space between the knees and the nose of the crossing. With the usual flangeway clearance we would advise that in no case should the gauge be widened more than $\frac{1}{2}$ inch at the nose of crossings.

Super-elevation of the outer rail on curves.

On curves, to relieve the side pressure of the wheel flanges against the rails, due to a tendency of the train to go forward in a straight line, it is necessary to elevate the outer rail above the inner one, by packing under the sleepers. The amount of this super-elevation should be as the square of the train speed, and inversely as the radius of the curve. Where the train speed varies considerably the

super-elevation should be adjusted to the speed of the greatest weight of traffic. For slow speeds about sidings it may be dispensed with altogether. The platelayer should begin to cant the sleepers on the straight a few yards before the curve is reached, gradually attaining the full super-elevation at a point not far from the spring of the curve, and similarly letting it die out gradually into the straight at the opposite end. The values in our table* are deduced from the formula $E = \frac{V^2 \times 5}{2R}$ where 5 is a constant for the standard gauge :—

E = Super-elevation of outer rail in inches.

V = Speed of train in miles per hour.

R = Radius of curve in feet.

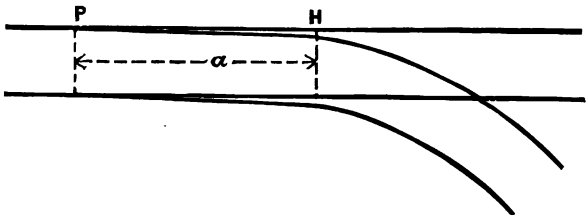
For other gauges E varies in direct ratio, half the super-elevation being required for a 1 ft. 6 in. gauge that is necessary for a 3 ft. 0 in. one.

Where it is not convenient to elevate the outer rail, a check rail should be placed on the inside of the curve. *(See Table No. 7, giving super-elevation, at end of book.)

Switches or Points. These are made of various lengths to suit the situation for which they are intended ; the usual lengths for the standard gauge on main lines being 12 ft., with a proportion of 15 ft. and 18 ft., whilst about sidings the lengths run principally 9 ft., down to as low as 6 ft. The principal object in long switches is to make an easy turn off ; they have also the advantage

of additional stability as compared with short ones, for, being secured only at one end, switches are liable to rock and jump when heavy loads are passing over them. The lengths of switches should in a measure be adapted to the radius of the curve, for obviously there is no advantage in making the angle at the point less than the angle at the heel. This will more readily be understood by reference to Fig. 2 below, which shows a pair of long switches (*a*) applied to a short curve, whereby the abruptness of the angle of turnout is met at the heel of the Switches (H) instead of the point (P).

FIG. 2.



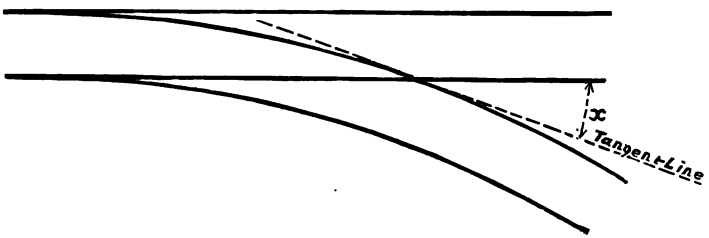
In general practice, for the standard gauge it will be found that there is nothing gained by making the switches longer than twice the angle of the crossing in feet; that is to say, 9 ft. is a better length of switch to work with crossings 1 in $4\frac{1}{2}$ than 12 ft., and longer switches than 12 ft. can only be applied with advantage to crossings above 1 in 6. Facing Points should always be made the extreme length compatible with the above conditions.

The length of stock rails is a variable quantity,

sometimes being 3 ft. or 4 ft. above the length of the point, and sometimes the standard length of the rails in use on the particular railway, but no hard and fast rule can be laid down, only due regard should be paid to allowing suitable distances at each end of the points for spacing the chairs with reference to the joints.

Crossings. The angle of a crossing is the one formed by a tangent to the curve at the point of intersection. See Fig. 3 below, in which *x* is the angle.

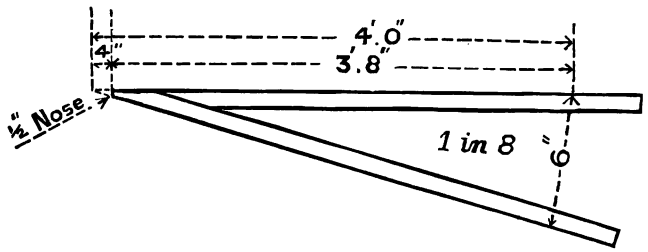
FIG. 3.



When ordering crossings to replace those in use, the simplest plan is to measure the width of the Crossing Vee across the outside of the rails at a distance of, say 4 ft. back from the nose, in which case the crossing should be specified thus—6 in. (or whatever the distance may be) at 4 ft. from actual nose of crossing, for an error is sometimes made by Platelayers when specifying crossings, due to not taking into account the thickness of the crossing

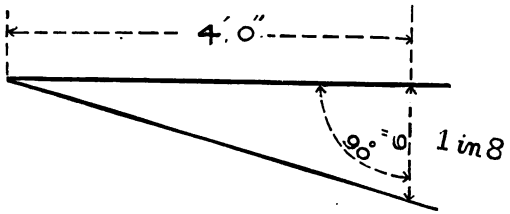
nose, thus giving the angle of a crossing which measures 6 in. at 4 ft. back from the nose, as 1 in 8, whilst, if we assume that the nose is $\frac{1}{2}$ in. thick, the actual angle, found by dividing $5\frac{1}{2}$ in. into 4 ft., is, say 1 in $8\frac{3}{4}$. This will more readily be understood by reference to Fig. 4, given below.

FIG. 4.



The above is the usual method of measuring the angle of a crossing in this country. Another plan in use on some of our Indian Railways is to measure the Vee across at right angles to one of the legs, as shown by Fig. 5.

FIG. 5.



Crossings are made right and left hand on some of our main lines, the point rail being always laid for the main way, and the splice rail for the

turnout or siding; thus in fig. No. 4 the Vee shown is for a left-hand crossing to suit a curve turning off to the left hand when facing the points. For sidings they may be made all the same hand.

When measuring the angles off a drawing, care should be taken to lay down the tangent lines referred to (see Fig. 3), instead of, as is sometimes done, measuring on the curved line. It is not necessary to include fractions in the angles of crossings, except for the more obtuse ones, and those given in our tables will meet all ordinary cases, but when a fraction appears in a calculation, it is better to take the next higher rather than the lower number; for instance, suppose the angle worked out to 1 in $6\frac{5}{8}$, we should make the crossing 1 in 7, for it is easier to adapt a crossing to a situation when it is made rather too acute than the reverse. The most useful angle of crossing for sidings is 1 in 6, and for the main line, 1 in 8. With regard to the length of the various rails composing a crossing, it is impossible to lay down any hard and fast rule. For main line purposes the Vee rails vary from 8 ft. to 12 ft., and the wing rails from 12 ft. up to the full length of a standard rail, and for sidings the Vees are made from 6 ft., and the wings from 7 ft. 6 in. upwards. Check rails should always be at least 4 or 5 ft. longer than the distance between the crossing knees and the nose; but to allow sufficient latitude in fixing, and for suitably arranging the chairs and sleepers, they are generally made much

longer than the above rule indicates. For main lines a usual length is 12 ft., whilst for sidings they run from 7 to 9 ft.

Specifications for Switches and Crossings. A full set of 9 ft. switches and crossings for D. H. or B. H. rails standard gauge consists of the following parts:—

SWITCHES.

2 Tongue Rails, 9 ft.
2 Stock Rails.
6 Cast-iron Slide Chairs.
2 Cast-iron Heel Chairs.
4 Slide Chair Bolts.
2 Bearing Studs.
4 Heel Chair Bolts.
2 Oak Keys.
1 Tie Rod.
1 Lever Box.
1 Lever Rod.

CROSSING.

1 Point Rail.
1 Splice Rail.
1 R.H. Wing Rail.
1 L.H. Wing Rail.
2 or more Splice Bolts.
4 Cast-iron Chairs.
6 to 8 Oak Keys.

CHECK RAILS.

2 Rails.
6 Cast-iron Chairs.
6 Oak Keys.

and a full set of 12 ft. Switches and Crossings of the following parts ;—

SWITCHES.

2 Tongue Rails, 12 ft.
2 Stock Rails.
10 Cast-iron Slide Chairs.
2 Cast-iron Collar Chairs, for behind heels.
8 Slide Chair Bolts.
2 Bearing Studs.
4 Oak Keys.
2 Tie Rods.
1 Lever Box.
1 Lever Rod.

CROSSING.

1 Point Rail.
1 Splice Rail.
1 R.H. Wing Rail.
1 L.H. Wing Rail.
2 or more Splice Bolts.
4 Cast-iron Chairs.
6 to 8 Oak Keys.

CHECK RAILS.

2 Rails.
6 Cast-iron Chairs.
6 Oak Keys.

For flange (F.B.) rails, when these are simply fastened directly to sleepers with dog spikes, a set of 9 ft. switches and crossings consists of the following parts :—

SWITCHES.

2 Tongue Rails, 9 ft.
2 Stock Rails.
8 Cast-iron Slide Chairs or Wrought-iron Sole Plates.
6 Slide Chair Bolts.
2 Bearing Studs.
1 Tie Rod.
1 Lever Box.
1 Lever Rod.

CROSSING.

1 Point Rail.
1 Splice Rail.
2 Wing Rails.
2 or more Splice Bolts.
3 Wrought-iron Sole Plates.
5 Cast-iron Distance Blocks.
6 Bolts for Distance Blocks.

CHECK RAILS.

2 Rails.
6 Cast-iron Distance Blocks.
6 Bolts for Distance Blocks,

and a set of 12 ft. of the following parts :—

SWITCHES.

2 Tongue Rails, 12 ft.
2 Stock Rails.
10 Cast-iron Slide Chairs.
6 Slide Chair Bolts.
4 Bearing Studs.
2 Tie Rods.
1 Lever Box.
1 Lever Rod.

CROSSING.

1 Point Rail.
1 Splice Rail.
2 Wing Rails.
2 or more Splice Bolts.
3 Wrought-iron Sole Plates.
5 Cast-iron Distance Blocks.
6 Bolts for Distance Blocks.

CHECK RAILS.

2 Rails.
6 Cast-iron Distance Blocks.
6 Bolts for Distance Blocks,

and the same specification is suitable when wrought-iron Sole Plates are used between the rails and the sleepers, but when cast-iron Chairs are used the specification should be similar to that given for D. H. and B. H. rails.

Lever Boxes. There is a great diversity in the patterns of Lever Boxes in use, and every Platelayer has his own particular fancy. A perfect Lever Box should embody the following points :—

(1) It should not take up much space.

(2) Whilst being easy to work by the shunter, it should always bring the points home with certainty.

(3) It should be readily changed from a "Turn-over Lever," which leaves the points indifferently on one side or the other, to a "Self-acting Lever," whereby the points are always brought back to the same side.

(4) It should possess facilities for padlocking, either to self-act always for one particular side, or to prevent it being worked at all except by authorized hands.

(5) It should possess fewness of parts, and not be liable to get out of order.

Flangeway Clearance. The factors in determining the width of flangeways between check rails and the main rail are the thickness of the wheel flange and the clearance allowed, and taking the standard gauge for example, when the flange is close up to the rail there should be at least $\frac{5}{8}$ in. clearance between the back of the flange and the check rail, which, with a flange $1\frac{1}{8}$ in. thick, allows $\frac{3}{8}$ in. clearance on the working faces, and $\frac{1}{4}$ in. clearance on the check rail side, making a total flangeway of $1\frac{3}{4}$ in.; thus when the back of the wheel flange is working close up to the check rail on the inside of the curve there is $\frac{1}{8}$ in. clearance between the working faces on the outside rail.

Platelaying. The road bed having been duly prepared and levelled by the Contractor, the material should be delivered in a manner to save unnecessary labour. The rails should be laid down in pairs end to end on one side of the road bed, and the sleepers and chairs thrown down in the numbers required for each length. The fish plates, bolts, spikes, and keys may be distributed in

heaps at convenient distances apart. Having all the material to hand, the work should proceed in the following order:—Place the sleepers on the road bed spaced approximately the required distances apart. Place the chairs upon the sleepers and lay a pair of rails loosely into them. Take a piece of chalk and with a lath properly divided set off the position of chairs on the rail. Then key the chairs to their places; adjust the sleepers to the position of the chairs. Adjust rails roughly to gauge and bore all the spike holes along one side only, having sighted along it first to see that it is straight; drive a few spikes to hold the chairs in position, then set the opposite rail carefully to gauge and square across ends with the one already fixed, bore and partly drive a few spikes, making a final trial with gauge and square to see that all is in order before driving all the spikes home. After the first length is laid, a second gang of men may be set to connect succeeding lengths in advance, to be adjusted and permanently spiked by the first gang in due order. The duties of a gang of platelayers, with the appropriate tools, may be divided as follows:—

(1) Unloading and parcelling out material. Tools required:—Pinches and rail forks.

(2) Fixing rails, chairs, and sleepers in their proper position. Tools required:—Tape line, T square, spirit level, road gauge, keying hammer, brace with bits, crow-

bars, picks, jim crow, hammer adze, spades, and shovels.

(3) Laying down and connecting succeeding length in preparation of the foregoing. Tools required :—Screw keys or wrenches, hammers, oil can, pinches, picks, clearance gauges to put in between rails at joints for giving proper space for expansion.

(4) Ballasting or packing road level under sleepers with ashes or other suitable material. Tools required :—Picks, spades, shovels, screw rail lifters or iron shod levers, winding laths, straight edges, spirit level, crow bars, super-elevation gauge.

(5) Boxing up and finishing, by levelling ballast to top of sleepers. Tools required:—Spades and shovels.

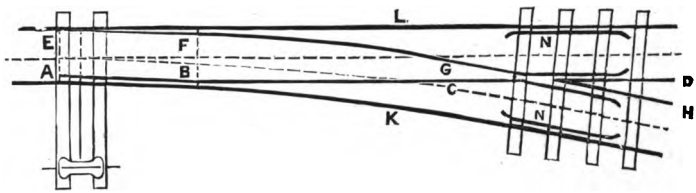
In addition to the above-mentioned there are various other tools necessary for a complete outfit, and a full list will be found on page 27.

Platelaying. Switches and Crossings.

First lay down the sleepers for the switches, then place the switches A B E F (see Fig. 6) upon them; lay the crossing upon its sleepers, the distance from heel of switch as per tables, according to angle, seeing that each crossing chair is in the middle of its sleeper; line the crossing rail, C D, with the switch point, A B, the point being closed and not open as shown in Figure, bore and spike in this

position: fix the opposite switch, E F, to gauge tightly at point. The closing rail, F G, should next be curved tentatively (using the versed sine given in Table No. 6, for the radius corresponding to the angle as per Tables), then placed in position, adjusting it with the rail bender till it ranges properly to the eye; the crossing rails, G H, will also require setting a little to suit the curve, although it must be remembered that it is no worse for being rather flat for a few feet on each side of the crossing nose. At the switch end the aim

FIG. 6.



should be to give the curve the appearance of having sprung from a point in advance of the switches, called "spring of curve" in the Tables, otherwise there is a tendency to prolong the straight of the point rail, E F, behind the switch heels, which should be avoided. The outside rail, F G, being truly ranged and spiked down, the inside rail, K, must now be laid to gauge with it, allowing a little extra width at the crossing nose, and working rather tight to gauge for two or three feet on each side of it. We may now put in the closing rail

B C, and the opposite rail, L, to gauge with it; then fix the check rails, N N, in position, care being taken, when these are short, to see that the centre is opposite the crossing nose.

Unless the switches have been specially ordered for the right hand, the stock rail of switch, A B, will require setting in front of the point, to gauge with the opposite rail.

Special sleepers should always be provided for the crossings, the length averaging, gauge × $2\frac{3}{4}$, and sections from 10 in. × 5 in. to 14 in. × 7 in., according to the width of base of the chairs they have to carry. There should also be long sleepers of the usual sections provided for the first four slide chairs of the points, length equal to gauge, × $2\frac{1}{2}$, to carry the lever box, when the switches are worked by one, for when this is fixed to an isolated piece of wood, there is often a good deal of trouble caused by it shifting, with the action of the falling weight.

Fixing Lever Boxes. When fixing the Lever-box be careful to see that the weight has plenty of clearance when down, in the case of a self-acting lever, and that it falls equally on each side of the Lever Frame, in case of a turn-over lever. Coach Screws or Bolts should be used for fixing the lever frame in preference to spikes. Switches should have $3\frac{1}{2}$ in. to $3\frac{3}{4}$ in. throw at the point, and it must be seen that, at no point between the heel and where

the planed part commences, there is less than 1½ in. clearance. If the lever does not bring the points home, it is better to get it to do so by easing the bolts at the heels, and well oiling the chairs, rather than by moving the weight further along the lever. Switches are apt to work rather stiffly at first, but after the chairs have worn smooth they will be found free enough to enable them to be worked with less leverage.

Platelayer's Tools. The following is a list of what constitutes a complete set of Platelayer's Tools, for use in laying D.H. or B.H. rails on wood sleepers with cast-iron chairs :—

1 Ratchet Brace, with key for same, and half-a-dozen drills.
1 Wrought-iron Cramp for same.
1 Screw Rail Lifter or iron shod Lever.
1 Rail Bender, or Jim Crow, and Lever.
2 Keying Hammers.
1 Oil Feeder.
1 Hand Hammer.
2 Cold Chisels.
1 Rodded Chisel.
2 Beater Picks.
1 Hammer Adze.
1 Small Axe.
1 Sledge Hammer, 8 lbs.
1 Auger Brace and 3 bits.
3 Claw-ended Crowbars.

3 Plain ended crowbars.
3 Pinch Bars.
2 Disc Signals.
2 Flag Signals.
2 Screw Keys.
1 Shifting Spanner.
6 Steel Shovels.
3 Steel Spades.
2 Rail Forks.
1 Graduated Spirit Level, for fixing super-elevation of outer rail on curves.
1 Road Gauge.
1 Footway do.
1 Straight Edge.
1 T-Square.
2 Winding Strips or Sighting Boards, with clips to fasten them to the rails.
1 10-inch Spirit Level.
1 Flat Bastard File.
1 Three-square do.
1 Metallic Wired Measuring Tape.
1 Large Box, to contain the above tools, with padlocked lid.
1 Trolley.

Useful Memoranda. The best Permanent Way consists of bull-head steel rails, keyed into cast-iron chairs, and spiked to creosoted sleepers. When flange rails are used, one of the best systems is a wrought-iron soleplate, rolled with a groove to take

the rail flange, having a hole at each side of groove to take a coach screw with deep-cut buttress threads, and a mushroom head, which impinges partly on the rail flange and partly upon the soleplate. These are screwed into the sleepers with a key applied to a square boss projecting from the head.

An excellent permanent way can be made with flange rails placed upon plain wrought-iron soleplates punched with four holes, through which four dog-eared spikes are driven into the sleeper, two on each side of the rail.

Flange rails fastened direct to sleepers with two or three dog spikes per yard make a good enough road for wagon sidings and temporary work.

The transverse strength of flange rails weight for weight is greater than that of Bull Head or Double Head Sections. The radii at the top corners of rail head should always be considerably less than the radius of fillet in the wheel flange. A large top radius of the head for the sake of adhesive surface is important. A top radius of 14 inches, with corner radii of $\frac{5}{16}$ in., gives good results.

The less the surface of a rail is interfered with the better, and notching should be avoided as much as possible.

Chairs should have either two spikes and two trenails, or three spikes, on curves. Two spikes, or two spikes and one trenail, are generally sufficient for straight road.

There is little or no advantage in jagging or

twisting spikes. One of the best forms consists of a round parallel shank swelled in the neck to fairly fill the tapered chair hole, and bevilled slightly at the point to facilitate driving.

Sleepers, except for temporary work, should be creosoted with 9 or 10 lbs. of creosote per cubic foot. The chairs should be laid on the sawn or heart side and bedded level. Sleepers at the joints should be laid only $\frac{3}{4}$ to $\frac{4}{5}$ths of the distance apart of the intermediate ones.

Old spike holes in sleepers should be filled by oak trenails tarred and driven very tight.

Spike holes should be about one-fourth less than diameter of spikes, and bored right through the sleeper.

Diamond Crossings should not be put in of a more acute angle than 1 in 8 where locomotives are used, and it is well where practicable to keep them down to 1 in 6.

In places where there is a tendency for the couplings to catch in the vees of the crossings, these should be fitted with blocks of wood inside of the rails; and where horses are used for hauling, the open ends of check rails and crossings should be protected by pieces of wood nailed to the sleepers.

Standard Dimensions, 4 ft. 8½ in. Gauge.

Flangeway Clearance, $1\frac{3}{4}$ in. to $1\frac{7}{8}$ in., according to thickness of wheel flanges.

Clearance between wheel flanges and rails, $\frac{3}{8}$ in.

Travel of points at end, $3\frac{1}{2}$ in. to $3\frac{3}{4}$ in.

Tilt, or inclination of rail inwards, and cone of wheels, 1 in 20.

Vertical flangeway clearance from top of rails, $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in.

Footway, or distance between lines of way inside of rail heads—

Sidings (minimum) ... ... 5 ft.

Main way (Board of Trade minimum) 6 ft.

Vertical height above rail level for bridges, &c., minimum, 14 ft. 6 in.

Sleepers, 9 ft. × 10 in. × 5 in.

Crossing sleepers, 12 ft. to 14 ft. × 12 in. × 6 in. to 14 in. × 7 in.

Sleepers (intermediate), centre and centre, 2 ft. 9 in. to 3 ft.

Sleepers (joint), centre and centre, 2 ft. 4 in. to 2 ft. 6 in.

The minimum distance between the two lines of way to allow trucks to clear, 3 ft. 9 in.

Minimum depth of ballast below sleepers, 8 in.

Length of spikes, 6 in.

Clearance between rail ends to allow for expansion when laid in cold weather, $\frac{3}{16}$ in.

Minimum width of wheel tread that will safely run over a crossing, 4 in.

On wagons for sidings, minimum width of tyres, $4\frac{1}{2}$ in. and on engines and wagons for main line, 5 ins.

Maximum width of wheel tread, 6 in.

Wheel flange should not exceed in depth $1\frac{1}{4}$ in.

Board of Trade Regulations referring to Main Lines.

Minimum distance of standing work from outer edge of rails at level of carriage steps, 3 ft. 6 in.

Switch handles not to be worked between lines of railway.

Facing Points to be avoided, but where unavoidable to be provided with locking bars and signals.

Catch points to be provided on sidings falling towards the main line.

Joints of rails to be fished.

Chairs to be secured by iron spikes.

TABLES AND DIAGRAMS,

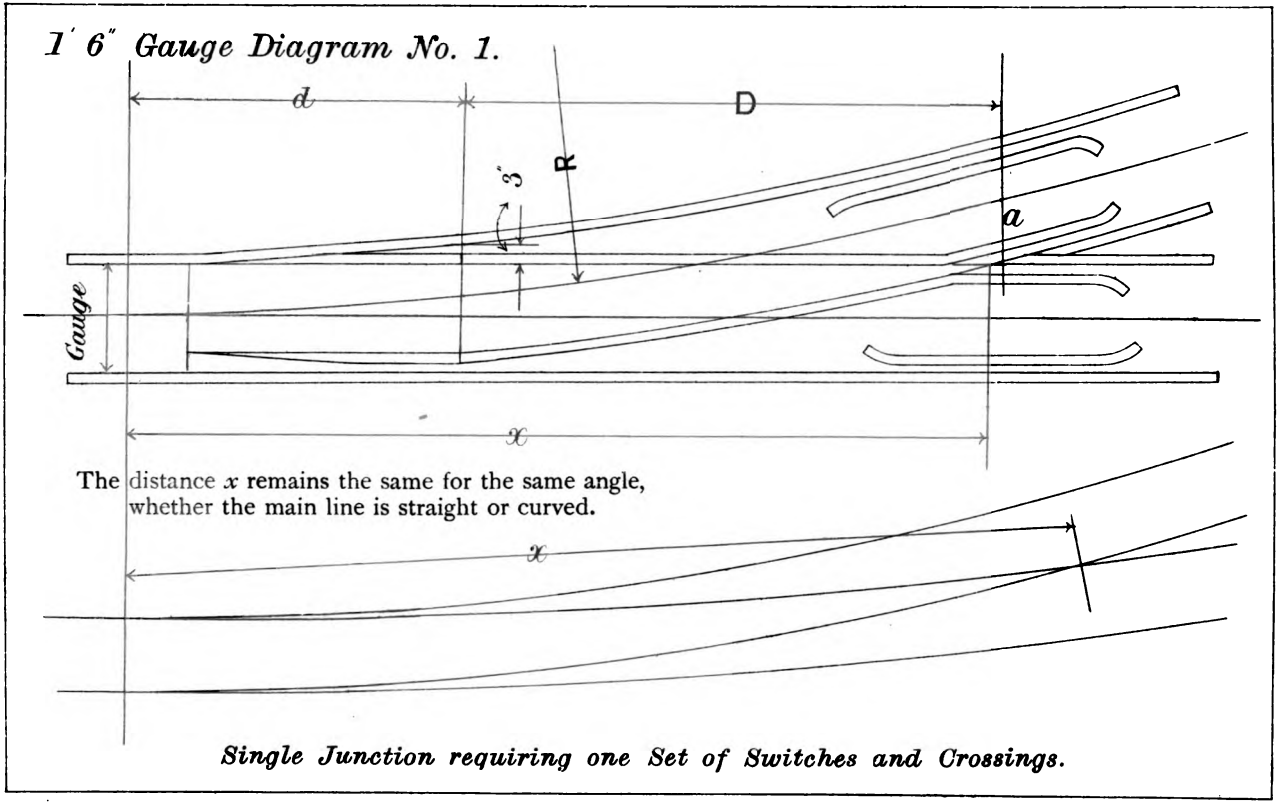
CONTAINING

TABLES FOR THE FOLLOWING GAUGES:—

1 FT. 6 IN., 2 FT. 0 IN., 2 FT. 6 IN., 3 FT. 0 IN., 3 FT. $3\frac{1}{8}$ IN., 3 FT. 6 IN., 4 FT. $8\frac{1}{2}$ IN., 5 FT. 3 IN., AND 5 FT. 6 IN.,

REFERRING TO

DIAGRAMS FOR SINGLE JUNCTIONS, DOUBLE JUNCTIONS, THREE-THROWS, SINGLE THROUGH ROADS, DOUBLE THROUGH ROADS, DIAMONDS WITH SINGLE SLIPS, AND DIAMONDS WITH DOUBLE SLIPS.



Single Junction requiring one Set of Switches and Crossings.

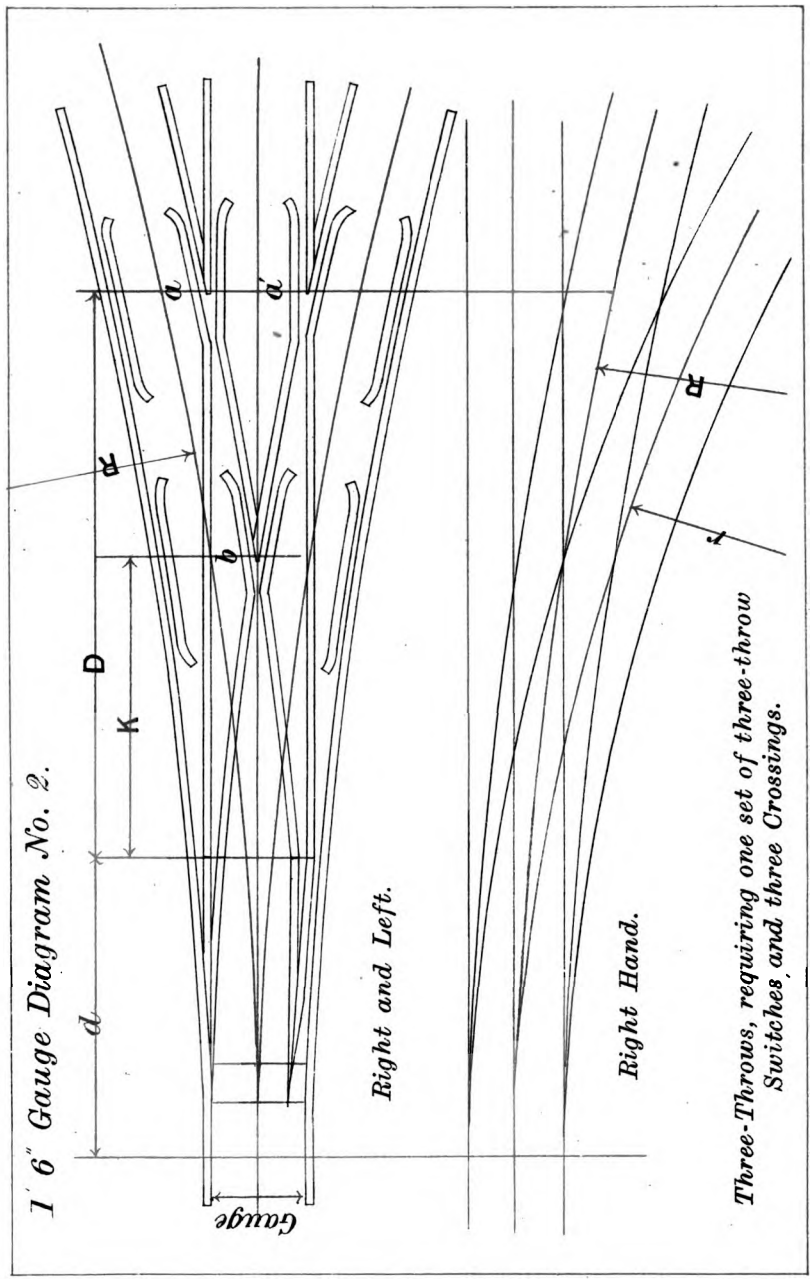
SINGLE JUNCTIONS.

1 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		f Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	31	52	2	1⅛	3	2	5	3	9	3
1 in 2	28	4	2	5¼	3	7¾	6	0	12	0
1 in 2¼	25	4	2	9	4	0⅞	6	9	15	3
1 in 2½	22	38	3	0⅜	4	6	7	6	18	9
1 in 2¾	20	36	3	4⅛	4	11⅛	8	3	22	9
1 in 3	18	54	3	8	5	4¾	9	0	27	0
1 in 3¼	17	26	3	11⅛	5	10¼	9	9	32	0
1 in 3½	16	16	4	3	6	3¾	10	6	37	0
1 in 3¾	15	12	4	7	6	9	11	3	42	6
1 in 4	14	14	4	10⅜	7	2¼	12	0	48	0
1 in 4¼	13	26	5	2	7	8	12	9	54	6
1 in 4½	12	40	5	6	8	1	13	6	61	0
1 in 4¾	12	2	5	10	8	6½	14	3	68	0
1 in 5	11	26	6	1⅛	9	0	15	0	75	0
1 in 5½	10	24	6	8⅛	9	11	16	6	91	0
1 in 6	9	32	7	4	10	9¼	18	0	108	0
1 in 6½	8	48	7	11	11	8½	19	6	127	0
1 in 7	8	10	8	7	12	7	21	0	147	0

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		f Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	7	38	9	2	13	6	22	6	169	0
1 in 8	7	10	9	9	14	5	24	0	192	0
1 in 8½	6	44	10	5	15	3	25	6	217	0
1 in 9	6	22	11	0	16	2	27	0	243	0
1 in 9½	6	2	11	7	17	1	28	6	271	0
1 in 10	5	44	12	3	18	0	30	0	300	0
1 in 10½	5	26	12	10	18	11	31	6	331	0
1 in 11	5	12	13	5	19	10	33	0	363	0
1 in 11½	4	58	14	1	20	8	34	6	397	0
1 in 12	4	46	14	8	21	7	36	0	432	0
1 in 12½	4	36	15	3	22	6	37	6	469	0
1 in 13	4	24	15	11	23	5	39	0	507	0
1 in 14	4	6	17	2	25	2	42	0	588	0
1 in 15	3	50	18	4	27	0	45	0	675	0
1 in 16	3	34	19	7	28	9	48	0	768	0
1 in 17	3	22	20	9	30	7	51	0	867	0
1 in 18	3	10	22	0	32	4	54	0	972	0

1′ 6″ Gauge Diagram No. 2.

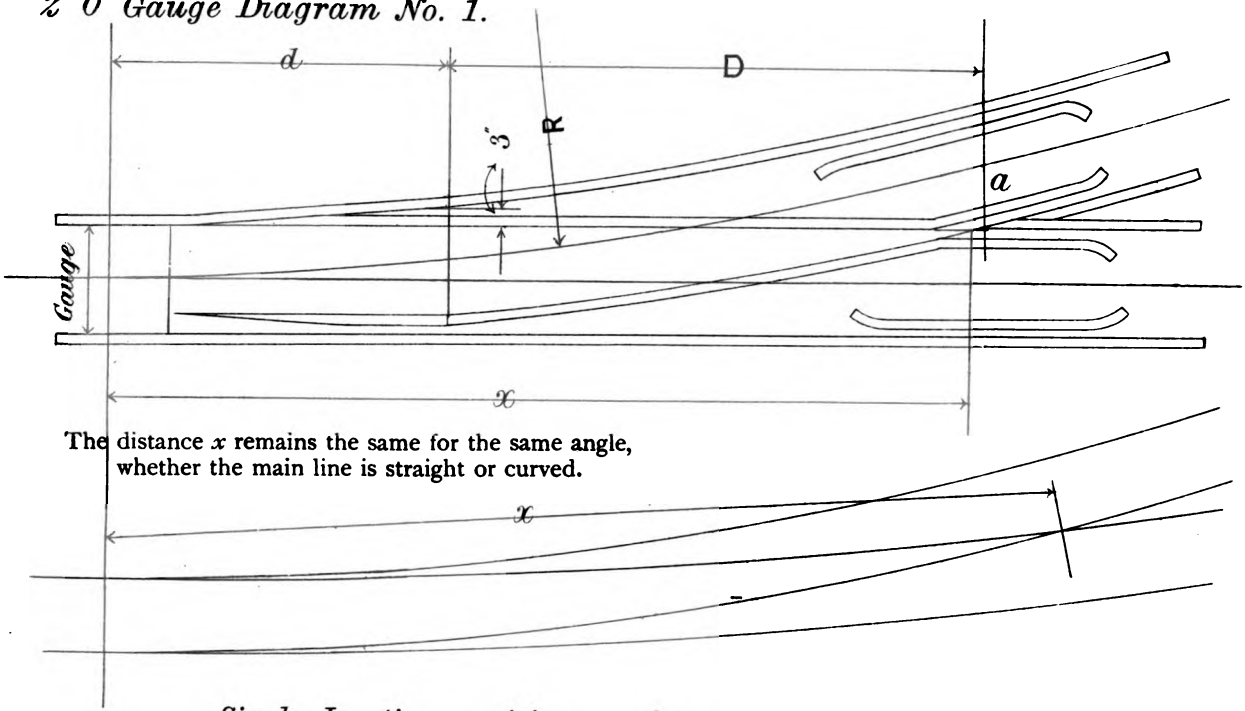


THREE THROWS.

1 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
		Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.			Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	1 in 1·21	2 1½	3 2	1 8¼	4 9	9 3	1 in 7½	1 in 5·29	9 2	13 6	6 10	84 6	169 0
1 in 2	1 in 1·39	2 5¼	3 7¾	1 11	6 0	12 0	1 in 8	1 in 5·65	9 9	14 5	7 4	96 0	192 0
1 in 2¼	1 in 1·57	2 9	4 0½	2 1½	7 9	15 3	1 in 8½	1 in 6·00	10 5	15 3	7 9	109 0	217 0
1 in 2½	1 in 1·75	3 0½	4 6	2 4	9 6	18 9	1 in 9	1 in 6·36	11 0	16 2	8 3	122 0	243 0
1 in 2¾	1 in 1·93	3 4¼	4 11½	2 6¾	11 6	22 9	1 in 9½	1 in 6·71	11 7	17 1	8 8	136 0	271 0
1 in 3	1 in 2·10	3 8	5 4¾	2 9½	13 0	27 0	1 in 10	1 in 7·06	12 3	18 0	9 2	150 0	300 0
1 in 3¼	1 in 2·28	3 11½	5 10¼	3 0	16 0	32 0	1 in 10½	1 in 7·42	12 10	18 11	9 7	166 0	331 0
1 in 3½	1 in 2·46	4 3	6 3¾	3 2¾	18 6	37 0	1 in 11	1 in 7·77	13 5	19 10	10 1	182 0	363 0
1 in 3¾	1 in 2·64	4 7	6 9	3 5½	21 3	42 6	1 in 11½	1 in 8·12	14 1	20 8	10 6	199 0	397 0
1 in 4	1 in 2·82	4 10¾	7 2¼	3 8	24 0	48 0	1 in 12	1 in 8·48	14 8	21 7	10 11	216 0	432 0
1 in 4¼	1 in 3·00	5 2	7 8	3 11	27 3	54 6	1 in 12½	1 in 8·84	15 3	22 6	11 5	235 0	469 0
1 in 4½	1 in 3·17	5 6	8 1	4 1½	30 6	61 0	1 in 13	1 in 9·19	15 11	23 5	11 10	254 0	507 0
1 in 4¾	1 in 3·34	5 10	8 6½	4 4½	34 0	68 0	1 in 14	1 in 9·89	17 2	25 2	12 9	294 0	588 0
1 in 5	1 in 3·52	6 1½	9 0	4 7	37 6	75 0	1 in 15	1 in 10·60	18 4	27 0	13 8	338 0	675 0
1 in 5½	1 in 3·88	6 8½	9 11	5 0½	46 0	91 0	1 in 16	1 in 11·31	19 7	28 9	14 7	384 0	768 0
1 in 6	1 in 4·23	7 4	10 9½	5 6	54 0	108 0	1 in 17	1 in 12·02	20 9	30 7	15 6	434 0	867 0
1 in 6½	1 in 4·58	7 11	11 8¼	5 11½	63 6	127 0	1 in 18	1 in 12·72	22 0	32 4	16 5	486 0	972 0
1 in 7	1 in 4·94	8 7	12 7	6 5	73 6	147 0							

2' 0" Gauge Diagram No. 1.



The distance x remains the same for the same angle, whether the main line is straight or curved.

Single Junction requiring one Set of Switches and Crossings.

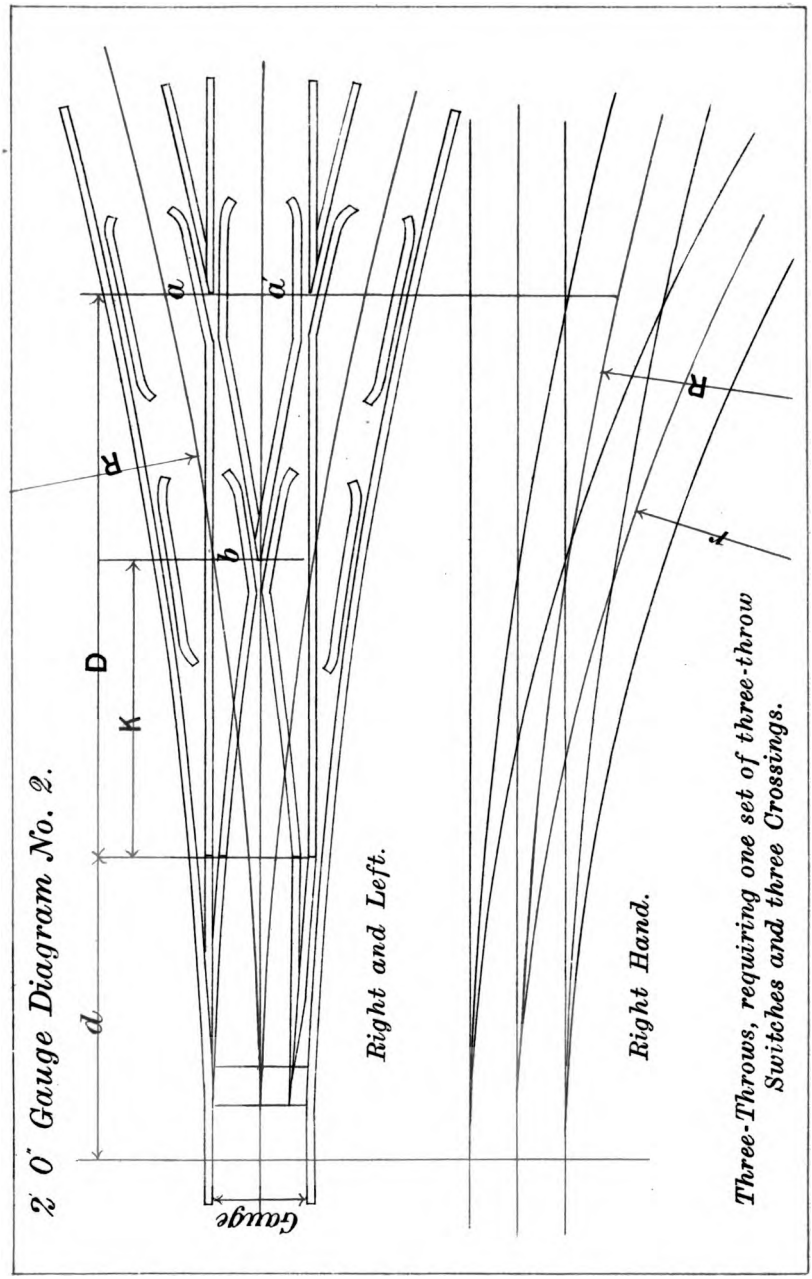
SINGLE JUNCTIONS.

2 ft. 0 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		x Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in $1\frac{3}{4}$	31	52	2	$5\frac{1}{4}$	4	$7\frac{1}{4}$	7	0	12	3
1 in 2	28	4	2	$9\frac{3}{4}$	5	$2\frac{3}{4}$	8	0	16	0
1 in $2\frac{1}{4}$	25	4	3	2	5	$10\frac{3}{4}$	9	0	20	3
1 in $2\frac{1}{2}$	22	38	3	$6\frac{1}{4}$	6	$6\frac{1}{2}$	10	0	25	0
1 in $2\frac{3}{4}$	20	36	3	$10\frac{1}{2}$	7	$2\frac{1}{4}$	11	0	30	3
1 in 3	18	54	4	$2\frac{3}{4}$	7	10	12	0	37	0
1 in $3\frac{1}{4}$	17	26	4	7	8	6	13	0	42	6
1 in $3\frac{1}{2}$	16	16	4	$11\frac{1}{4}$	9	$1\frac{3}{4}$	14	0	49	0
1 in $3\frac{3}{4}$	15	12	5	$3\frac{1}{2}$	9	$9\frac{1}{2}$	15	0	56	6
1 in 4	14	14	5	$7\frac{3}{4}$	10	5	16	0	64	0
1 in $4\frac{1}{4}$	13	26	6	0	11	1	17	0	72	6
1 in $4\frac{1}{2}$	12	40	6	$4\frac{1}{2}$	11	9	18	0	81	0
1 in $4\frac{3}{4}$	12	2	6	$8\frac{1}{2}$	12	5	19	0	90	0
1 in 5	11	26	7	$0\frac{1}{2}$	13	$0\frac{1}{2}$	20	0	100	0
1 in $5\frac{1}{2}$	10	24	7	$9\frac{1}{2}$	14	4	22	0	121	0
1 in 6	9	32	8	$5\frac{1}{2}$	15	8	24	0	144	0
1 in $6\frac{1}{2}$	8	48	9	2	16	$11\frac{1}{2}$	26	0	169	0
1 in 7	8	10	9	$10\frac{1}{2}$	18	3	28	0	196	0

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		x Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in $7\frac{1}{2}$	7	38	10	7	19	7	30	0	225	0
1 in 8	7	10	11	$3\frac{1}{2}$	20	$10\frac{1}{2}$	32	0	256	0
1 in $8\frac{1}{2}$	6	44	12	0	22	2	34	0	289	0
1 in 9	6	22	12	8	23	6	36	0	324	0
1 in $9\frac{1}{2}$	6	2	13	5	24	9	38	0	361	0
1 in 10	5	44	14	2	26	1	40	0	400	0
1 in $10\frac{1}{2}$	5	26	14	10	27	5	42	0	441	0
1 in 11	5	12	15	6	28	9	44	0	484	0
1 in $11\frac{1}{2}$	4	58	16	3	30	0	46	0	529	0
1 in 12	4	46	16	11	31	4	48	0	576	0
1 in $12\frac{1}{2}$	4	36	17	8	32	7	50	0	625	0
1 in 13	4	24	18	4	33	11	52	0	676	0
1 in 14	4	6	19	9	36	6	56	0	784	0
1 in 15	3	50	21	2	39	2	60	0	900	0
1 in 16	3	34	22	7	41	9	64	0	1024	0
1 in 17	3	22	24	0	44	4	68	0	1156	0
1 in 18	3	10	25	5	46	11	72	0	1296	0

2′ 0″ Gauge Diagram No. 2.

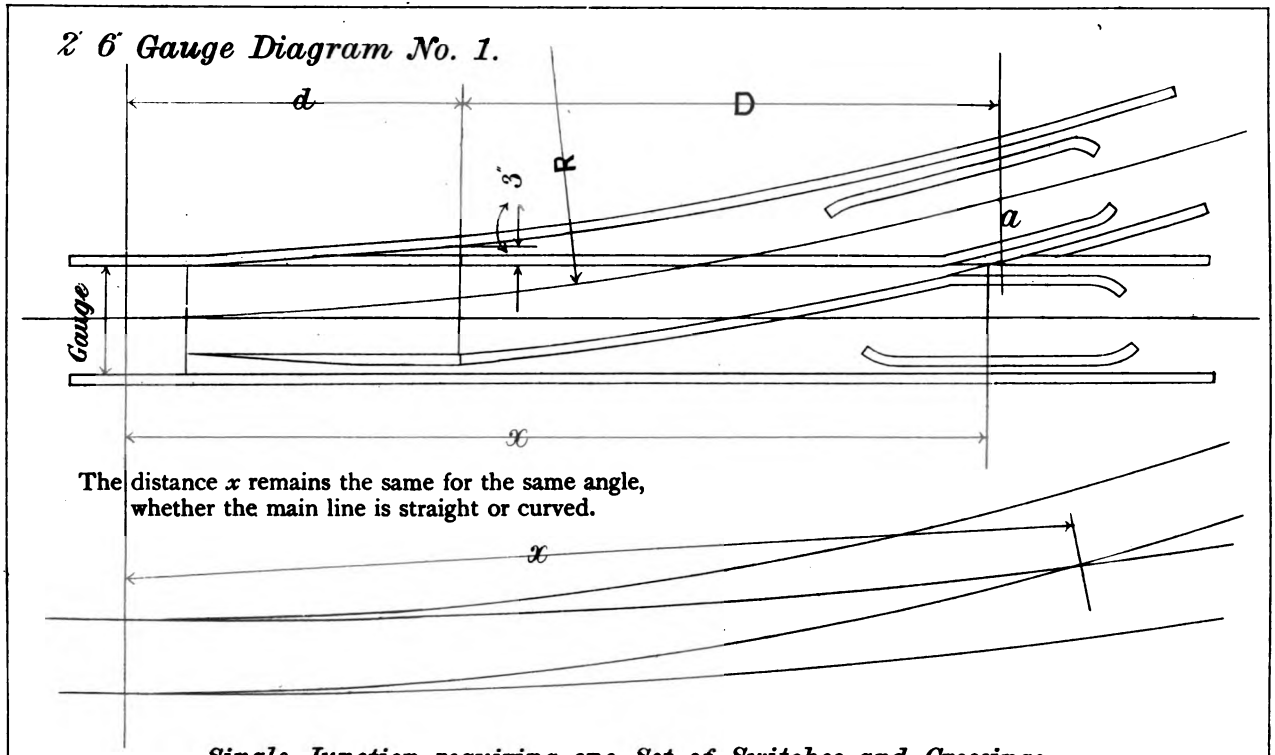


THREE THROWS.

2 ft. 0 in. Gauge. Table No. 2.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings a a'		K Heel of Switches to Nose of Crossing. b		r Radius of Inside Curve.		R Radius of Curve.	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	1 in 1·21	2	5¼	4	7¼	2	7½	6	3	12	3
1 in 2	1 in 1·39	2	9¾	5	2¾	2	11½	8	0	16	0
1 in 2¼	1 in 1·57	3	2	5	10¾	3	3¾	10	3	20	3
1 in 2½	1 in 1·75	3	6¼	6	6½	3	8	12	6	25	0
1 in 2¾	1 in 1·93	3	10½	7	2¼	4	0¼	15	3	30	3
1 in 3	1 in 2·10	4	2¾	7	10	4	4¼	18	6	37	0
1 in 3¼	1 in 2.28	4	7	8	6	4	8½	21	3	42	6
1 in 3½	1 in 2·46	4	11¼	9	1¾	5	0¾	29	6	49	0
1 in 3¾	1 in 2·64	5	3½	9	9½	5	5	28	3	56	6
1 in 4	1 in 2·82	5	7¾	10	5	5	9¼	32	0	64	0
1 in 4¼	1 in 3·00	6	0	11	1	6	1½	36	6	72	6
1 in 4½	1 in 3.17	6	4½	11	9	6	5¾	41	0	81	0
1 in 4¾	1 in 3·34	6	8½	12	5	6	10	45	6	90	0
1 in 5	1 in 3·52	7	0½	13	0½	7	2	50	0	100	0
1 in 5½	1 in 3·88	7	9½	14	4	7	11	60	6	121	0
1 in 6	1 in 4·23	8	5½	15	8	8	7½	72	0	144	0
1 in 6½	1 in 4·58	9	2	16	11½	9	4	84	6	169	0
1 in 7	1 in 4·94	9	10½	18	3	10	0½	98	0	196	0

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		K Heel of Switches to Nose of Crossing. b		r Radius of Inside Curve.		R Radius of Curve.	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	1 in 5·29	10	7	19	7	10	9	113	0	225	0
1 in 8	1 in 5·65	11	3½	20	10½	11	5½	128	0	256	0
1 in 8½	1 in 6·00	12	0	22	2	12	2	145	0	289	0
1 in 9	1 in 6·36	12	8	23	6	12	11	162	0	324	0
1 in 9½	1 in 6·71	13	5	24	9	13	7	181	0	361	0
1 in 10	1 in 7·06	14	2	26	1	14	4	200	0	400	0
1 in 10½	1 in 7·42	14	10	27	5	15	1	221	0	441	0
1 in 11	1 in 7·77	15	6	28	9	15	9	242	0	484	0
1 in 11½	1 in 8·12	16	3	30	0	16	5½	265	0	529	0
1 in 12	1 in 8:48	16	11	31	4	17	2	288	0	576	0
1 in 12½	1 in 8·84	17	8	32	7	17	11	313	0	625	0
1 in 13	1 in 9·19	18	4	33	11	18	7	338	0	676	0
1 in 14	1 in 9·89	19	9	36	6	20	0	392	0	784	0
1 in 15	1 in 10·60	21	2	39	2	21	6	450	0	900	0
1 in 16	1 in 11·31	22	7	41	9	22	11	512	0	1024	0
1 in 17	1 in 12·02	24	0	44	4	24	4	578	0	1156	0
1 in 18	1 in 12·72	25	5	46	11	25	9	648	0	1296	0



Single Junction requiring one Set of Switches and Crossings.

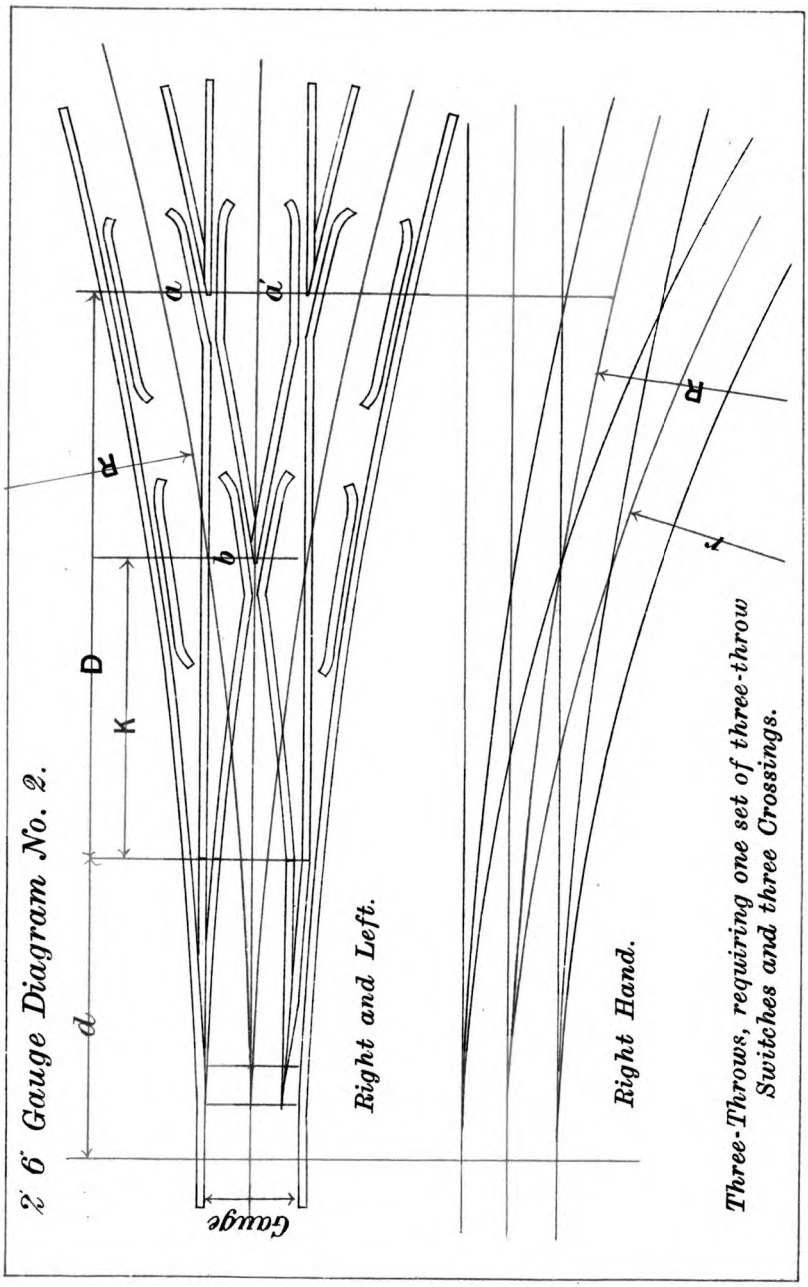
2′ 6″ Gauge Diagram No. 1.

SINGLE JUNCTIONS.

2 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		x Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in $1\frac{3}{4}$	31	52	2	9	6	$0\frac{3}{4}$	8	9	15	3
1 in 2	28	4	3	$1\frac{3}{4}$	6	11	10	0	20	0
1 in $2\frac{1}{4}$	25	4	3	$6\frac{1}{2}$	7	$9\frac{1}{2}$	11	3	25	3
1 in $2\frac{1}{2}$	22	38	3	$11\frac{1}{4}$	8	$7\frac{3}{4}$	12	6	31	6
1 in $2\frac{3}{4}$	20	36	4	4	9	6	13	9	38	0
1 in 3	18	54	4	$8\frac{3}{4}$	10	$4\frac{1}{2}$	15	0	45	0
1 in $3\frac{1}{4}$	17	26	5	$1\frac{1}{2}$	11	$2\frac{3}{4}$	16	3	53	0
1 in $3\frac{1}{2}$	16	16	5	$6\frac{1}{4}$	12	$1\frac{1}{2}$	17	6	61	6
1 in $3\frac{3}{4}$	15	12	5	11	12	$11\frac{1}{2}$	18	9	70	6
1 in 4	14	14	6	$3\frac{3}{4}$	13	$9\frac{3}{4}$	20	0	80	0
1 in $4\frac{1}{4}$	13	26	6	$8\frac{1}{2}$	14	8	21	3	90	6
1 in $4\frac{1}{2}$	12	40	7	1	15	$6\frac{1}{2}$	22	6	102	0
1 in $4\frac{3}{4}$	12	2	7	6	16	5	23	9	113	0
1 in 5	11	26	7	$10\frac{1}{2}$	17	$3\frac{1}{2}$	25	0	125	0
1 in $5\frac{1}{2}$	10	24	8	8	19	0	27	6	152	0
1 in 6	9	32	9	$5\frac{1}{2}$	20	$8\frac{1}{2}$	30	0	180	0
1 in $6\frac{1}{2}$	8	48	10	3	22	$5\frac{1}{2}$	32	6	212	0
1 in 7	8	10	11	$0\frac{1}{2}$	24	2	35	0	245	0
1 in $7\frac{1}{2}$	7	38	11	10	25	11	37	6	282	0
1 in 8	7	10	12	$7\frac{1}{2}$	27	$7\frac{1}{2}$	40	0	320	0
1 in $8\frac{1}{2}$	6	44	13	5	29	4	42	6	362	0
1 in 9	6	22	14	2	31	1	45	0	405	0
1 in $9\frac{1}{2}$	6	2	15	0	32	10	47	6	452	0
1 in 10	5	44	15	9	34	7	50	0	500	0
1 in $10\frac{1}{2}$	5	26	16	7	36	3	52	6	552	0
1 in 11	5	12	17	4	38	0	55	0	605	0
1 in $11\frac{1}{2}$	4	58	18	2	39	8	57	6	662	0
1 in 12	4	46	18	11	41	5	60	0	720	0
1 in $12\frac{1}{2}$	4	36	19	9	43	2	62	6	782	0
1 in 13	4	24	20	6	44	11	65	0	845	0
1 in 14	4	6	22	1	48	4	70	0	980	0
1 in 15	3	50	23	8	51	10	75	0	1125	0
1 in 16	3	34	25	3	55	3	80	0	1280	0
1 in 17	3	22	26	10	58	8	85	0	1445	0
1 in 18	3	10	28	5	62	2	90	0	1620	0

2′ 6″ Gauge Diagram No. 2.



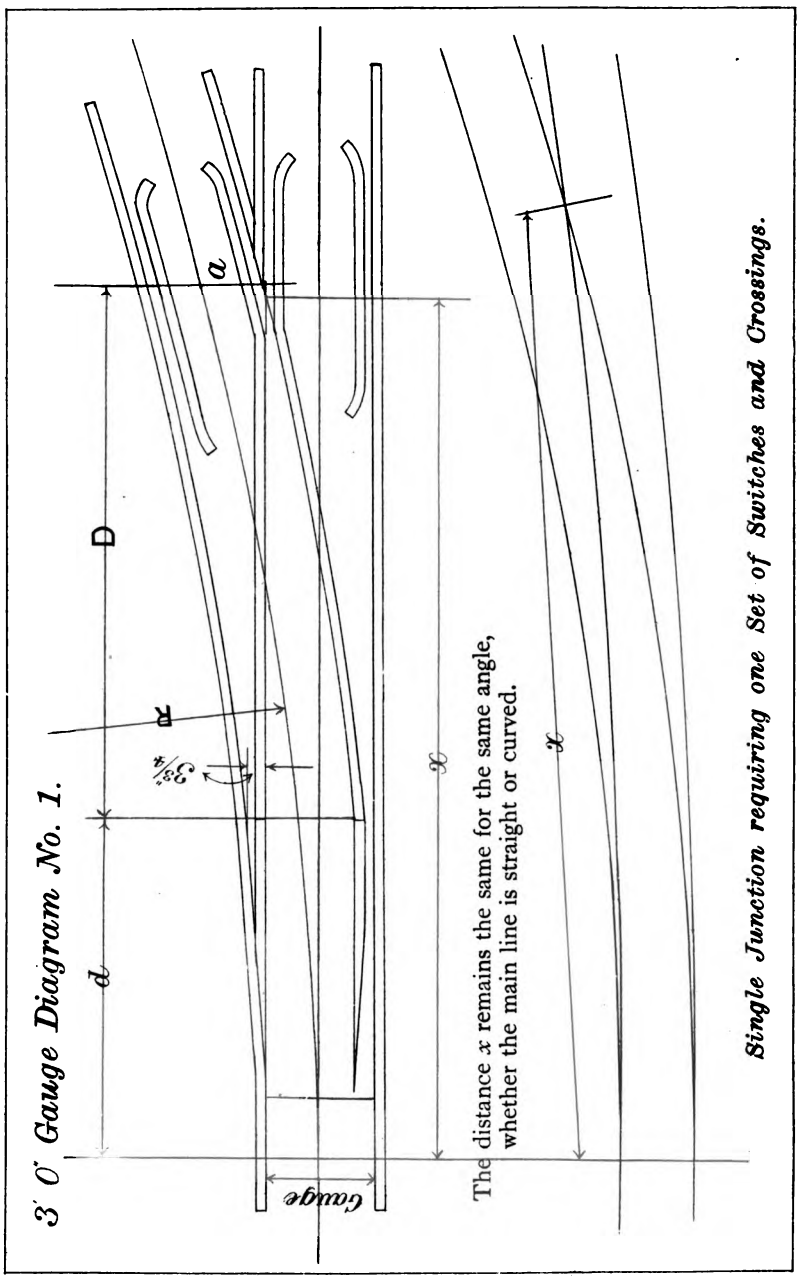
THREE THROWS.

2 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossings a a' Ft.	Ins.	K Heel of Switches to Nose of Crossing. b Ft.	Ins.	r Radius of Inside Curve. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 1¾	1 in 1·21	2	9	6	0¾	3	7¼	7	9	15	3
1 in 2	1 in 1·39	3	1¾	6	11	4	0¾	10	0	20	0
1 in 2¼	1 in 1·57	3	6½	7	9½	4	6¾	12	9	25	3
1 in 2½	1 in 1·75	3	11¼	8	7	5	0½	15	9	31	6
1 in 2¾	1 in 1·93	4	4	9	6	5	6½	19	0	38	0
1 in 3	1 in 2·10	4	8¾	10	4½	6	0	22	6	45	0
1 in 3¼	1 in 2·28	5	1½	11	2¾	6	6	26	6	53	0
1 in 3½	1 in 2·46	5	6¼	12	1¼	6	11¾	31	0	61	6
1 in 3¾	1 in 2·64	5	11	12	11½	7	5¾	35	6	70	6
1 in 4	1 in 2·82	6	3¾	13	9¾	7	11½	40	0	80	0
1 in 4¼	1 in 3·00	6	8½	14	8	8	5½	45	6	90	6
1 in 4½	1 in 3·17	7	1	15	6½	8	11½	51	0	102	0
1 in 4¾	1 in 3·34	7	6	16	5¾	9	5½	57	0	113	0
1 in 5	1 in 3·52	7	10½	17	3½	9	11½	63	0	125	0
1 in 5½	1 in 3·88	8	8	19	0	10	11	76	0	152	0
1 in 6	1 in 4·23	9	5½	20	8½	11	11	90	0	180	0
1 in 6½	1 in 4·58	10	3	22	5½	12	11	106	0	212	0
1 in 7	1 in 4·94	11	0½	24	2	13	10½	123	0	245	0

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossings. a a' Ft.	Ins.	K Heel of Switches to Nose of Crossing. b Ft.	Ins.	r Radius of Inside Curve. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 7½	1 in 5·29	11	10	25	11	14	10½	141	0	282	0
1 in 8	1 in 5·65	12	7½	27	7½	15	10½	160	0	320	0
1 in 8½	1 in 6·00	13	5	29	4	16	10	181	0	362	0
1 in 9	1 in 6·36	14	2	31	1	17	10	203	0	405	0
1 in 9½	1 in 6·71	15	0	32	10	18	10	226	0	452	0
1 in 10	1 in 7·06	15	9	34	7	19	10	250	0	500	0
1 in 10½	1 in 7·42	16	7	36	3	20	9	277	0	552	0
1 in 11	1 in 7·77	17	4	38	0	21	9	303	0	605	0
1 in 11½	1 in 8·12	18	2	39	8	22	9	331	0	662	0
1 in 12	1 in 8·48	18	11	41	5	23	9	360	0	720	0
1 in 12½	1 in 8·84	19	9	43	2	24	9	391	0	782	0
1 in 13	1 in 9·19	20	6	44	11	25	8	423	0	845	0
1 in 14	1 in 9·89	22	1	48	4	27	8	490	0	980	0
1 in 15	1 in 10·60	23	8	51	10	29	8	563	0	1125	0
1 in 16	1 in 11·31	25	3	55	3	31	8	640	0	1280	0
1 in 17	1 in 12·02	26	10	58	8	33	7	723	0	1445	0
1 in 18	1 in 12·72	28	5	62	2	35	7	810	0	1620	0

3′ 0″ Gauge Diagram No. 1.

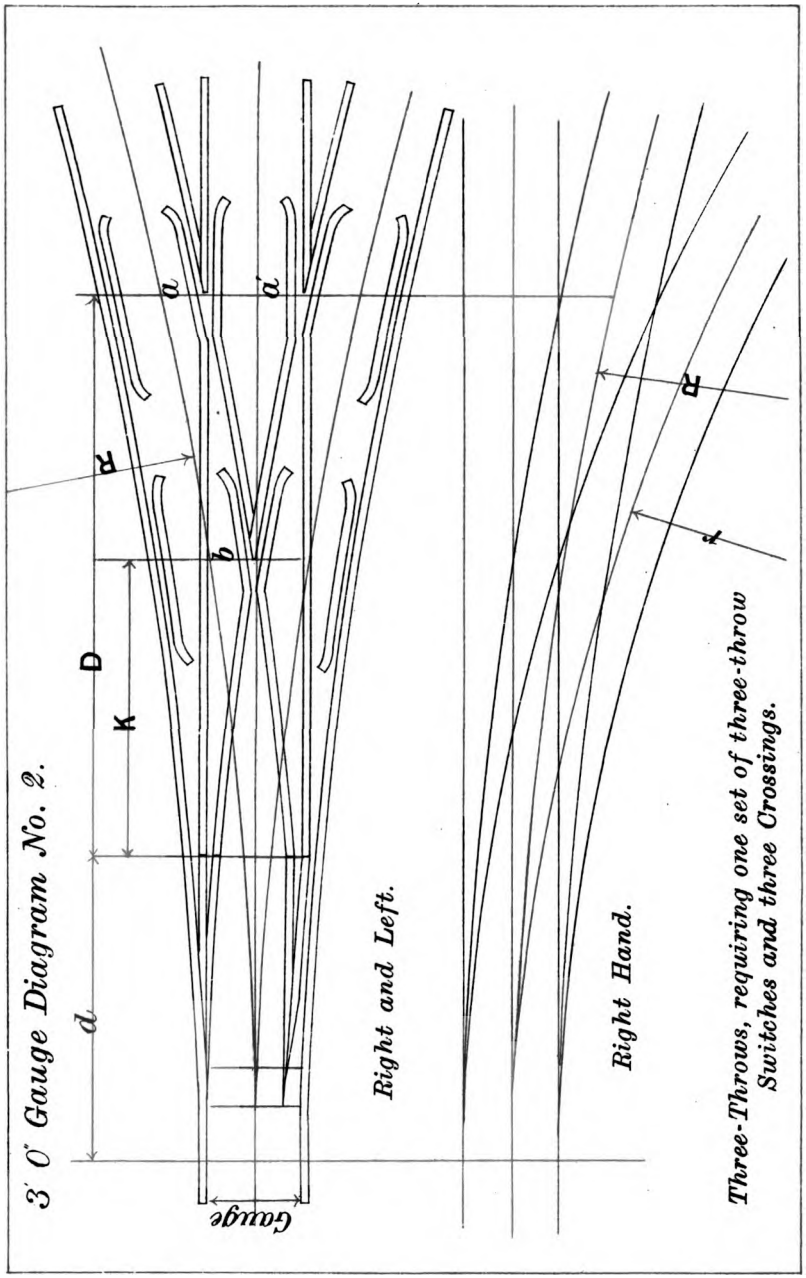


SINGLE JUNCTIONS.

3 ft. 0 in. Gauge. Table No. 1.

Angle of Crossing. a. In units.	Angle of Crossing. a. In degrees.	d. Spring of Curve to Heel of Switches.	D. Heel of Switches to Nose of Crossing. a	f. Spring of Curve to Intersection of Gauge Lines.	R. Radius of Curve.	Angle of Crossing. a. In units.	Angle of Crossing. a. In degrees.	d. Spring of Curve to Heel of Switches.	D. Heel of Switches to Nose of Crossing. a	f. Spring of Curve to Intersection of Gauge Lines.	R. Radius of Curve.
	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	31 52	3 4¼	7 2¼	10 6	18 3	1 in 7½	7 38	14 5½	30 9½	45 0	338 0
1 in 2	28 4	3 10	8 2¾	12 0	24 0	1 in 8	7 10	15 5	32 10	48 0	384 0
1 in 2¼	25 4	4 4	9 3	13 6	30 3	1 in 8½	6 44	16 4	34 11	51 0	434 0
1 in 2½	22 38	4 9¾	10 3¼	15 0	37 6	1 in 9	6 22	17 4	36 11	54 0	486 0
1 in 2¾	20 36	5 3½	11 3½	16 6	45 6	1 in 9½	6 2	18 4	39 0	57 0	542 0
1 in 3	18 54	5 9½	12 4	18 0	54 0	1 in 10	5 44	19 3	41 1	60 0	600 0
1 in 3¼	17 26	6 3	13 4¼	19 6	63 6	1 in 10½	5 26	20 3	43 1	63 0	662 0
1 in 3½	16 16	6 9	14 4½	21 0	73 6	1 in 11	5 12	21 2	45 2	66 0	726 0
1 in 3¾	15 12	7 2¼	15 4¾	22 6	84 6	1 in 11½	4 58	22 2	47 2	69 0	794 0
1 in 4	14 14	7 8¼	16 5¼	24 0	96 0	1 in 12	4 46	23 1	49 4	72 0	864 0
1 in 4¼	13 26	8 2	17 6	25 6	109 0	1 in 12½	4 36	24 1	51 4	75 0	938 0
1 in 4½	12 40	8 8	18 6	27 0	121 6	1 in 13	4 24	25 1	53 4	78 0	1014 0
1 in 4¾	12 2	9 1¼	19 6	28 6	136 0	1 in 14	4 6	27 0	57 5	84 0	1176 0
1 in 5	11 26	9 7½	20 6¼	30 0	150 0	1 in 15	3 50	28 11	61 7	90 0	1350 0
1 in 5¼	10 24	10 7	22 7	33 0	182 0	1 in 16	3 34	30 10	65 8	96 0	1536 0
1 in 6	9 32	11 6½	24 8	36 0	217 0	1 in 17	3 22	32 9	69 9	102 0	1734 0
1 in 6½	8 48	12 6	26 8½	39 0	254 0	1 in 18	3 10	34 8	73 11	108 0	1944 0
1 in 7	8 10	13 5½	28 9	42 0	294 0						

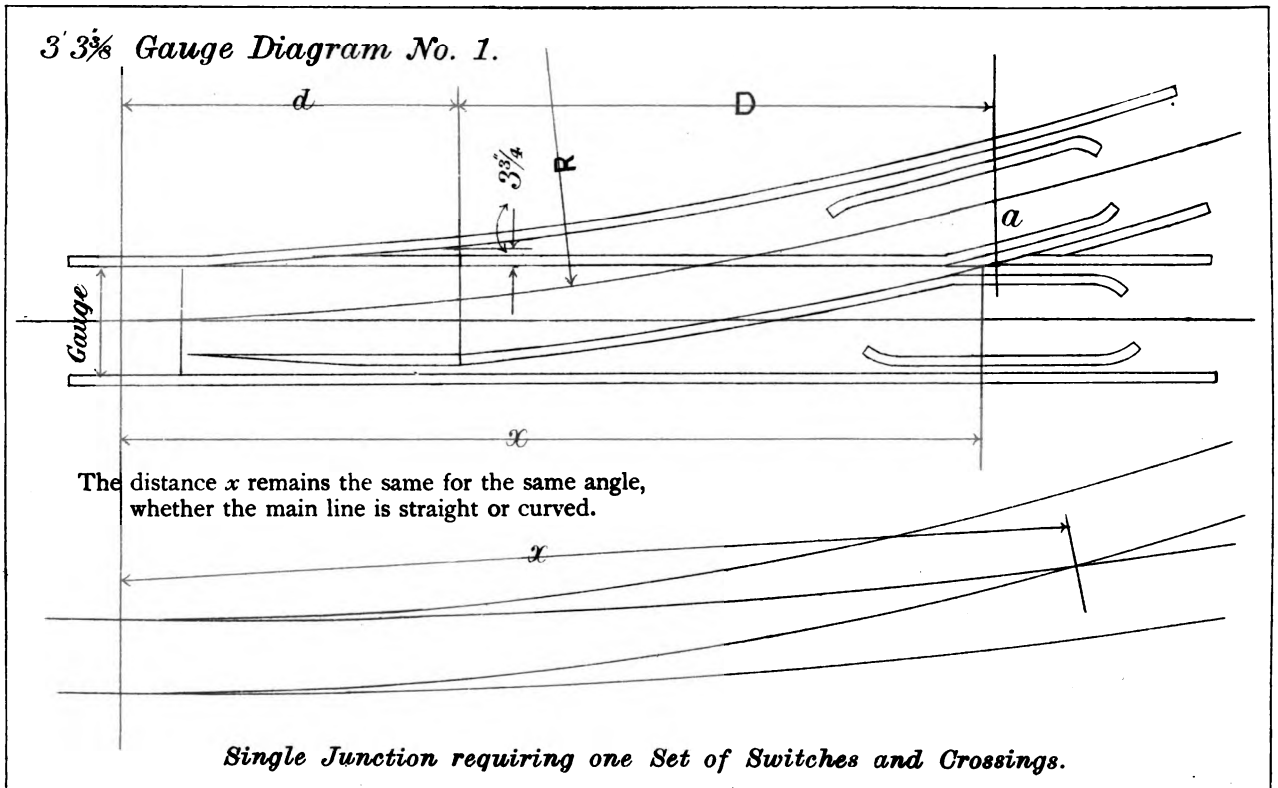
3′ 0″ Gauge Diagram No. 2.



THREE THROWS.

3 ft. 0 in. Gauge. Table No. 2.

Angle of Crossings. a a	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
		Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.			Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¼	1 in 1·21	3 4½	7 2½	4 3	9 3	18 3	1 in 7½	1 in 5·29	14 5½	30 9½	17 7	169 0	338 0
1 in 2	1 in 1·39	3 10	8 2¾	4 9¾	12 0	24 0	1 in 8	1 in 5·65	15 5	32 10	18 9	192 0	384 0
1 in 2¼	1 in 1·57	4 4	9 3	5 4¾	15 3	30 3	1 in 8½	1 in 6·00	16 4	34 11	19 11	217 0	434 0
1 in 2½	1 in 1·75	4 9¾	10 3¼	5 11½	18 9	37 6	1 in 9	1 in 6·36	17 4	36 11	21 1	243 0	486 0
1 in 2¾	1 in 1·93	5 3½	11 3½	6 6½	22 9	45 6	1 in 9½	1 in 6·71	18 4	39 0	22 3	271 0	542 0
1 in 3	1 in 2·10	5 9¼	12 4	7 1¼	27 0	54 0	1 in 10	1 in 7·06	19 3	41 1	23 5	300 0	600 0
1 in 3¼	1 in 2·28	6 3	13 4¼	7 8¼	32 0	63 6	1 in 10½	1 in 7·42	20 3	43 1	24 7	331 0	662 0
1 in 3½	1 in 2·46	6 9	14 4½	8 3½	36 9	73 6	1 in 11	1 in 7·77	21 2	45 2	25 9	363 0	726 0 0
1 in 3¾	1 in 2·64	7 2½	15 4¾	8 10	42 6	84 6	1 in 11½	1 in 8·12	22 2	47 2	26 11	397 0	794 0 0
1 in 4	1 in 2·82	7 8¼	16 5¼	9 5	48 0	96 0	1 in 12	1 in 8·48	23 1	49 4	28 1	432 0	864 0 0
1 in 4¼	1 in 3·00	8 2	17 6	10 0	54 6	109 0	1 in 12½	1 in 8·84	24 1	51 4	29 3	469 0	938 0 0
1 in 4½	1 in 3·17	8 8	18 6	10 7	61 0	121 6	1 in 13	1 in 9·19	25 1	53 4	30 5	507 0	1014 0 0
1 in 4¾	1 in 3·34	9 1½	19 6	11 2	68 0	136 0	1 in 14	1 in 9·89	27 0	57 5	32 9	588 0	1176 0 0
1 in 5	1 in 3·52	9 7½	20 6½	11 9	75 0	150 0	1 in 15	1 in 10·60	28 11	61 7	35 1	675 0	1350 0 0
1 in 5½	1 in 3·88	10 7	22 7	12 11	91 0	182 0	1 in 16	1 in 11·31	30 10	65 8	37 5	768 0	1536 0 0
1 in 6	1 in 4·23	11 6½	24 8	14 1	108 0	217 0	1 in 17	1 in 12·02	32 9	69 9	39 9	867 0	1734 0 0
1 in 6½	1 in 4·58	12 6	26 8½	15 3	127 0	254 0	1 in 18	1 in 12·72	34 8	73 11	42 1	972 0	1944 0 0
1 in 7	1 in 4·94	13 5½	28 9	16 5	147 0	294 0							



Single Junction requiring one Set of Switches and Crossings.

3′ 3⅜ Gauge Diagram No. 1.

SINGLE JUNCTIONS.

3 ft. 3⅜ in. Gauge. Table No. 1.

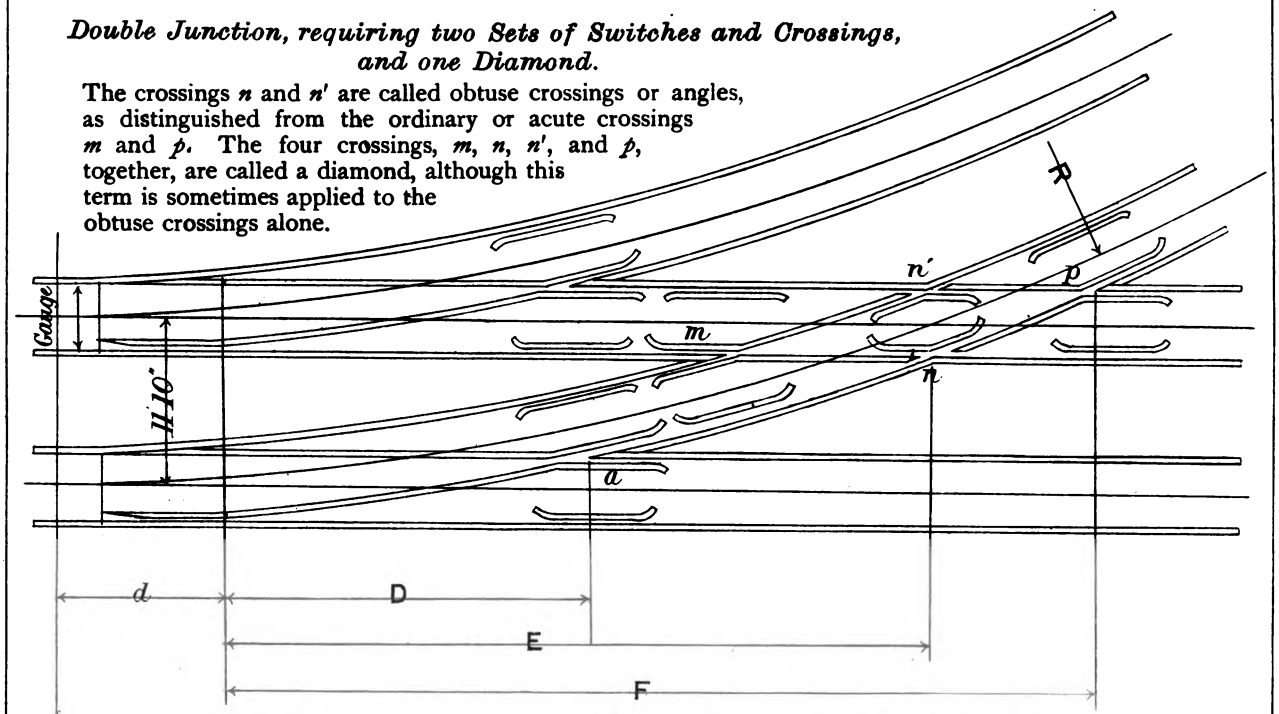
Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		f Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	31	52	3	6	8	0 1/16	11	5 3/4	20	0
1 in 2	28	4	4	0 1/4	9	2 1/4	13	1 1/8	26	3
1 in 2¼	25	4	4	6 1/4	10	4	14	9	33	6
1 in 2½	22	38	5	0 3/16	11	5 3/4	16	4 3/4	41	0
1 in 2¾	20	36	5	6 1/16	12	7 1/8	18	0 1/8	50	0
1 in 3	18	54	6	0 1/16	13	8 1/4	19	8 1/4	59	0
1 in 3¼	17	56	6	6 1/16	14	11	21	4	69	6
1 in 3½	16	16	7	0 1/16	16	0 3/4	22	11 1/8	80	6
1 in 3¾	15	12	7	6 3/16	17	2 1/8	24	7 1/4	92	6
1 in 4	14	14	8	0 3/16	18	4 1/4	26	3	105	0
1 in 4¼	13	26	8	6 1/16	19	6	27	10 1/8	119	0
1 in 4½	12	40	9	1	20	7 1/8	29	6	133	0
1 in 4¾	12	2	9	7	21	9 1/16	31	2	148	0
1 in 5	11	26	10	1	22	11 1/8	32	10	164	0
1 in 5½	10	24	11	1	25	3	36	1	199	0
1 in 6	9	32	12	1	27	6 1/8	39	4 1/8	237	0
1 in 6½	8	48	13	1	29	10	42	8	278	0
1 in 7	8	10	14	1	32	1 1/8	45	11	322	0

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		f Spring of Curve to intersection of Gauge Lines.		R Radius of Curve.	
	Deg.	Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7⅛	7	38	15	1 1/16	34	5	49	2 1/16	369	0
1 in 8	7	10	16	1 1/8	36	8 1/16	52	6	420	0
1 in 8½	6	44	17	1 1/16	39	0	55	9	474	0
1 in 9	6	22	18	1 1/8	41	3	59	0	532	0
1 in 9½	6	2	19	2	43	7	62	4	592	0
1 in 10	5	44	20	2	45	10 1/8	65	7	656	0
1 in 10½	5	26	21	2	48	2	68	11	724	0
1 in 11	5	12	22	2	50	5	72	2	794	0
1 in 11½	4	58	23	2	52	9	75	5	868	0
1 in 12	4	46	24	2	55	1	78	9	945	0
1 in 12½	4	36	25	2	57	4	82	0	1025	0
1 in 13	4	24	26	2	59	8	85	3	1109	0
1 in 14	4	6	28	3	64	2	91	10	1286	0
1 in 15	3	50	30	3	68	10	98	5	1476	0
1 in 16	3	34	32	3	73	4	104	11	1680	0
1 in 17	3	22	34	3	77	11	111	6	1896	0
1 in 18	3	10	36	3	82	7	118	1	2126	0

3′ 3⅜ Gauge Diagram No. 2.

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n′* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n′*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



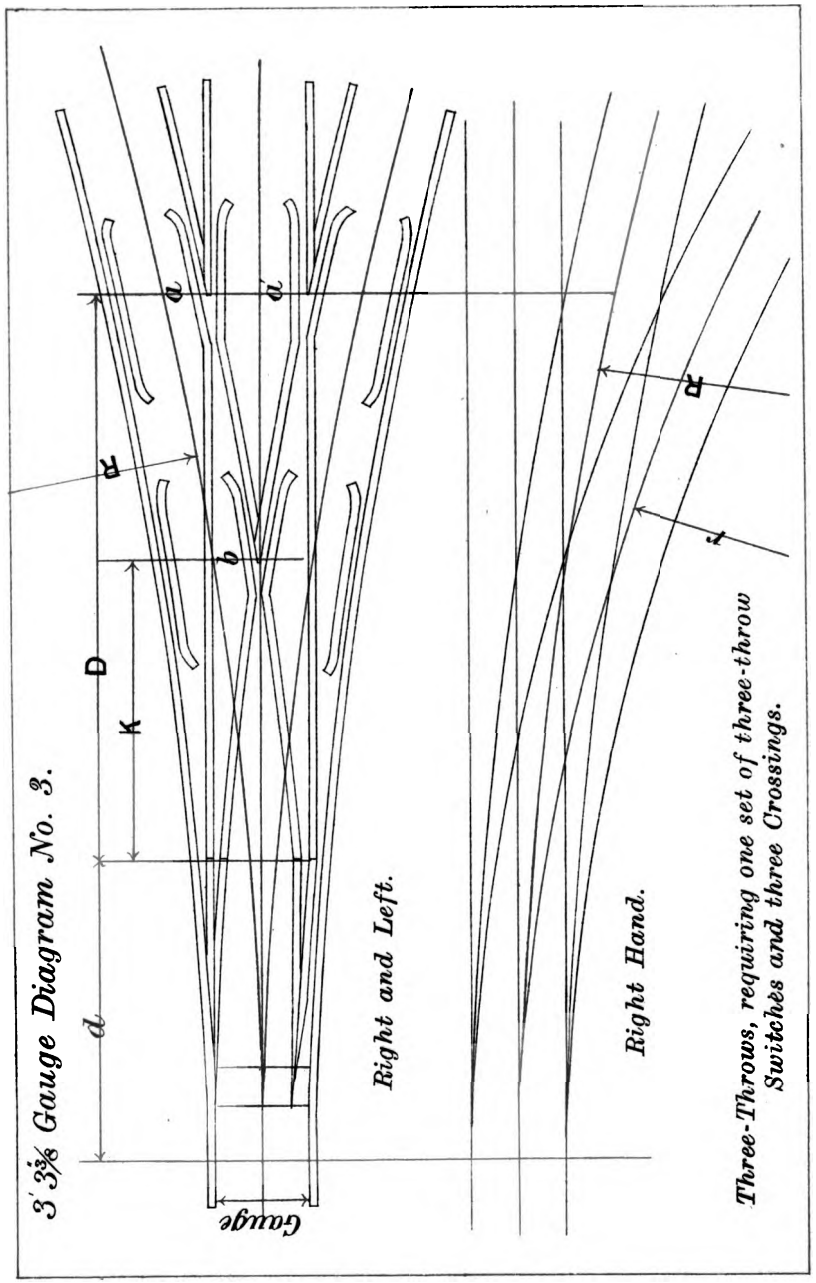
DOUBLE JUNCTIONS.

3 ft. 3⅜ in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins.	E Heel of Switches to Knees of Crossing n Ft.	Ins.	F Heel of Switches to Nose of Crossing. p Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 1¾	1 in ·91	1 in ·82	1 in ·73	1 in ·68	3	6	8	0½	15	10	17	2½	20	0
1 in 2	1 in 1·09	1 in ·96	1 in ·89	1 in ·82	4	0¼	9	2¼	18	9¼	20	9¼	26	3
1 in 2¼	1 in 1·26	1 in 1·11	1 in 1·04	1 in ·95	4	6¼	10	4	21	7½	24	2½	33	6
1 in 2½	1 in 1·43	1 in 1·25	1 in 1·19	1 in 1·08	5	0¼	11	5¾	24	5¼	27	6¾	41	0
1 in 2¾	1 in 1·60	1 in 1·38	1 in 1·33	1 in 1·20	5	6½	12	7½	27	2½	30	10	50	0
1 in 3	1 in 1·76	1 in 1·52	1 in 1·47	1 in 1·33	6	0½	13	8¼	29	11½	34	0¾	59	0
1 in 3¼	1 in 1·92	1 in 1·66	1 in 1·61	1 in 1·45	6	6½	14	11	32	8	37	3	69	6
1 in 3½	1 in 2·09	1 in 1·79	1 in 1·75	1 in 1·57	7	0½	16	0¾	35	4½	40	5¼	80	6
1 in 3¾	1 in 2·25	1 in 1·93	1 in 1·89	1 in 1·69	7	6½	17	2½	38	0¾	43	7	92	6
1 in 4	1 in 2·41	1 in 2·06	1 in 2·03	1 in 1·81	8	0½	18	4¼	40	8¾	46	8¾	105	0
1 in 4¼	1 in 2·57	1 in 2·20	1 in 2·16	1 in 1·93	8	6½	19	6	43	5	49	10	119	0
1 in 4½	1 in 2·72	1 in 2·33	1 in 2·30	1 in 2·05	9	1	20	7½	46	1	52	11½	133	0
1 in 4¾	1 in 2·89	1 in 2·46	1 in 2·44	1 in 2·17	9	7	21	9½	48	9	56	0½	148	0
1 in 5	1 in 3·04	1 in 2·60	1 in 2·57	1 in 2·29	10	1	22	11½	51	4½	59	1½	164	0
1 in 5½	1 in 3·36	1 in 2·86	1 in 2·84	1 in 2·52	11	1	25	3	56	8½	65	3½	199	0
1 in 6	1 in 3·67	1 in 3·13	1 in 3·11	1 in 2.76	12	1	27	6½	62	0	71	5	237	0
1 in 6½	1 in 3·98	1 in 3.40	1 in 3·38	1 in 3·00	13	1	29	10	67	3	77	7	278	0
1 in 7	1 in 4·30	1 in 3·66	1 in 3·65	1 in 3·23	14	1	32	1½	72	6	83	8	322	0

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossings. n n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins	E Heel of Switches to Knees of Crossing. n Ft.	Ins.	F Heel of Switches to Nose of Crossing. p Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 7½	1 in 4·61	1 in 3·47	1 in 4·07	15	1½	34	5	77	9	89	9	369	0
1 in 8	1 in 4·92	1 in 3·70	1 in 4·34	16	1½	36	8½	83	0½	95	10½	420	0
1 in 8½	1 in 5·23	1 in 3·93	1 in 4·61	17	1½	39	0	88	4	102	0	474	0
1 in 9	1 in 5·54	1 in 4·17	1 in 4·89	18	1½	41	3	93	7	108	1	532	0
1 in 9½	1 in 5·85	1 in 4·40	1 in 5·16	19	2	43	7	98	9	114	2	592	0
1 in 10	1 in 6·17	1 in 4·64	1 in 5·44	20	2	45	10½	104	0	120	2	656	0
1 in 10½	1 in 6·48	1 in 4·87	1 in 5·71	21	2	48	2	109	3	126	3	724	0
1 in 11	1 in 6·79	1 in 5·11	1 in 5·98	22	2	50	5	114	6	132	4	794	0
1 in 11½	1 in 7·10	1 in 5·34	1 in 6·25	23	2	52	9	119	9	138	5	868	0
1 in 12	1 in 7·41	1 in 5·57	1 in 6·53	24	2	55	1	125	0	144	6	945	0
1 in 12½	1 in 7·72	1 in 5·81	1 in 6·80	25	2	57	4	130	3	150	6	1025	0
1 in 13	1 in 8·03	1 in 6·04	1 in 7·07	26	2	59	8	135	6	156	7	1109	0
1 in 14	1 in 8·66	1 in 6·51	1 in 7·62	28	3	64	2	145	11	168	9	1286	0
1 in 15	1 in 9·27	1 in 6·97	1 in 8·17	30	3	68	10	156	5	180	10	1476	0
1 in 16	1 in 9·89	1 in 7·44	1 in 8·71	32	3	73	4	166	10	193	0	1680	0
1 in 17	1 in 10·51	1 in 7·91	1 in 9·26	34	3	77	11	177	4	205	1	1896	0
1 in 18	1 in 11·13	1 in 8·37	1 in 9·80	36	3	82	7	187	9	217	2	2126	0

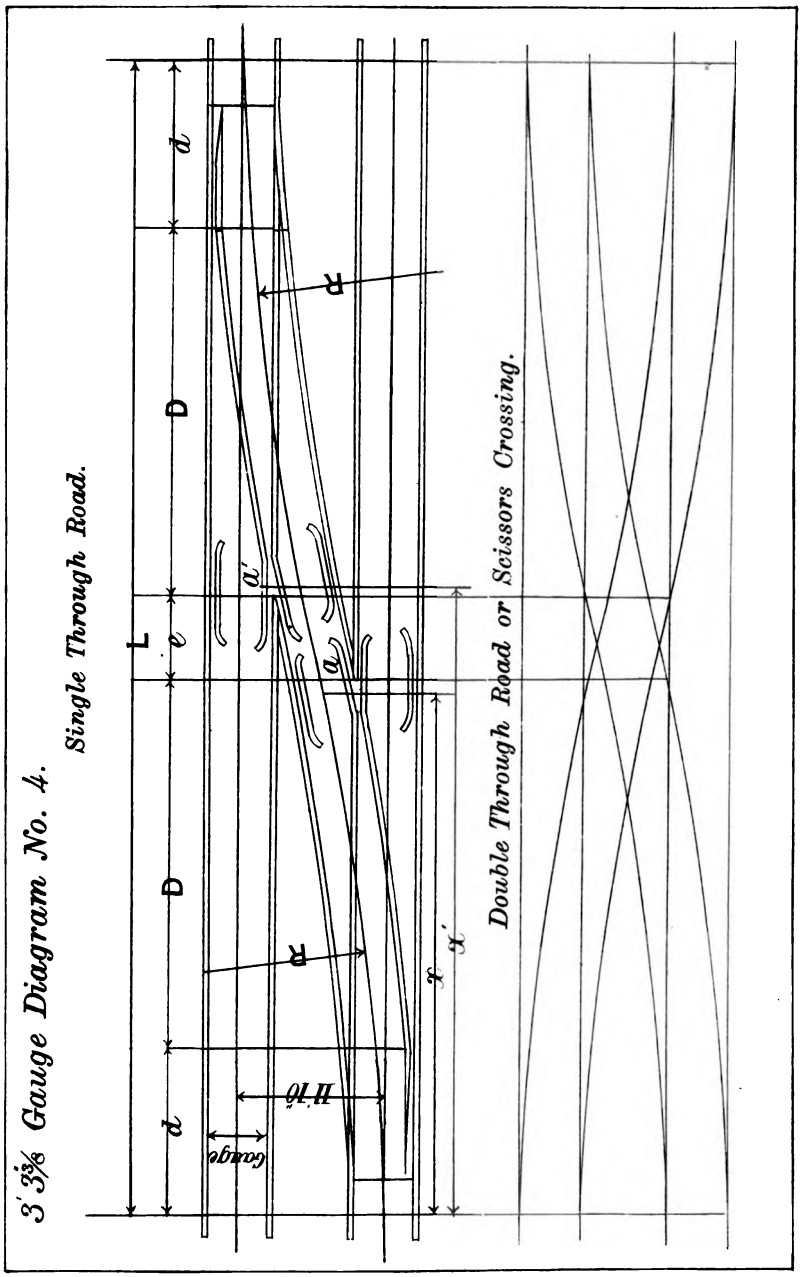
3′ 3⅜ Gauge Diagram No. 3.



THREE THROWS.

3 ft. 3⅜ in. Gauge. Table No. 3.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
		Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.			Ft. Ins	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1⅜	1 in 1·21	3 6	8 0½	4 9⅜	10 0	20 0	1 in 7½	1 in 5·29	15 1½	34 5	19 11	185 0	369 0
1 in 2	1 in 1·39	4 0¼	9 2¼	5 5¼	13 3	26 3	1 in 8	1 in 5·65	16 1½	36 8½	21 3	210 0	420 0
1 in 2¼	1 in 1·57	4 6¼	10 4	6 1¼	16 9	33 6	1 in 8½	1 in 6·00	17 1½	39 0	22 7	237 0	474 0
1 in 2½	1 in 1·75	5 0¼	11 5¾	6 9	20 6	41 0	1 in 9	1 in 6·36	18 1½	41 3	23 11	266 0	532 0
1 in 2⅝	1 in 1·93	5 6½	12 7½	7 5	24 9	50 0	1 in 9½	1 in 6·71	19 2	43 7	25 3	296 0	592 0
1 in 3	1 in 2·10	6 0½	13 8¼	8 0¾	29 6	59 0	1 in 10	1 in 7·06	20 2	45 10½	26 7	328 0	656 0
1 in 3¼	1 in 2·28	6 6½	14 11	8 8⅛	35 0	69 6	1 in 10½	1 in 7·42	21 2	48 2	27 10	362 0	724 0
1 in 3½	1 in 2·46	7 0½	16 0¾	9 4¼	40 6	80 6	1 in 11	1 in 7·77	22 2	50 5	29 2	397 0	794 0
1 in 3¾	1 in 2·64	7 6½	17 2½	10 0¼	46 6	92 6	1 in 11½	1 in 8·12	23 2	52 9	30 6	434 0	868 0
1 in 4	1 in 2·82	8 0½	18 4¼	10 8¼	52 6	105 0	1 in 12	1 in 8·48	24 2	55 1	31 10	473 0	945 0
1 in 4¼	1 in 3·00	8 6½	19 6	11 4	59 6	119 0	1 in 12½	1 in 8·84	25 2	57 4	33 2	513 0	1025 0
1 in 4½	1 in 3·17	9 1	20 7½	11 11½	66 6	133 0	1 in 13	1 in 9·19	26 2	59 8	34 6	555 0	1109 0
1 in 4¾	1 in 3·34	9 7	21 9½	12 8	74 0	148 0	1 in 14	1 in 9·89	28 3	64 2	37 2	643 0	1286 0
1 in 5	1 in 3·52	10 1	22 11½	13 3½	82 0	164 0	1 in 15	1 in 10·60	30 3	68 10	39 9	738 0	1476 0
1 in 5½	1 in 3·88	11 1	25 3	14 8	99 6	199 0	1 in 16	1 in 11·31	32 3	73 4	42 5	840 0	1680 0
1 in 6	1 in 4·23	12 1	27 6½	15 11½	118 0	237 0	1 in 17	1 in 12·02	34 3	77 11	45 1	948 0	1896 0
1 in 6½	1 in 4·58	13 1	29 10	17 3½	139 0	278 0	1 in 18	1 in 12·72	36 3	82 7	47 9	1063 0	2126 0
1 in 7	1 in 4·94	14 1	32 1½	18 7½	161 0	322 0							

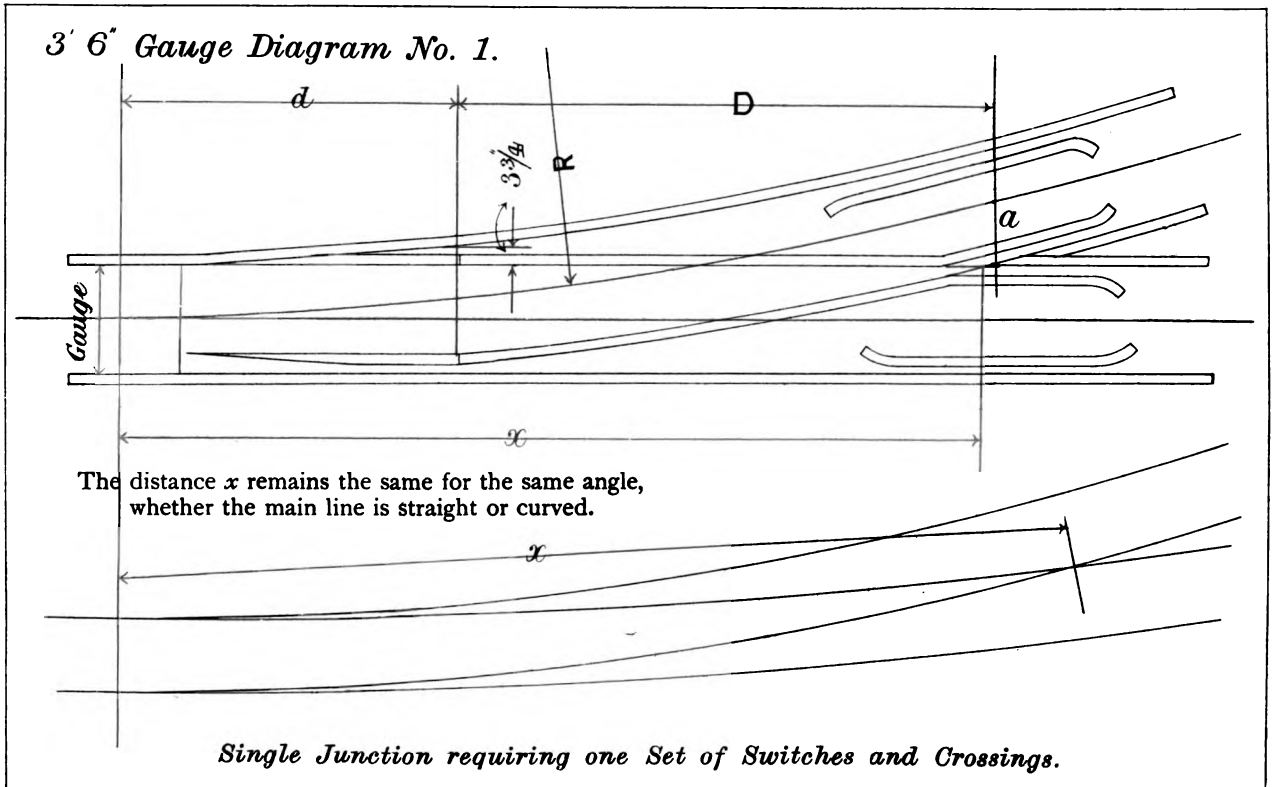


THROUGH ROAD.

3 ft. 3½ in. Gauge. Table No. 4.

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		● Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins	Ft.	Ins.
1 in 1¾	3	6	8	0½	5	4¼	11	5¾	17	0	28	5½	20	0
1 in 2	4	0¼	9	2¼	6	9¼	13	1½	20	1	33	2	26	3
1 in 2¼	4	6¼	10	4	8	1½	14	9	23	1	37	10	33	6
1 in 2½	5	0¼	11	5¾	9	5	16	4¾	26	0	42	5	41	0
1 in 2¾	5	6½	12	7½	10	8	18	0½	28	11	47	0	50	0
1 in 3	6	0½	13	8¼	11	11	19	8¼	31	10	51	6½	59	0
1 in 3¼	6	6½	14	11	13	1¼	21	4	34	8½	56	0	69	6
1 in 3½	7	0½	16	0¾	14	3½	22	11½	37	6½	60	6	80	6
1 in 3¾	7	6½	17	2½	15	6	24	7¼	40	5	65	0	92	6
1 in 4	8	0½	18	4¼	16	8	26	3	43	3	69	6	105	0
1 in 4¼	8	6½	19	6	17	10	27	10½	46	1	74	0	119	0
1 in 4½	9	1	20	7½	19	0	29	6	48	11	78	5	133	0
1 in 4¾	9	7	21	9½	20	1½	31	2	51	8	82	10	148	0
1 in 5	10	1	22	11½	21	3½	32	10	54	6	87	4	164	0
1 in 5½	11	1	25	3	23	7	36	1	60	1	96	2	199	0
1 in 6	12	1	27	6½	25	9½	39	4½	65	8	105	0	237	0
1 in 6½	13	1	29	10	28	1	42	8	71	3	113	11	278	0
1 in 7	14	1	32	1½	30	4	45	11	76	10	122	9	322	0

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		● Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	15	1½	34	5	32	7	49	2½	82	5	131	7	369	0
1 in 8	16	1½	36	8½	34	10	52	6	88	0	140	6	420	0
1 in 8½	17	1½	39	0	37	1	55	9	93	7	149	4	474	0
1 in 9	18	1½	41	3	39	4	59	0	99	1	158	2	532	0
1 in 9½	19	2	43	7	41	7	62	4	104	8	167	0	592	0
1 in 10	20	2	45	10½	43	9	65	7	110	2	175	10	656	0
1 in 10½	21	2	48	2	46	0	68	11	115	9	184	8	724	0
1 in 11	22	2	50	5	48	3	72	2	121	4	193	6	794	0
1 in 11½	23	2	52	9	50	6	75	5	126	10	202	4	868	0
1 in 12	24	2	55	1	52	8	78	9	132	5	211	2	945	0
1 in 12½	25	2	57	4	54	11	82	0	137	11	220	0	1025	0
1 in 13	26	2	59	8	57	1	85	3	143	6	228	9	1109	0
1 in 14	28	3	64	2	61	7	91	10	154	8	246	6	1286	0
1 in 15	30	3	68	10	66	0	98	5	165	8	264	0	1476	0
1 in 16	32	3	73	4	70	5	104	11	176	9	281	8	1680	0
1 in 17	34	3	77	11	74	10	111	6	187	10	299	4	1896	0
1 in 18	36	3	82	7	79	3	118	1	198	10	316	11	2126	0



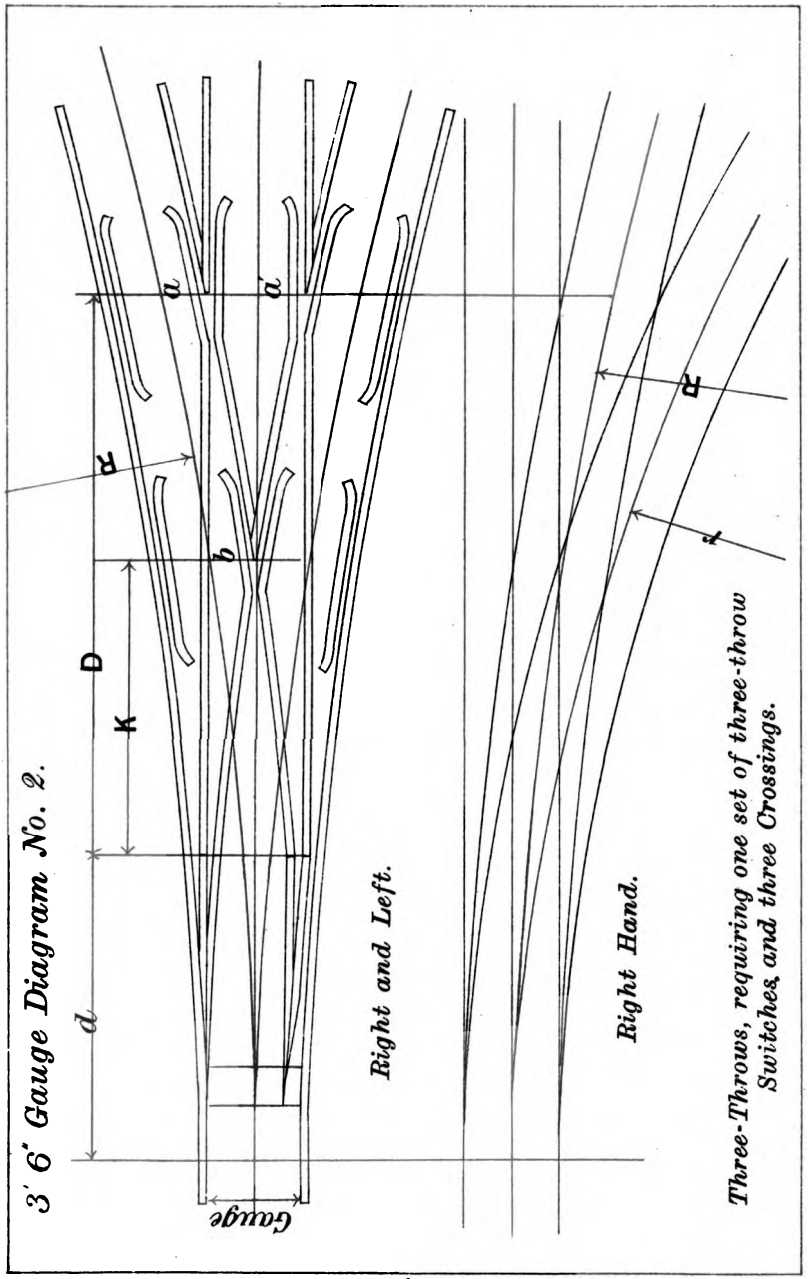
Single Junction requiring one Set of Switches and Crossings.

SINGLE JUNCTIONS.

3 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.	Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.
	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¼	31 52	3 7½	8 8½	12 3	21 6	1 in 7½	7 38	15 7½	37 2½	52 6	394 0
1 in 2	28 4	4 1¾	9 11¼	14 0	28 0	1 in 8	7 10	16 8	39 8	56 0	448 0
1 in 2¼	25 4	4 8	11 2¼	15 9	35 6	1 in 8½	6 44	17 8	42 2	59 6	506 0
1 in 2½	22 38	5 2¼	12 5	17 6	44 0	1 in 9	6 22	18 9	44 8	63 0	567 0
1 in 2¾	20 36	5 8½	13 7¾	19 3	53 0	1 in 9½	6 2	19 9	47 2	66 6	632 0
1 in 3	18 54	6 2¾	14 10¾	21 0	63 0	1 in 10	5 44	20 10	49 7	70 0	700 0
1 in 3¼	17 26	6 9	16 1½	22 9	74 0	1 in 10½	5 26	21 10	52 1	73 6	772 0
1 in 3½	16 16	7 3¼	17 4½	24 6	86 0	1 in 11	5 12	22 11	54 7	77 0	847 0
1 in 3¾	15 12	7 9½	18 7½	26 3	98 6	1 in 11½	4 58	23 11	57 1	80 6	926 0
1 in 4	14 14	8 3¾	19 10¼	28 0	112 0	1 in 12	4 46	25 0	59 6	84 0	1008 0
1 in 4¼	13 26	8 10	21 1	29 9	127 0	1 in 12½	4 36	26 0	62 0	87 6	1094 0
1 in 4½	12 40	9 4½	22 4	31 6	142 0	1 in 13	4 24	27 1	64 6	91 0	1183 0
1 in 4¾	12 2	9 10½	23 7	33 3	158 0	1 in 14	4 6	29 2	69 5	98 0	1372 0
1 in 5	11 26	10 5	24 9½	35 0	175 0	1 in 15	3 50	31 3	74 5	105 0	1575 0
1 in 5½	10 24	11 5½	27 3½	38 6	212 0	1 in 16	3 34	33 4	79 4	112 0	1792 0
1 in 6	9 32	12 6	29 9	42 0	252 0	1 in 17	3 22	35 5	84 4	119 0	2023 0
1 in 6½	8 48	13 6½	32 3	45 6	296 0	1 in 18	3 10	37 6	89 3	126 0	2268 0
1 in 7	8 10	14 7	34 8½	49 0	343 0						

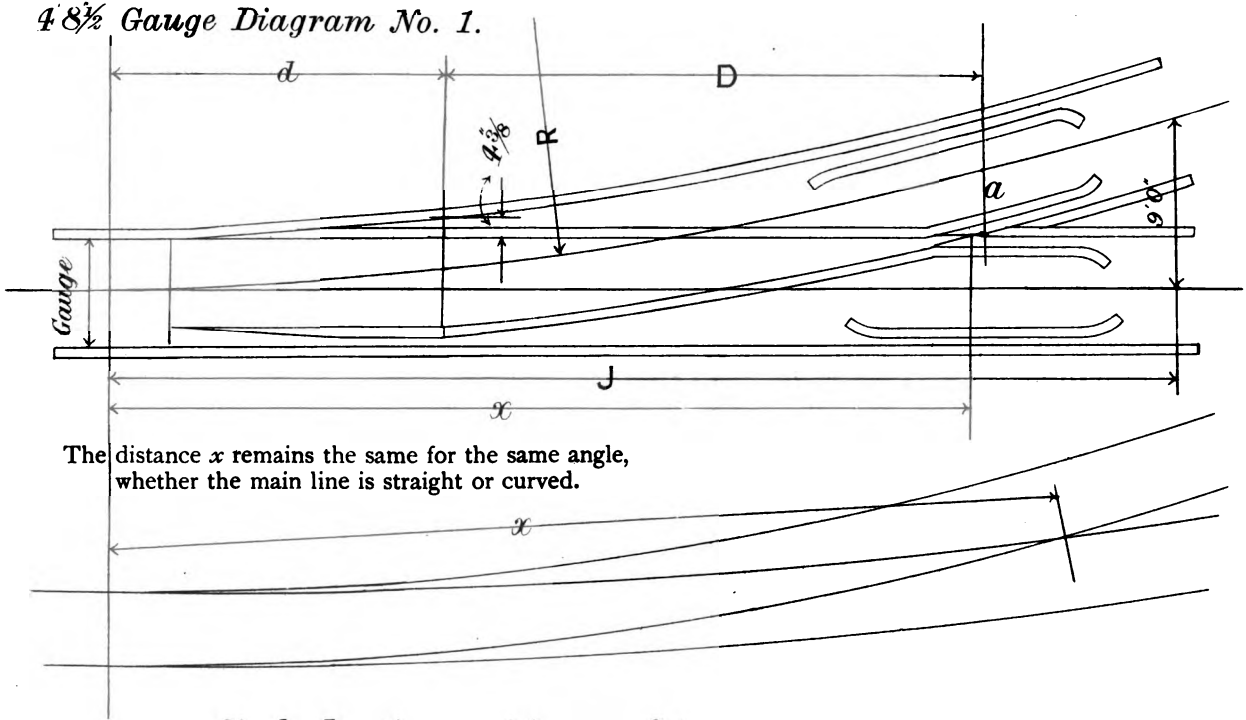
3′ 6″ Gauge Diagram No. 2.



THREE THROWS.

3 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
		Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.			Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	1 in 1·21	3 7½	8 8½	5 3	10 9	21 6	1 in 7½	1 in 5·29	15 7½	37 2½	21 9	197 0	394 0
1 in 2	1 in 1·39	4 1¾	9 11¼	5 11½	14 0	28 0	1 in 8	1 in 5·65	16 8	39 8	23 2½	224 0	448 0
1 in 2¼	1 in 1·57	4 8	11 2¼	6 8	17 9	35 6	1 in 8½	1 in 6·00	17 8	42 2	24 8	253 0	506 0
1 in 2½	1 in 1·75	5 2¼	12 5	7 4¾	22 0	44 0	1 in 9	1 in 6·36	18 9	44 8	26 1	284 0	567 0
1 in 2¾	1 in 1·93	5 8½	13 7¾	8 1	26 6	53 0	1 in 9½	1 in 6·71	19 9	47 2	27 7	316 0	632 0
1 in 3	1 in 2·10	6 2¾	14 10¾	8 9½	31 6	63 0	1 in 10	1 in 7·06	20 10	49 7	29 0	350 0	700 0
1 in 3¼	1 in 2·28	6 9	16 1⅛	9 6	37 0	74 0	1 in 10½	1 in 7·42	21 10	52 1	30 5	386 0	772 0
1 in 3½	1 in 2·46	7 3¼	17 4½	10 2¾	43 0	86 0	1 in 11	1 in 7·77	22 11	54 7	31 11	424 0	847 0
1 in 3¾	1 in 2·64	7 9½	18 7⅝	10 11½	49 6	98 6	1 in 11½	1 in 8·12	23 11	57 1	33 4	463 0	926 0
1 in 4	1 in 2·82	8 3¾	19 10¼	11 8	56 0	112 0	1 in 12	1 in 8·48	25 0	59 6	34 10	504 0	1008 0
1 in 4¼	1 in 3·00	8 10	21 1	12 4½	63 6	127 0	1 in 12½	1 in 8·84	26 0	62 0	36 3	547 0	1094 0
1 in 4½	1 in 3·17	9 4½	22 4	13 1⅝	71 0	142 0	1 in 13	1 in 9·19	27 1	64 6	37 8	592 0	1183 0
1 in 4¾	1 in 3·34	9 10⅛	23 7	13 10	79 0	158 0	1 in 14	1 in 9·89	29 2	69 5	40 7	686 0	1372 0
1 in 5	1 in 3·52	10 5	24 9½	14 6½	87 6	175 0	1 in 15	1 in 10·60	31 3	74 5	43 5	788 0	1575 0
1 in 5½	1 in 3·88	11 5½	27 3½	16 0	106 0	212 0	1 in 16	1 in 11·31	33 4	79 4	46 4	896 0	1792 0
1 in 6	1 in 4·23	12 6	29 9	17 5	126 0	252 0	1 in 17	1 in 12·02	35 5	84 4	49 3	1012 0	2023 0
1 in 6½	1 in 4·58	13 6½	32 3	18 10½	148 0	296 0	1 in 18	1 in 12·72	37 6	89 3	52 2	1134 0	2268 0
1 in 7	1 in 4·94	14 7	34 8½	20 4	172 0	343 0							



The distance x remains the same for the same angle, whether the main line is straight or curved.

Single Junction requiring one Set of Switches and Crossings.

4'8½ Gauge Diagram No. 1.

SINGLE JUNCTIONS.

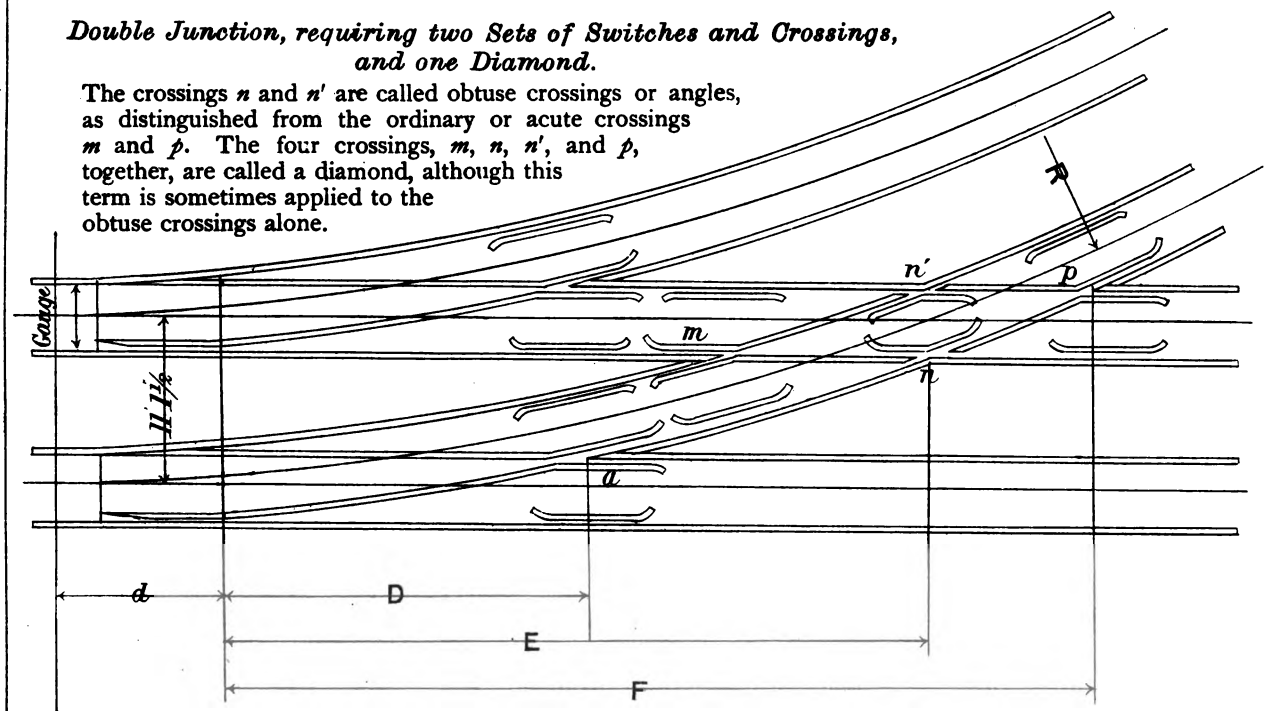
4 ft. 8½ in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	J Spring of Curve to point where Trucks clear.	R Radius of Curve.	Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	J Spring of Curve to point where Trucks clear.	R Radius of Curve.
	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		Deg. Mins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1⅝	31 52	4 6¼	12 0⅝	16 5⅝	17 0	29 0	1 in 7½	7 38	19 6	51 7	70 8	78 0	529 0
1 in 2	28 4	5 2¼	13 9¼	18 10	20 0	37 6	1 in 8	7 10	20 10	55 0	75 4½	83 0	602 0
1 in 2¼	25 4	5 9⅝	15 6	21 2¼	22 6	47 6	1 in 8½	6 44	22 1	58 6	80 1	88 0	680 0
1 in 2⅜	22 38	6 6	17 2¼	23 6½	25 0	59 0	1 in 9	6 22	23 5	61 11	84 10	94 0	762 0
1 in 2⅝	20 36	7 1½	18 11½	25 10⅝	28 0	71 0	1 in 9½	6 2	24 9	65 4	89 6	99 0	849 0
1 in 3	18 54	7 10	20 7	28 3¼	30 6	84 6	1 in 10	5 44	26 0	68 9	94 2	104 0	941 0
1 in 3⅛	17 26	8 5¼	22 4½	30 7½	33 6	99 6	1 in 10½	5 26	27 4	72 2	98 11	109 0	1037 0
1 in 3¼	16 16	9 1¾	24 0⅝	32 11½	36 0	116 0	1 in 11	5 12	28 7	75 8	103 8	115 0	1139 0
1 in 3⅝	15 12	9 9	25 9½	35 4	38 6	133 0	1 in 11½	4 58	29 11	79 1	108 4	120 0	1244 0
1 in 4	14 14	10 4¾	27 6	37 8	41 0	151 0	1 in 12	4 46	31 3	82 6	113 1	125 0	1355 0
1 in 4¼	13 26	11 0½	29 3	40 0½	44 0	170 0	1 in 12½	4 36	32 6	85 11	117 9	130 0	1470 0
1 in 4⅜	12 40	11 8½	30 11½	42 5	47 0	191 0	1 in 13	4 24	33 10	89 5	122 6	135 0	1590 0
1 in 4⅝	12 2	12 4	32 8	44 9	49 0	212 0	1 in 14	4 6	36 5	96 3	131 11	146 0	1844 0
1 in 5	11 26	13 0	34 5	47 1½	52 0	235 0	1 in 15	3 50	39 0	103 2	141 4	156 0	2117 0
1 in 5⅛	10 24	14 3½	37 10	51 10	57 0	285 0	1 in 16	3 34	41 8	110 0	150 9	167 0	2409 0
1 in 6	9 32	15 7½	41 3	56 6	62 0	339 0	1 in 17	3 22	44 3	116 11	160 2	177 0	2719 0
1 in 6½	8 48	16 11	44 8½	61 3	68 0	398 0	1 in 18	3 10	46 10	123 9	169 7	188 0	3049 0
1 in 7	8 10	18 2½	48 3	65 11½	73 0	461 0							

4′ 8½ Gauge Diagram No. 2.

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n′* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n′*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.

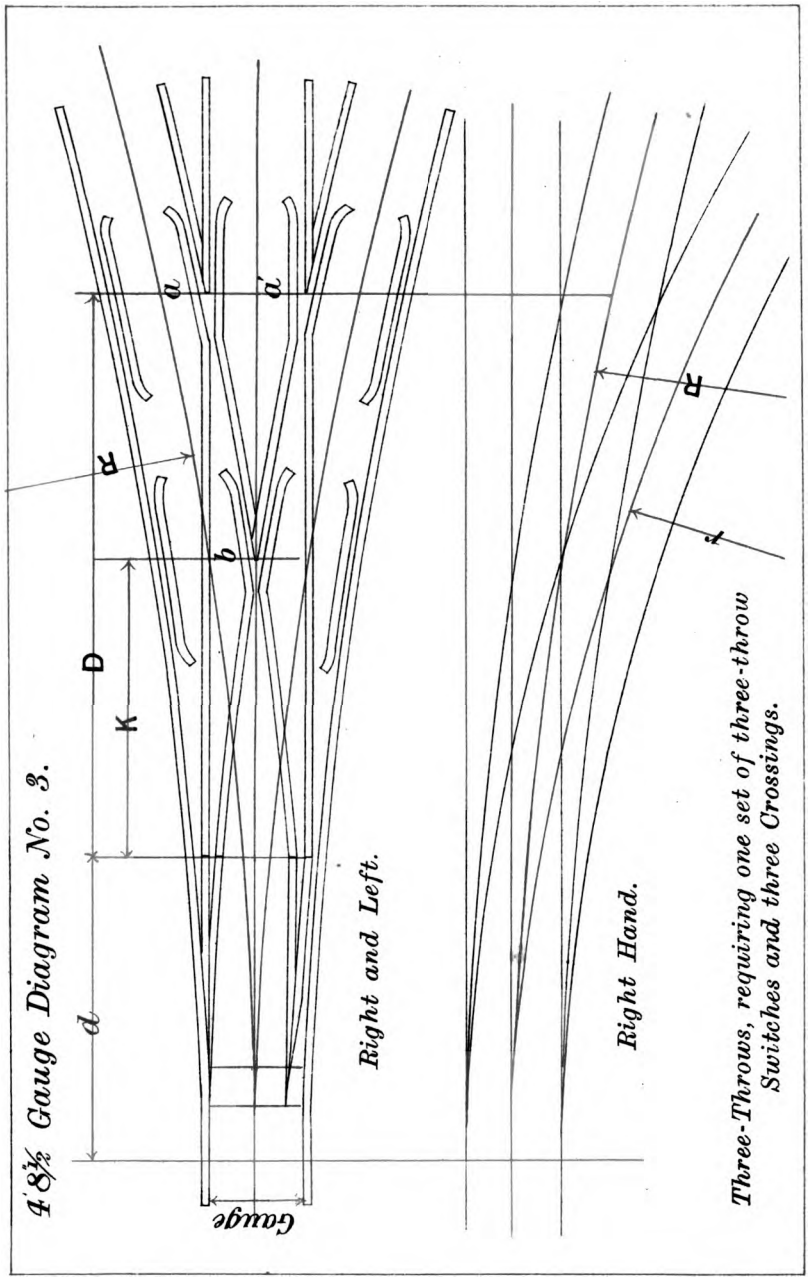


DOUBLE JUNCTIONS.

4 ft. 8½ in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins.	E Heel of Switches to Knees of Crossing. n Ft.	Ins.	F Heel of Switches to Nose of Crossing. p Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 1¾	1 in 1·35	1 in 1·07	1 in ·97	1 in ·86	4	6¼	12	0¾	19	5½	22	7½	29	0
1 in 2	1 in 1·58	1 in 1·25	1 in 1·16	1 in 1·01	5	2¼	13	9¼	22	6½	26	8¾	37	6
1 in 2¼	1 in 1·81	1 in 1·41	1 in 1·34	1 in 1·15	5	9¾	15	6	25	7¼	30	8¾	47	6
1 in 2½	1 in 2·04	1 in 1·58	1 in 1·51	1 in 1·30	6	6	17	2¼	28	8	34	7¾	59	0
1 in 2¾	1 in 2·26	1 in 1·75	1 in 1·69	1 in 1·44	7	1½	18	11½	31	8½	38	6	71	0
1 in 3	1 in 2·48	1 in 1·91	1 in 1·86	1 in 1·58	7	10	20	7	34	9	42	3¾	84	6
1 in 3¼	1 in 2·70	1 in 2·08	1 in 2·03	1 in 1·72	8	5¼	22	4¼	37	9½	46	1½	99	6
1 in 3½	1 in 2·92	1 in 2·24	1 in 2·20	1 in 1·86	9	1¼	24	0¾	40	9¾	49	11	116	0
1 in 3¾	1 in 3·14	1 in 2·41	1 in 2·36	1 in 2·00	9	9	25	9½	43	10	53	8½	133	0
1 in 4	1 in 3·36	1 in 2·57	1 in 2·53	1 in 2·14	10	4¾	27	6	46	10	57	5½	151	0
1 in 4¼	1 in 3·57	1 in 2·74	1 in 2·70	1 in 2·28	11	0½	29	3	49	10	61	2½	170	0
1 in 4½	1 in 3·79	1 in 2·90	1 in 2·86	1 in 2·42	11	8½	30	11½	52	10	64	11½	191	0
1 in 4¾	1 in 4·01	1 in 3·06	1 in 3·03	1 in 2·55	12	4	32	8	55	10	68	8	212	0
1 in 5	1 in 4·23	1 in 3·23	1 in 3·20	1 in 2·69	13	0	34	5	58	10	72	5	235	0
1 in 5½	1 in 4·66	1 in 3·56	1 in 3·53	1 in 2·97	14	3½	37	10	64	9½	79	10	285	0
1 in 6	1 in 5·09	1 in 3·89	1 in 3·86	1 in 3·24	15	7½	41	3	70	9½	87	3	339	0
1 in 6½	1 in 5·52	1 in 4·21	1 in 4·19	1 in 3·52	16	11	44	8½	76	9	94	8½	398	0
1 in 7	1 in 5·95	1 in 4·54	1 in 4·52	1 in 3·79	18	2½	48	3	82	8½	102	1	461	0

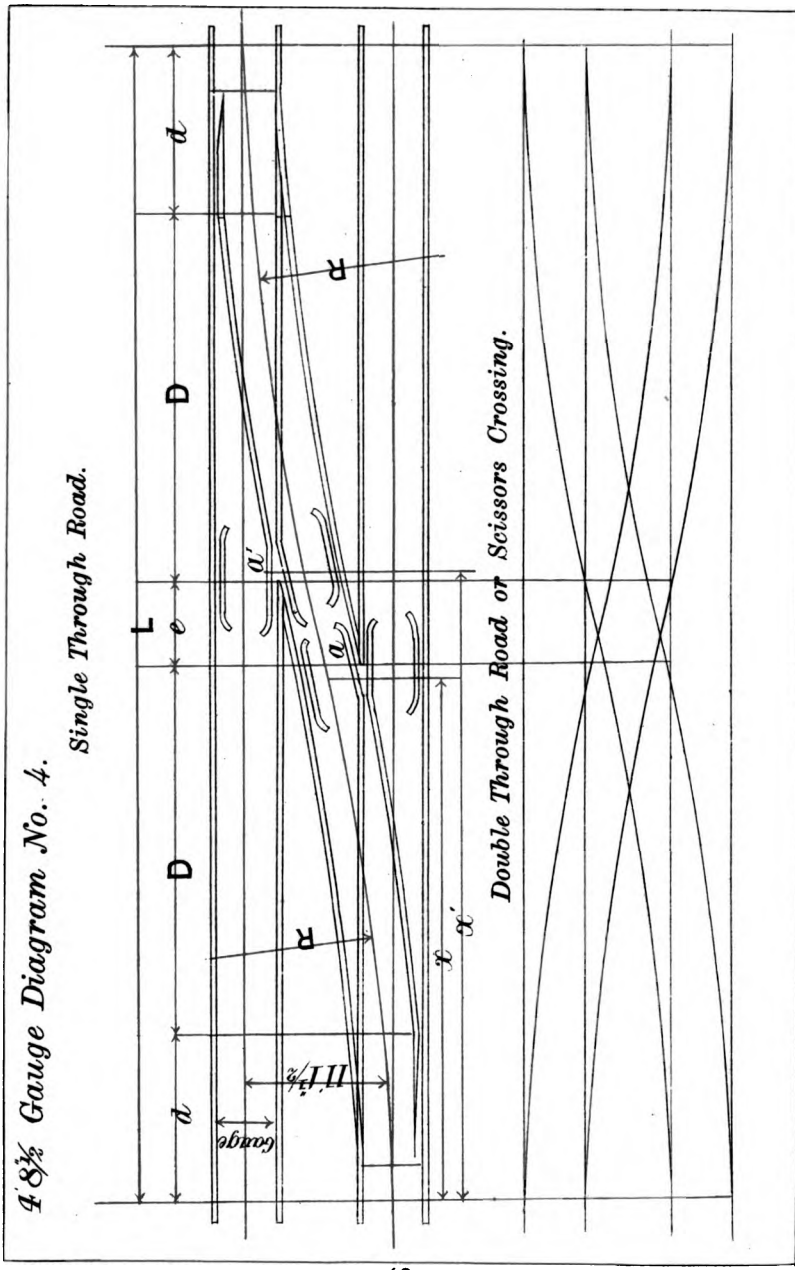
Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins.	E Heel of Switches to Knees of Crossing. n Ft.	Ins.	F Heel of Switches to Nose of Crossing. p Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 7½	1 in 6·38	1 in 4·86	1 in 4·07	19	6	51	7	88	8	109	6	529	0
1 in 8	1 in 6·81	1 in 5·19	1 in 4·34	20	10	55	0	94	7½	116	10½	602	0
1 in 8½	1 in 7·24	1 in 5·51	1 in 4·61	22	1	58	6	100	7	124	3	680	0
1 in 9	1 in 7·67	1 in 5·84	1 in 4·89	23	5	61	11	106	6	131	8	762	0
1 in 9½	1 in 8·10	1 in 6·17	1 in 5·16	24	9	65	4	112	6	139	0	849	0
1 in 10	1 in 8·53	1 in 6·49	1 in 5·44	26	0	68	9	118	5	146	5	941	0
1 in 10½	1 in 8·96	1 in 6·82	1 in 5·71	27	4	72	2	124	4	153	10	1037	0
1 in 11	1 in 9·39	1 in 7·14	1 in 5·98	28	7	75	8	130	4	161	2	1139	0
1 in 11½	1 in 9·82	1 in 7·47	1 in 6·25	29	11	79	1	136	3	168	6	1244	0
1 in 12	1 in 10·25	1 in 7·79	1 in 6·53	31	3	82	6	142	2	175	10	1355	0
1 in 12½	1 in 10·68	1 in 8·12	1 in 6·80	32	6	85	11	148	1	183	3	1470	0
1 in 13	1 in 11·11	1 in 8·45	1 in 7·07	33	10	89	5	154	1	190	7	1590	0
1 in 14	1 in 11·96	1 in 9·10	1 in 7·62	36	5	96	3	166	0	205	4	1844	0
1 in 15	1 in 12·82	1 in 9·75	1 in 8·17	39	0	103	2	177	10	220	0	2117	0
1 in 16	1 in 13·68	1 in 10·40	1 in 8·71	41	8	110	0	189	8	234	9	2409	0
1 in 17	1 in 14·54	1 in 11·05	1 in 9·26	44	3	116	11	201	7	249	5	2719	0
1 in 18	1 in 15·39	1 in 11·70	1 in 9·80	46	10	113	9	213	5	264	1	3049	0



THREE THROWS.

4 ft. 8½ in. Gauge. Table No. 3.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings a a'		K Heel of Switches to Nose of Crossing. b		r Radius of Inside Curve.		R Radius of Curve.		Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		K Heel of Switches to Nose of Crossing. b		r Radius of Inside Curve.		R Radius of Curve.	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.			Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	1 in 1·21	4	6¼	12	0¾	7	5	14	6	29	0	1 in 7½	1 in 5·29	19	6	51	7	30	9	265	0	529	0
1 in 2	1 in 1·39	5	2¼	13	9¼	8	4¾	18	9	37	6	1 in 8	1 in 5·65	20	10	55	0	32	10	301	0	602	0
1 in 2¼	1 in 1·57	5	9¾	15	6	9	5	23	9	47	6	1 in 8½	1 in 6·00	22	1	58	6	34	11	340	0	680	0
1 in 2½	1 in 1·75	6	6	17	2¼	10	5	29	6	59	0	1 in 9	1 in 6·36	23	5	61	11	36	11	381	0	762	0
1 in 2¾	1 in 1·93	7	1½	18	11½	11	5¼	35	6	71	0	1 in 9½	1 in 6·71	24	9	65	4	39	0	425	0	849	0
1 in 3	1 in 2·10	7	10	20	7	12	5	42	6	84	6	1 in 10	1 in 7·06	26	0	68	9	41	0	471	0	941	0
1 in 3¼	2 in 2·28	8	5¼	22	4¼	13	5¼	50	0	99	6	1 in 10½	1 in 7·42	27	4	72	2	43	1	519	0	1037	0
1 in 3½	1 in 2·46	9	1¼	24	0¾	14	5½	58	0	116	0	1 in 11	1 in 7·77	28	7	75	8	45	1	570	0	1139	0
1 in 3¾	1 in 2·61	9	9	25	9½	15	5½	66	6	133	0	1 in 11½	1 in 8·12	29	11	79	1	47	2	622	0	1244	0
1 in 4	1 in 2·82	10	4¾	27	6	16	5½	75	6	151	0	1 in 12	1 in 8·48	31	3	82	6	49	2	678	0	1355	0
1 in 4¼	1 in 3·00	11	0½	29	3	17	6½	85	0	170	0	1 in 12½	1 in 8·84	32	6	85	11	51	3	735	0	1470	0
1 in 4½	1 in 3 17	11	8½	30	11½	18	6½	95	0	191	0	1 in 13	1 in 9·19	33	10	89	5	53	4	795	0	1590	0
1 in 4¾	1 in 3·34	12	4	32	8	19	6½	106	0	212	0	1 in 14	1 in 9·89	36	5	96	3	57	5	922	0	1844	0
1 in 5	1 in 3·52	13	0	34	5	20	7	118	0	235	0	1 in 15	1 in 10·60	39	0	103	2	61	6	1059	0	2117	0
1 in 5½	1 in 3·88	14	3½	37	10	22	7½	143	0	285	0	1 in 16	1 in 11·31	41	8	110	0	65	7	1205	0	2409	0
1 in 6	1 in 4·23	15	7½	41	3	24	7½	170	0	339	0	1 in 17	1 in 12·02	44	3	116	11	69	8	1360	0	2719	0
1 in 6½	1 in 4·58	16	11	44	8½	26	8	199	0	398	0	1 in 18	1 in 12·72	46	10	123	9	73	9	1525	0	3049	0
1 in 7	1 in 4·94	18	2½	48	3	28	8½	231	0	461	0												



THROUGH ROAD.

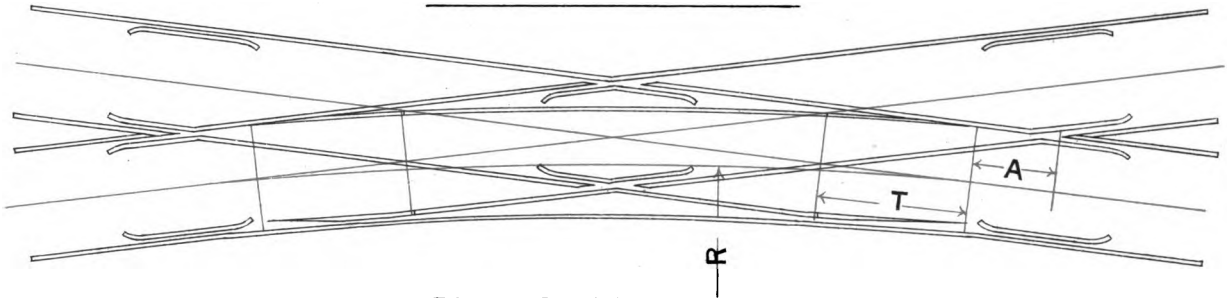
4 ft. 8½ in. Gauge. Table No. 4.

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		e Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	4	6¼	12	0¾	0	10½	16	5¾	17	6¾	34	0½	29	0
1 in 2	5	2¼	13	9¼	1	5½	18	10	20	6½	39	4½	37	6
1 in 2¼	5	9¾	15	6	2	0¼	21	2¼	23	5½	44	8	47	6
1 in 2½	6	6	17	2¼	2	6½	23	6½	26	4½	49	11	59	0
1 in 2¾	7	1½	18	11½	3	0	25	10¾	29	3	55	1½	71	0
1 in 3	7	10	20	7	3	5¼	28	3¼	32	0	60	4	84	6
1 in 3¼	8	5¼	22	4¼	3	10¾	30	7¼	34	11	65	6½	99	6
1 in 3½	9	1¼	24	0¾	4	4¼	32	11⅝	37	9	70	8½	116	0
1 in 3¾	9	9	25	9½	4	9½	35	4	40	7	75	10½	133	0
1 in 4	10	4¾	27	6	5	3	37	8	43	5	81	1	151	0
1 in 4¼	11	0½	29	3	5	8	40	0½	46	2	86	3	170	0
1 in 4½	11	8½	30	11½	6	1	42	5	49	0	91	4	191	0
1 in 4¾	12	4	32	8	6	6	44	9	51	10	96	6	212	0
1 in 5	13	0	34	5	6	11	47	1½	54	7	101	8	235	0
1 in 5½	14	3½	37	10	7	8½	51	10	60	2	112	0	285	0
1 in 6	15	7½	41	3	8	6½	56	6	65	9	122	3	339	0
1 in 6½	16	11	44	8½	9	4	61	3	71	4	132	6	398	0
1 in 7	18	2½	48	3	10	1½	65	11½	76	11	142	9	461	0

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		e Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	19	6	51	7	10	11	70	8	82	5	153	1	529	0
1 in 8	20	10	55	0	11	8	75	4½	88	0	163	4	602	0
1 in 8½	22	1	58	6	12	5	80	1	93	6	173	7	680	0
1 in 9	23	5	61	11	13	2	84	10	99	0	183	10	762	0
1 in 9½	24	9	65	4	14	0	89	6	104	7	194	1	849	0
1 in 10	26	0	68	9	14	9	94	2	110	1	204	4	941	0
1 in 10½	27	4	72	2	15	7	98	11	115	8	214	7	1037	0
1 in 11	28	7	75	8	16	4	103	8	121	2	224	10	1139	0
1 in 11½	29	11	79	1	17	1	108	4	126	9	235	1	1244	0
1 in 12	31	3	82	6	17	10	113	1	132	3	245	4	1355	0
1 in 12½	32	6	85	11	18	7	117	9	137	10	255	7	1470	0
1 in 13	33	10	89	5	19	4	122	6	143	4	265	9	1590	0
1 in 14	36	5	96	3	20	11	131	11	154	5	286	3	1844	0
1 in 15	39	0	103	2	22	5	141	4	165	5	306	9	2117	0
1 in 16	41	8	110	0	23	11	150	9	176	6	327	3	2409	0
1 in 17	44	3	116	11	25	5	160	2	187	7	347	9	2719	0
1 in 18	46	10	123	9	27	0	169	7	198	7	368	2	3049	0

4' 8½" Gauge Diagram No. 5.

Diamond with Single Slip.



Diamond with Double Slip.

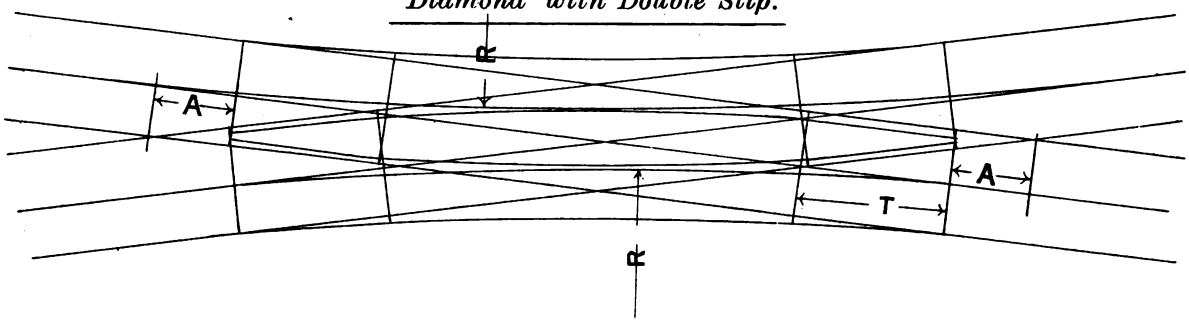


Table No. 5.

DIAMONDS WITH SINGLE AND DOUBLE SLIPS.

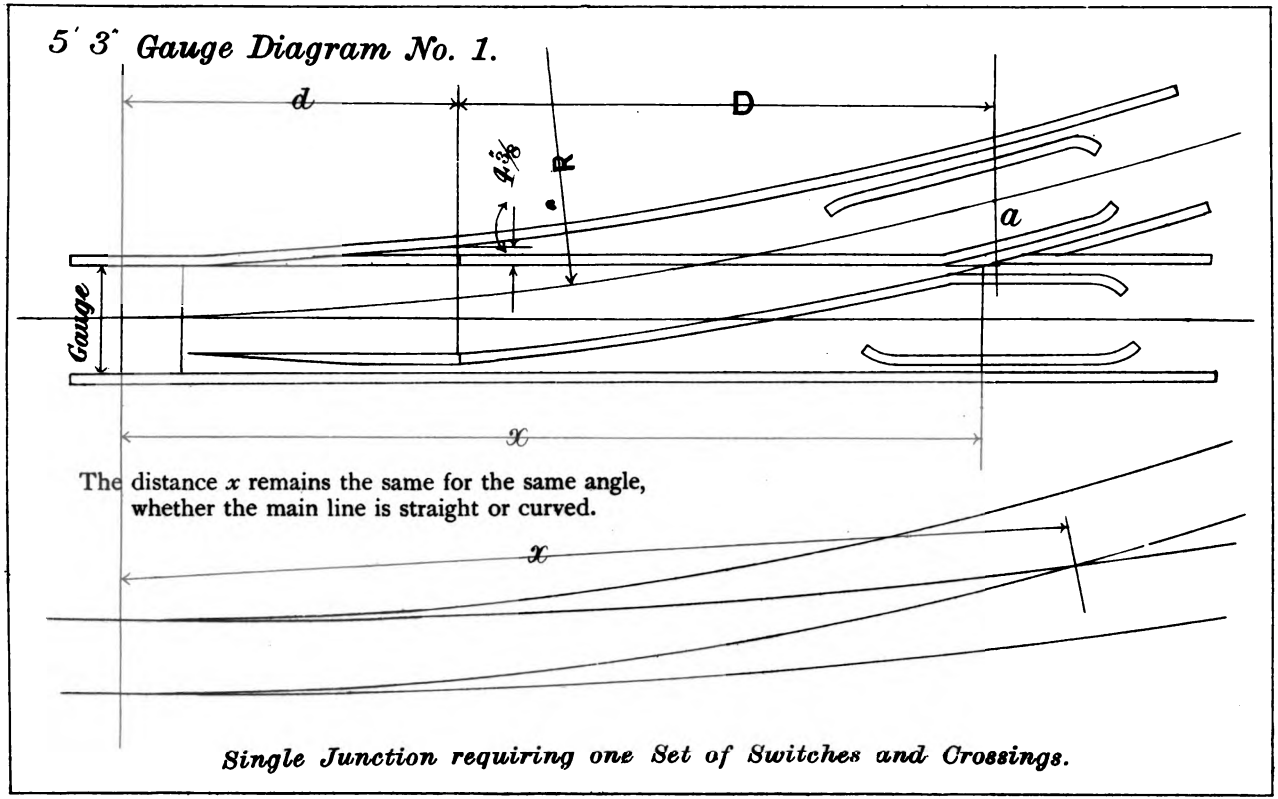
4 ft. 8½ in. Gauge.

SINGLE SLIP.

Angle of Diamond.	R Maximum Radius of Slip.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.	Angle of Diamond.	R Maximum Radius of Slip.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.
	Ft. Ins.	Ft. Ins.	Ft. Ins		Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 3	87 6	1 8	6 0	1 in 7	520 0	3 11	12 0
1 in 4	160 0	2 3	7 6	1 in 8	720 0	4 5½	12 0
1 in 5	260 0	2 9½	9 0	1 in 9	920 0	5 0	12 0
1 in 6	380 0	3 4	9 0	1 in 10	1080 0	5 7	15 0

DOUBLE SLIP.

Angle of Diamond.	R Maximum Radius of Slip.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.	Angle of Diamond.	R Maximum Radius of Slip.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.
	Ft. Ins.	Ft. Ins.	Ft. Ins.		Ft. Ins.	Ft. Ins.	Ft. Ins
1 in 3	77 6	2 11	6 0	1 in 7	460 0	6 10	12 0
1 in 4	150 0	3 11	7 6	1 in 8	640 0	7 9½	12 0
1 in 5	230 0	4 10½	9 0	1 in 9	800 0	8 9	12 0
1 in 6	360 0	5 10	9 0	1 in 10	1000 0	9 9	15 0



Single Junction requiring one Set of Switches and Crossings.

5′ 3″ Gauge Diagram No. 1.

SINGLE JUNCTIONS.

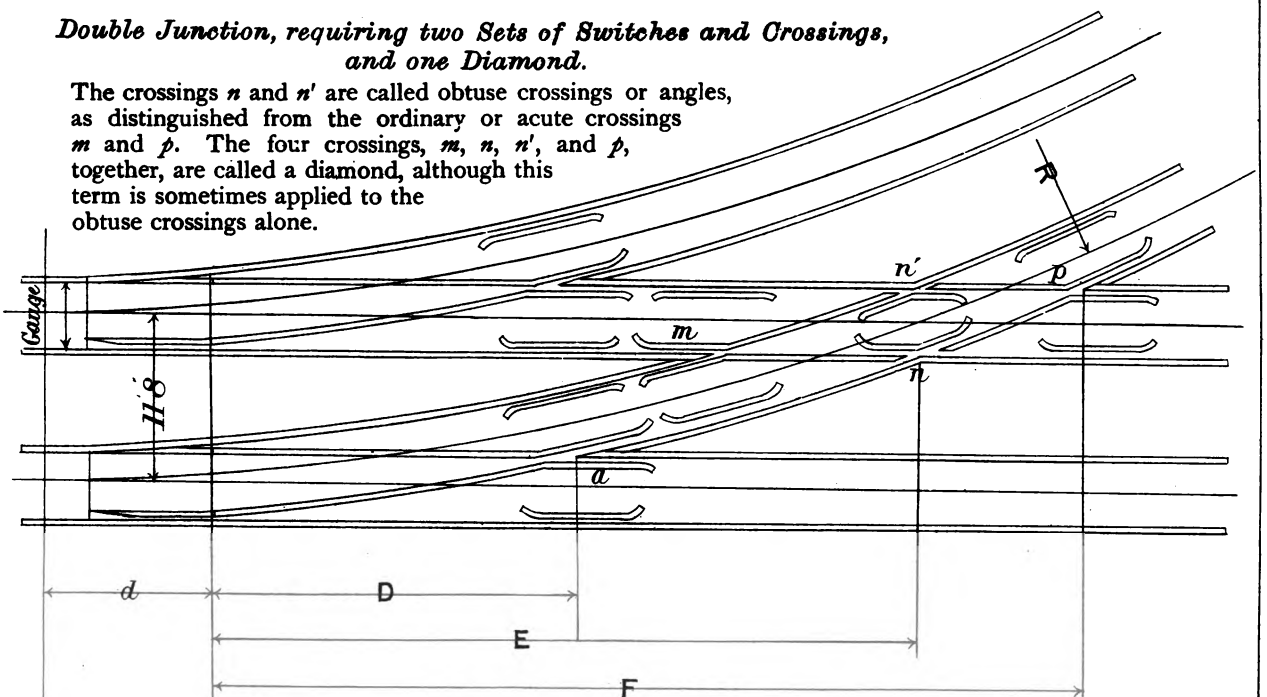
5 ft. 3 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.	Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.
	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1 5/8	31 52	4 9 1/8	13 8 1/4	18 4 1/2	32 6	1 in 7 1/2	7 38	20 7	58 7	78 9	591 0
1 in 2	28 4	5 5 3/4	15 7 3/4	21 0	42 0	1 in 8	7 10	22 0	62 5 1/2	84 0	672 0
1 in 2 1/4	25 4	6 2	17 6	23 7 1/2	53 6	1 in 8 1/2	6 44	23 4	66 5	89 3	759 0
1 in 2 1/2	22 38	6 10 1/4	19 6 1/2	26 3	66 0	1 in 9	6 22	24 9	70 3	94 6	851 0
1 in 2 3/4	20 36	7 6 1/2	21 5 3/4	28 10 1/2	79 6	1 in 9 1/2	6 2	26 1	74 3	99 9	948 0
1 in 3	18 54	8 3	23 5 1/4	31 6	94 6	1 in 10	5 44	27 6	78 1	105 0	1050 0
1 in 3 1/4	17 26	8 11	25 5	34 1 1/2	111 0	1 in 10 1/2	5 26	28 10	82 0	110 3	1158 0
1 in 3 1/2	16 16	9 7 1/4	27 4 1/4	36 9	129 0	1 in 11	5 12	30 3	85 11	115 6	1271 0
1 in 3 3/4	15 12	10 3 1/2	29 3 1/2	39 4 1/2	148 0	1 in 11 1/2	4 58	31 7	89 10	120 9	1389 0
1 in 4	14 14	11 0	31 2 3/4	42 0	168 0	1 in 12	4 46	33 0	93 8	126 0	1572 0
1 in 4 1/4	13 26	11 8	33 2 1/2	44 7 1/2	190 0	1 in 12 1/2	4 36	34 4	97 7	131 3	1641 0
1 in 4 1/2	12 40	12 4 1/2	35 1 1/2	47 3	213 0	1 in 13	4 24	35 9	101 6	136 6	1775 0
1 in 4 3/4	12 2	13 0 1/2	37 1 1/2	49 10 1/2	237 0	1 in 14	4 6	38 6	109 4	147 0	2058 0
1 in 5	11 26	13 9	39 0 1/2	52 6	263 0	1 in 15	3 50	41 3	117 1	157 6	2363 0
1 in 5 1/2	10 24	15 1 1/2	42 11 1/2	57 9	318 0	1 in 16	3 34	44 0	124 11	168 0	2688 0
1 in 6	9 32	16 5 1/2	46 11	63 0	378 0	1 in 17	3 22	46 9	132 9	178 6	3035 0
1 in 6 1/2	8 48	17 10 1/2	50 9	68 3	444 0	1 in 18	3 10	49 6	140 7	189 0	3402 0
1 in 7	8 10	19 3	54 8	73 6	515 0						

5′ 3″ Gauge Diagram No. 2.

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n′* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n′*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



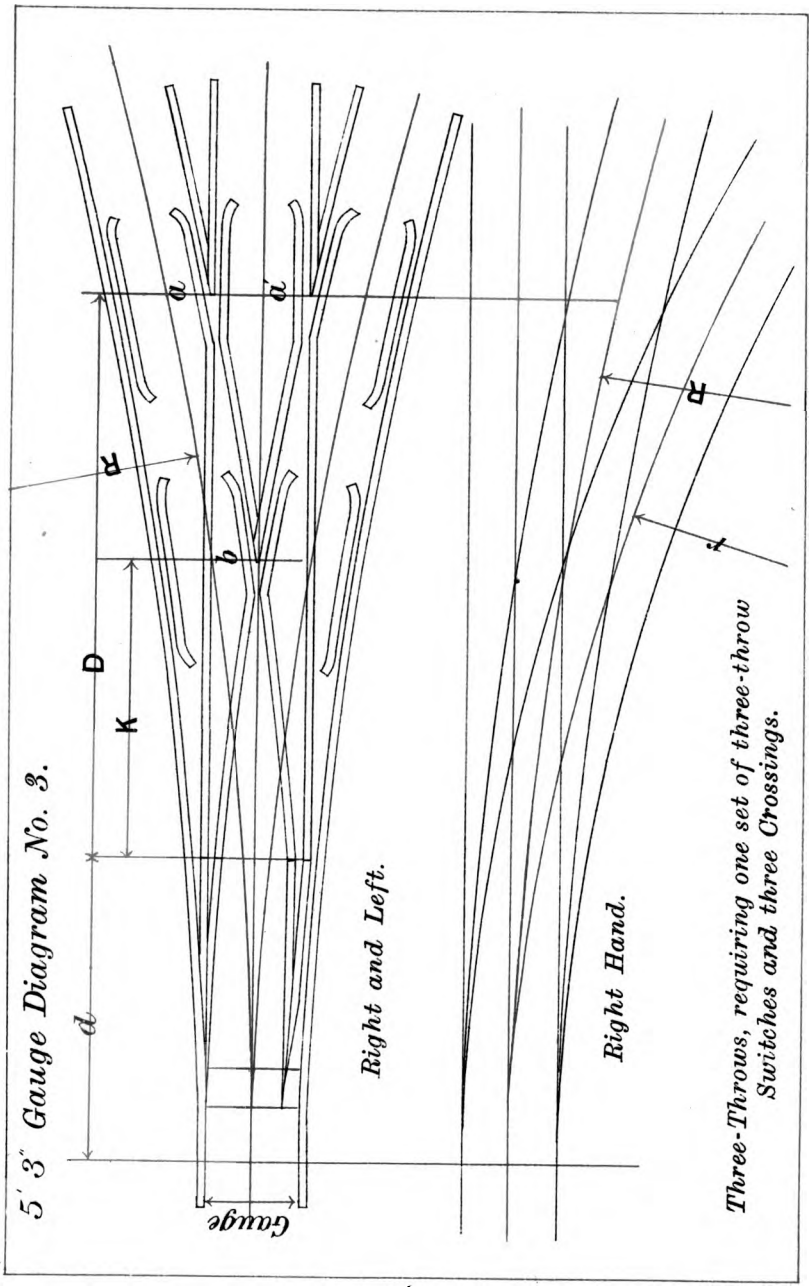
DOUBLE JUNCTIONS.

5 ft. 3 in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	E Heel of Switches to Knees of Crossing. n	F Heel of Switches to Nose of Crossing. p	R Radius of Curve.
					Ft. Ins	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	1 in 1·43	1 in 1·11	1 in 1·01	1 in ·88	4 9½	13 8¼	21 2¼	25 0¾	32 6
1 in 2	1 in 1·68	1 in 1·29	1 in 1·20	1 in 1·03	5 5¾	15 7¾	24 7	29 6½	42 0
1 in 2¼	1 in 1·92	1 in 1·46	1 in 1·38	1 in 1·18	6 2	17 6	27 11¼	33 10¾	53 6
1 in 2½	1 in 2·16	1 in 1·64	1 in 1·57	1 in 1·33	6 10¼	19 6½	31 3¼	38 2¼	66 0
1 in 2¾	1 in 2·39	1 in 1 81	1 in 1·74	1 in 1·47	7 6½	21 5¾	34 7	42 5	79 6
1 in 3	1 in 2·63	1 in 1·98	1 in 1·92	1 in 1·62	8 3	23 5¼	37 10¾	46 7¼	94 6
1 in 3¼	1 in 2·86	1 in 2·15	1 in 2·09	1 in 1·76	8 11	25 5	41 2½	50 9¼	111 0
1 in 3½	1 in 3·09	1 in 2·32	1 in 2·27	1 in 1·90	9 7¼	27 4¼	44 5¾	54 11	129 0
1 in 3¾	1 in 3·32	1 in 2·49	1 in 2·44	1 in 2·05	10 3½	29 3½	47 8¾	59 0½	148 0
1 in 4	1 in 3·55	1 in 2·66	1 in 2·61	1 in 2·19	11 0	31 2¾	51 0	63 2	168 0
1 in 4¼	1 in 3·78	1 in 2·83	1 in 2·79	1 in 2·33	11 8	33 2½	54 3½	67 3½	190 0
1 in 4½	1 in 4·01	1 in 3·00	1 in 2·96	1 in 2·47	12 4½	35 1½	57 6	71 4½	213 0
1 in 4¾	1 in 4·24	1 in 3·16	1 in 3·13	1 in 2·61	13 0½	37 1½	60 9½	75 5½	237 0
1 in 5	1 in 4·47	1 in 3·33	1 in 3·30	1 in 2·75	13 9	39 0½	64 0½	79 6½	263 0
1 in 5½	1 in 4·93	1 in 3 67	1 in 3·64	1 in 3·03	15 1½	42 11½	70 6½	87 8½	318 0
1 in 6	1 in 5·38	1 in 4·01	1 in 3·98	1 in 3·32	16 5½	46 11	77 0	95 10½	378 0
1 in 6½	1 in 5·84	1 in 4·34	1 in 4 32	1 in 3·60	17 10½	50 9	83 6	104 0	444 0
1 in 7	1 in 6·30	1 in 4 68	1 in 4·66	1 in 3·88	19 3	54 8	89 11½	112 1½	515 0

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossings. n n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	E Heel of Switches to Knees of Crossing. n	F Heel of Switches to Nose of Crossing. p	R Radius of Curve.
				Ft. Ins	Ft. Ins.	Ft. Ins.	Ft. Ins	Ft. Ins.
1 in 7½	1 in 6·75	1 in 5·02	1 in 4·16	20 7	58 7	96 5	120 2	591 0
1 in 8	1 in 7 20	1 in 5·35	1 in 4·44	22 0	62 5½	102 11	128 4	672 0
1 in 8½	1 in 7 66	1 in 5·69	1 in 4 72	23 4	66 5	109 4	136 5	759 0
1 in 9	1 in 8·11	1 in 6·03	1 in 5 00	24 9	70 3	115 10	144 6	851 0
1 in 9½	1 in 8·57	1 in 6·36	1 in 5 27	26 1	74 3	122 3	152 7	948 0
1 in 10	1 in 9·02	1 in 6·70	1 in 5·56	27 6	78 1	128 9	160 9	1050 0
1 in 10½	1 in 9·47	1 in 7·03	1 in 5·83	28 10	82 0	135 3	168 10	1158 0
1 in 11	1 in 9·93	1 in 7·37	1 in 6·11	30 3	85 11	141 8	176 11	1271 0
1 in 11½	1 in 10·38	1 in 7·70	1 in 6·39	31 7	89 10	148 2	185 0	1389 0
1 in 12	1 in 10·83	1 in 8·04	1 in 6·67	33 0	93 8	154 7	193 1	1572 0
1 in 12½	1 in 11·29	1 in 8·38	1 in 6·95	34 4	97 7	161 1	201 2	1641 0
1 in 13	1 in 11·74	1 in 8 71	1 in 7·23	35 9	101 6	167 6	209 3	1775 0
1 in 14	1 in 12 64	1 in 9·38	1 in 7·88	38 6	109 4	180 5	225 5	2058 0
1 in 15	1 in 13 55	1 in 10·05	1 in 8·34	41 3	117 1	193 4	241 7	2363 0
1 in 16	1 in 14·46	1 in 10·73	1 in 8·90	44 0	124 11	206 3	257 9	2688 0
1 in 17	1 in 15·36	1 in 11·40	1 in 9·46	46 9	132 9	219 2	273 10	3035 0
1 in 18	1 in 16·27	1 in 12·07	1 in 10 02	49 6	140 7	232 1	290 0	3402 0

5′ 3″ Gauge Diagram No. 3.

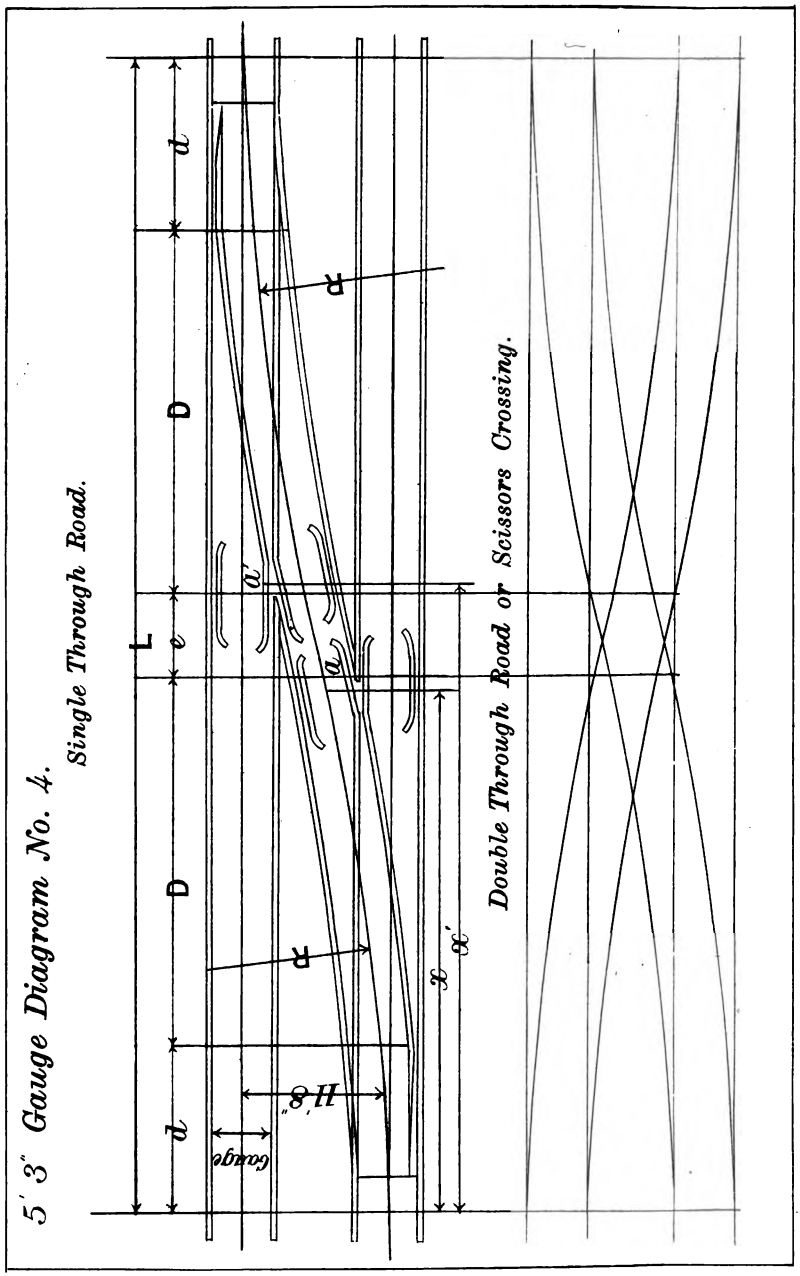


THREE THROWS.

5 ft. 3 in. Gauge. Table No. 3.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossings a a' Ft.	Ins.	K Heel of Switches to Nose of Crossing. b Ft.	Ins.	r Radius of Inside Curve. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 1¾	1 in 1·21	4	9½	13	8¼	8	6¼	16	3	32	6
1 in 2	1 in 1·39	5	5¾	15	7¾	9	8¼	21	0	42	0
1 in 2¼	1 in 1·57	6	2	17	6	10	10	26	9	53	6
1 in 2½	1 in 1·75	6	10¼	19	6½	11	11¾	33	0	66	0
1 in 2¾	1 in 1·93	7	6½	21	5¾	13	1¾	39	9	79	6
1 in 3	1 in 2·10	8	3	23	5¼	14	3½	47	6	94	6
1 in 3¼	1 in 2·28	8	11	25	5	15	5½	55	6	111	0
1 in 3½	1 in 2·46	9	7¼	27	4¼	16	7½	64	6	129	0
1 in 3¾	1 in 2·64	10	3½	29	3½	17	9½	74	0	148	0
1 in 4	1 in 2·82	11	0	31	2¾	18	11½	84	0	168	0
1 in 4¼	1 in 3·00	11	8	33	2½	20	2	95	0	190	0
1 in 4½	1 in 3·17	12	4½	35	1½	21	3½	107	0	213	0
1 in 4¾	1 in 3·34	13	0½	37	1½	22	6½	119	0	237	0
1 in 5	1 in 3·52	13	9	39	0½	24	8	132	0	263	0
1 in 5½	1 in 3·88	15	1½	42	11½	26	0½	159	0	318	0
1 in 6	1 in 4·23	16	5½	46	11	28	4½	189	0	378	0
1 in 6½	1 in 4·58	17	10½	50	9	30	8½	222	0	444	0
1 in 7	1 in 4·94	19	3	54	8	33	1	258	0	515	0

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossings. a a' Ft.	Ins.	K Heel of Switches to Nose of Crossing. b Ft.	Ins.	r Radius of Inside Curve. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 7½	1 in 5·29	20	7	58	7	35	5½	296	0	591	0
1 in 8	1 in 5·65	22	0	62	5½	37	9½	336	0	672	0
1 in 8½	1 in 6·00	23	4	66	5	40	2	380	0	759	0
1 in 9	1 in 6·36	24	9	70	3	42	6	426	0	851	0
1 in 9½	1 in 6·71	26	1	74	3	44	10	474	0	948	0
1 in 10	1 in 7·06	27	6	78	1	47	2	525	0	1050	0
1 in 10½	1 in 7·42	28	10	82	0	49	7	579	0	1158	0
1 in 11	1 in 7·77	30	3	85	11	51	11	636	0	1271	0
1 in 11½	1 in 8·12	31	7	89	10	54	3	695	0	1389	0
1 in 12	1 in 8·48	33	0	93	8	56	7	786	0	1572	0
1 in 12½	1 in 8·84	34	4	97	7	59	0	821	0	1641	0
1 in 13	1 in 9·19	35	9	101	6	61	4	888	0	1775	0
1 in 14	1 in 9·89	38	6	109	4	66	1	1029	0	2058	0
1 in 15	1 in 10·60	41	3	117	1	70	9	1182	0	2363	0
1 in 16	1 in 11·31	44	0	124	11	75	5	1344	0	2688	0
1 in 17	1 in 12·02	46	9	132	9	80	2	1518	0	3035	0
1 in 18	1 in 12·72	49	6	140	7	84	11	1701	0	3402	0



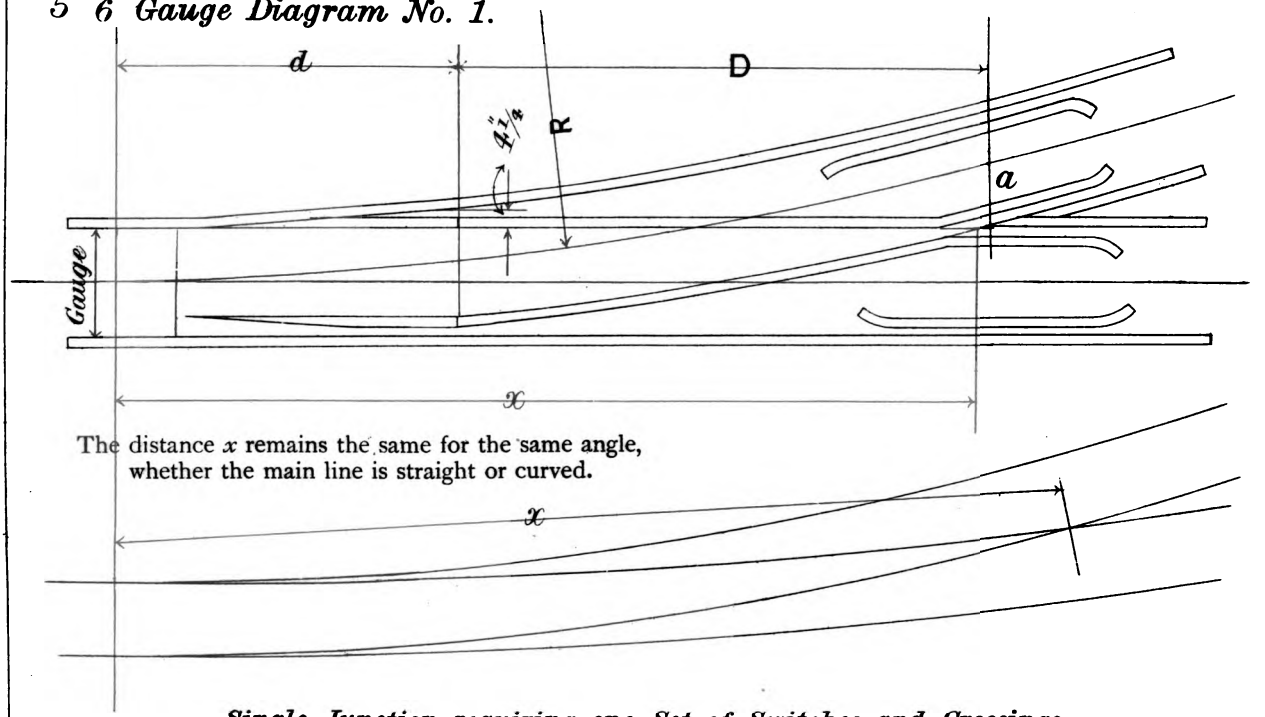
THROUGH ROAD.

5 ft. 3 in. Gauge. Table No. 4.

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	e Nose to Nose of Crossings. a a'	x Spring of Curve to intersection of Gauge Lines at Crossing a	x' Spring of Curve to intersection of Gauge Lines at Crossing a'	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	4 9½	13 8¼	...	18 4½	18 6	36 11	32 6
1 in 2	5 5¾	15 7¾	5	21 0	21 8	42 11	42 0
1 in 2¼	6 2	17 6	10½	23 7½	24 9	48 5	53 6
1 in 2½	6 10¼	19 6½	1 3½	26 3	27 10	54 1	66 0
1 in 2¾	7 6½	21 5¾	1 7¾	28 10½	30 10	59 8½	79 6
1 in 3	8 3	23 5¼	1 11¾	31 6	33 10	65 4	94 6
1 in 3¼	8 11	25 5	2 4	34 1½	36 10	70 11½	111 0
1 in 3½	9 7¼	27 4¼	2 8	36 9	39 10	76 7	129 0
1 in 3¾	10 3½	29 3½	2 11¾	39 4½	42 9½	82 2	148 0
1 in 4	11 0	31 2¾	3 3¼	42 0	45 9	87 9	168 0
1 in 4¼	11 8	33 2½	3 7	44 7½	48 8	93 4	190 0
1 in 4½	12 4½	35 1½	3 10½	47 3	51 8	98 11	213 0
1 in 4¾	13 0½	37 1½	4 2	49 10½	54 7	104 6	237 0
1 in 5	13 9	39 0½	4 5½	52 6	57 6	110 0	263 0
1 in 5½	15 1½	42 11½	5 0½	57 9	63 5	121 2	318 0
1 in 6	16 5½	46 11	5 7	63 0	69 3	132 4	378 0
1 in 6½	17 10½	50 9	6 2	68 3	75 2	143 5	444 0
1 in 7	19 3	54 8	6 8	73 6	81 0	154 5	515 0

Angle of Crossings a a'	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	e Nose to Nose of Crossings. a a'	x Spring of Curve to intersection of Gauge Lines at Crossing a	x' Spring of Curve to intersection of Gauge Lines at Crossing a'	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	20 7	58 7	7 3	78 9	86 11	165 7	591 0
1 in 8	22 0	62 5½	7 9	84 0	92 9	176 8	672 0
1 in 8½	23 4	66 5	8 4	89 3	98 7	187 9	759 0
1 in 9	24 9	70 3	8 10	94 6	104 5	198 10	851 0
1 in 9½	26 1	74 3	9 4	99 9	110 3	209 11	948 0
1 in 10	27 6	78 1	9 11	105 0	116 1	221 0	1050 0
1 in 10½	28 10	82 0	10 5	110 3	121 11	232 1	1158 0
1 in 11	30 3	85 11	10 11	115 6	127 9	243 2	1271 0
1 in 11½	31 7	89 10	11 6	120 9	133 7	254 3	1389 0
1 in 12	33 0	93 8	12 0	126 0	139 5	265 4	1572 0
1 in 12½	34 4	97 7	12 6	131 3	145 3	276 5	1641 0
1 in 13	35 9	101 6	13 0	136 6	151 1	287 6	1775 0
1 in 14	38 6	109 4	14 1	147 0	162 8	309 8	2058 0
1 in 15	41 3	117 1	15 1	157 6	174 4	331 10	2363 0
1 in 16	44 0	124 11	16 2	168 0	186 0	353 11	2688 0
1 in 17	46 9	132 9	17 2	178 6	197 8	376 1	3035 0
1 in 18	49 6	140 7	18 2	189 0	209 2	398 2	3402 0

5′ 6″ Gauge Diagram No. 1.



The distance *x* remains the same for the same angle, whether the main line is straight or curved.

Single Junction requiring one Set of Switches and Crossings.

SINGLE JUNCTIONS.

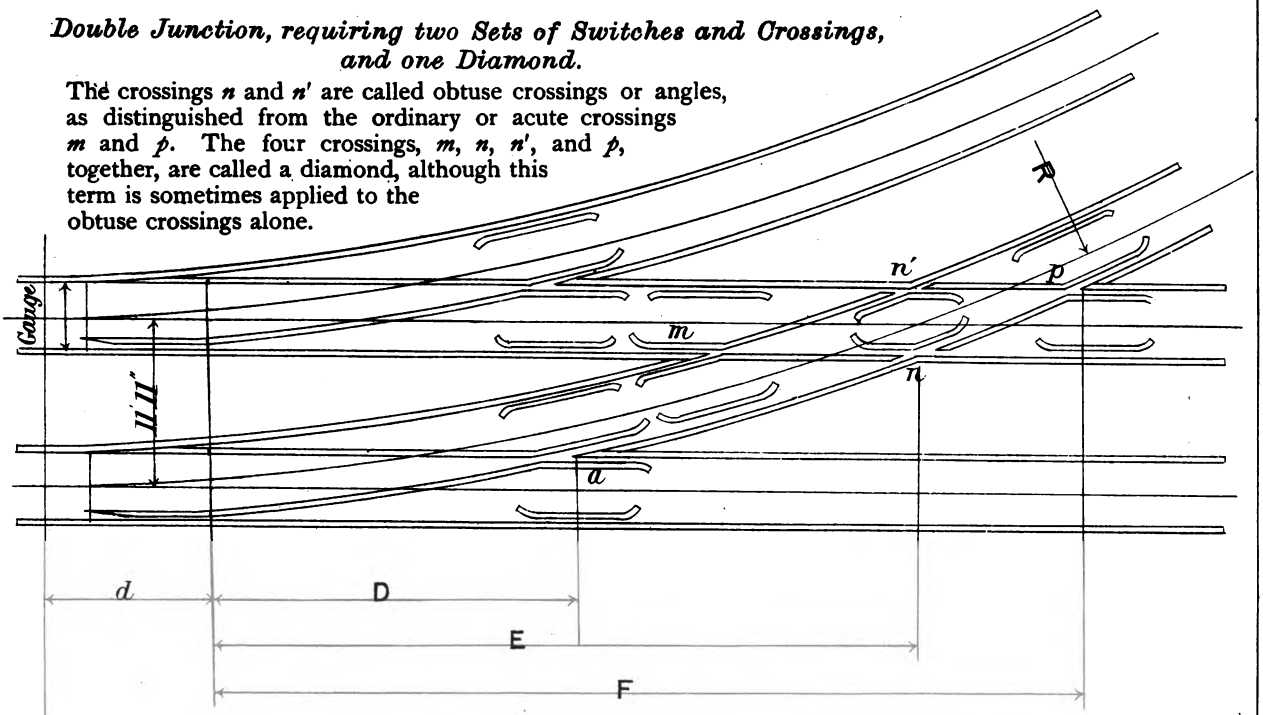
5 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.	Angle of Crossing. a In units.	Angle of Crossing. a In degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	f Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.
	Deg. Mins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		Deg. Mins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	31 52	4 10	14 6	19 3	34 0	1 in 7½	7 38	20 9½	62 2	82 6	619 0
1 in 2	28 4	5 6½	16 7	22 0	44 0	1 in 8	7 10	22 2	66 3½	88 0	704 0
1 in 2¼	25 4	6 2½	18 8	24 9	56 0	1 in 8½	6 44	23 7	70 5	93 6	795 0
1 in 2½	22 38	6 11	20 8¾	27 6	69 0	1 in 9	6 22	24 11	74 7	99 0	891 0
1 in 2¾	20 36	7 7½	22 9½	30 3	84 6	1 in 9½	6 2	26 4	78 9	104 6	993 0
1 in 3	18 54	8 3¾	24 10¼	33 0	99 0	1 in 10	5 44	27 9	82 10	110 0	1100 0
1 in 3¼	17 26	9 0	26 11	35 9	117 0	1 in 10½	5 26	29 1	87 0	115 6	1213 0
1 in 3½	16 16	9 8¼	29 0	38 6	135 0	1 in 11	5 12	30 6	91 0	121 0	1331 0
1 in 3¾	15 12	10 4¾	31 1	41 3	155 0	1 in 11½	4 58	31 11	95 3	126 6	1455 0
1 in 4	14 14	11 1	33 1¾	44 0	176 0	1 in 12	4 46	33 3	99 5	132 0	1584 0
1 in 4¼	13 26	11 9½	35 2½	46 9	199 0	1 in 12½	4 36	34 8	103 6	137 6	1719 0
1 in 4½	12 40	12 5½	37 3½	49 6	223 0	1 in 13	4 24	36 1	107 8	143 0	1859 0
1 in 4¾	12 2	13 2	39 4½	52 3	249 0	1 in 14	4 6	38 10	116 0	154 0	2156 0
1 in 5	11 26	13 10½	41 5	55 0	275 0	1 in 15	3 50	41 7	124 3	165 0	2475 0
1 in 5½	10 24	15 3	45 7	60 6	333 0	1 in 16	3 34	44 5	132 6	176 0	2816 0
1 in 6	9 32	16 7½	49 8½	66 0	396 0	1 in 17	3 22	47 2	140 10	187 0	3179 0
1 in 6½	8 48	18 0½	53 10	71 6	465 0	1 in 18	3 10	49 11	149 1	198 0	3564 0
1 in 7	8 10	19 5	57 11½	77 0	539 0						

5′ 6″ Gauge Diagram No. 2.

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n′* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n′*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



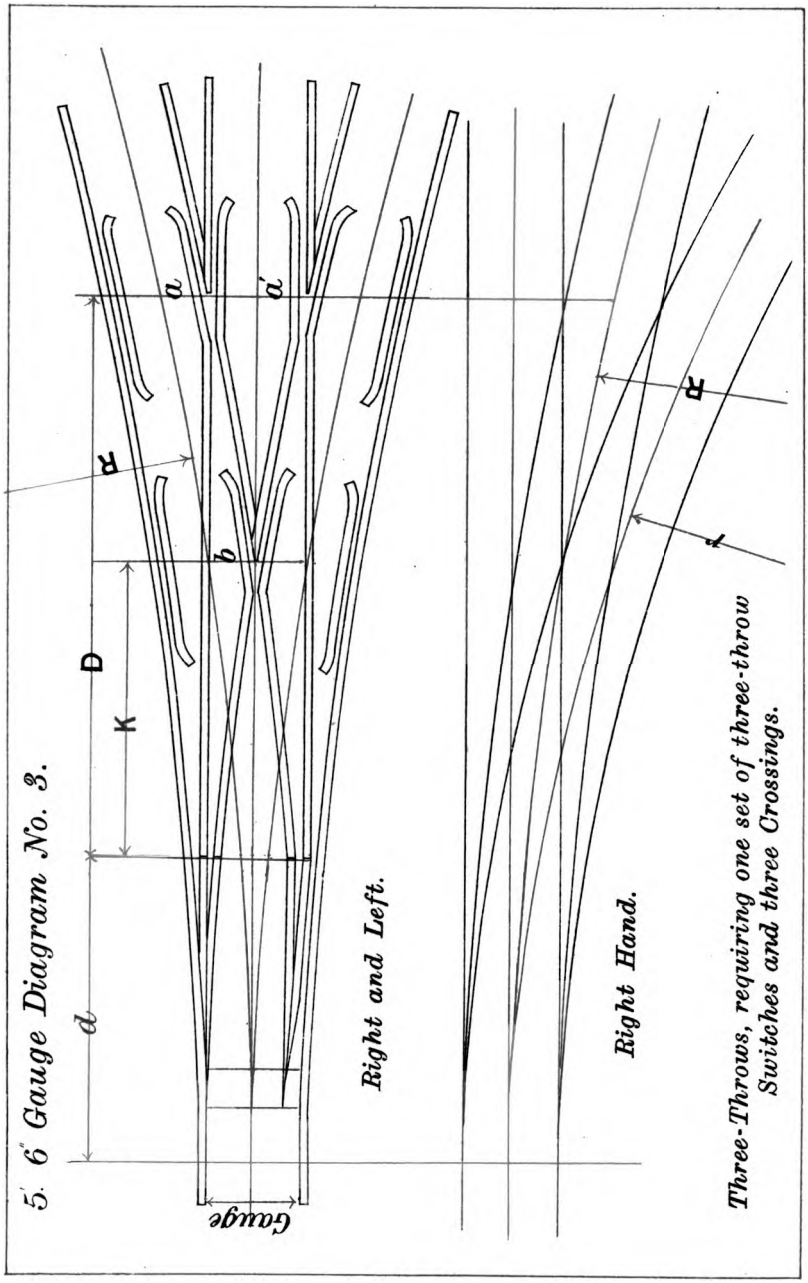
DOUBLE JUNCTIONS.

5 ft. 6 in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	E Heel of Switches to Knees o Crossing. n	F Heel of Switches to Nose of Crossing. p	R Radius of Curve.
					Ft. Ins	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	1 in 1·47	1 in 1·13	1 in 1·02	1 in 89	4 10	14 6	22 1	26 3	34 0
1 in 2	1 in 1·72	1 in 1·31	1 in 1·22	1 in 1·04	5 6¼	16 7	22 7½	30 10½	44 0
1 in 2¼	1 in 1·97	1 in 1·48	1 in 1·40	1 in 1·19	6 2½	18 8	29 1½	35 5¼	56 0
1 in 2½	1 in 2·21	1 in 1·66	1 in 1·59	1 in 1·34	6 11	20 8¾	32 7	39 11	69 0
1 in 2¾	1 in 2·45	1 in 1·83	1 in 1·77	1 in 1·49	7 7½	22 9½	36 0¼	44 3¾	84 6
1 in 3	1 in 2·69	1 in 2·00	1 in 1·95	1 in 1·63	8 3¾	24 10¼	39 5¼	48 8¼	99 0
1 in 3¼	1 in 2·93	1 in 2·17	1 in 2·12	1 in 1·78	9 0	26 11	42 10¼	53 0¼	117 0
1 in 3½	1 in 3·17	1 in 2·35	1 in 2·30	1 in 1·92	9 8¼	29 0	46 3¼	57 4¼	135 0
1 in 3¾	1 in 3·40	1 in 2·52	1 in 2·47	1 in 2 07	10 4¾	31 1	49 8	61 8	155 0
1 in 4	1 in 3·64	1 in 2·69	1 in 2·65	1 in 2·21	11 1	33 1¾	53 0¾	65 11¾	176 0
1 in 4¼	1 in 3·87	1 in 2·86	1 in 2·82	1 in 2·35	11 9½	35 2½	56 5½	70 3¼	199 0
1 in 4½	1 in 4·11	1 in 3·03	1 in 3·00	1 in 2·49	12 5½	37 3½	59 10	74 6½	223 0
1 in 4¾	1 in 4·34	1 in 3·21	1 in 3·17	1 in 2·64	13 2	39 4½	63 2½	78 9½	249 0
1 in 5	1 in 4·58	1 in 3·38	1 in 3·34	1 in 2·78	13 10½	41 5	66 7	83 0½	275 0
1 in 5½	1 in 5·05	1 in 3·72	1 in 3·69	1 in 3·06	15 3	45 7	73 4½	91 7	333 0
1 in 6	1 in 5·51	1 in 4·06	1 in 4·03	1 in 3·35	16 7½	9 8½	80 1¼	100 1	396 0
1 in 6½	1 in 5·98	1 in 4·40	1 in 4·37	1 in 3·63	18 0½	53 10	86 10	108 6½	465 0
1 in 7	1 in 6·44	4 in 4·74	1 in 4·72	1 in 3·91	19 5	57 11½	93 7	117 0½	539 0

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossings. n n'	Angle of Crossing. p	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	E Heel of Switches to Knees of Crossing. n	F Heel of Switches to Nose of Crossing. p	R Radius of Curve.
				Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	1 in 6·91	1 in 5·08	1 in 4·20	20 9½	62 2	100 3½	125 6	619 0
1 in 8	1 in 7·37	1 in 5 42	1 in 4·48	22 2	66 3½	07 0½	133 1½	704 0
1 in 8½	1 in 7·84	1 in 5 76	1 in 4·76	23 7	70 5	113 9	142 5	795 0
1 in 9	1 in 8·30	1 in 6·10	1 in 5·04	24 11	74 7	120 6	150 10	891 0
1 in 9½	1 in 8·77	1 in 6·44	1 in 5·32	26 4	78 9	127 3	159 4	993 0
1 in 10	1 in 9·23	1 in 6·78	1 in 5·60	27 9	82 10	133 11	167 9	1100 0
1 in 10½	1 in 9·70	1 in 7·12	1 in 5·89	29 1	87 0	140 8	176 3	1213 0
1 in 11	1 in 10·16	1 in 7·46	1 in 6·17	30 6	91 0	147 4	184 8	1331 0
1 in 11½	1 in 10·62	1 in 7·80	1 in 6·45	31 11	95 3	154 1	193 1	1455 0
1 in 12	1 in 11·09	1 in 8·14	1 in 6·73	33 3	99 5	160 9	201 6	1584 0
1 in 12½	1 in 11·55	1 in 8·48	1 in 7·01	34 8	103 6	167 6	209 11	1719 0
1 in 13	1 in 12·02	1 in 8·82	1 in 7·29	36 1	107 8	174 2	218 4	1859 0
1 in 14	1 in 12·94	1 in 9·50	1 in 7·86	38 10	116 0	187 8	235 3	2156 0
1 in 15	1 in 13·87	1 in 10·18	1 in 8·42	41 7	124 3	201 1	253 1	2475 0
1 in 16	1 in 14·80	1 in 10·86	1 in 8·98	44 5	132 6	214 6	268 11	2816 0
1 in 17	1 in 15·72	1 in 11·54	1 in 9·54	47 2	140 10	227 11	285 9	3179 0
1 in 18	1 in 16·65	1 in 12·22	1 in 10·11	49 11	149 1	241 4	302 8	3564 0

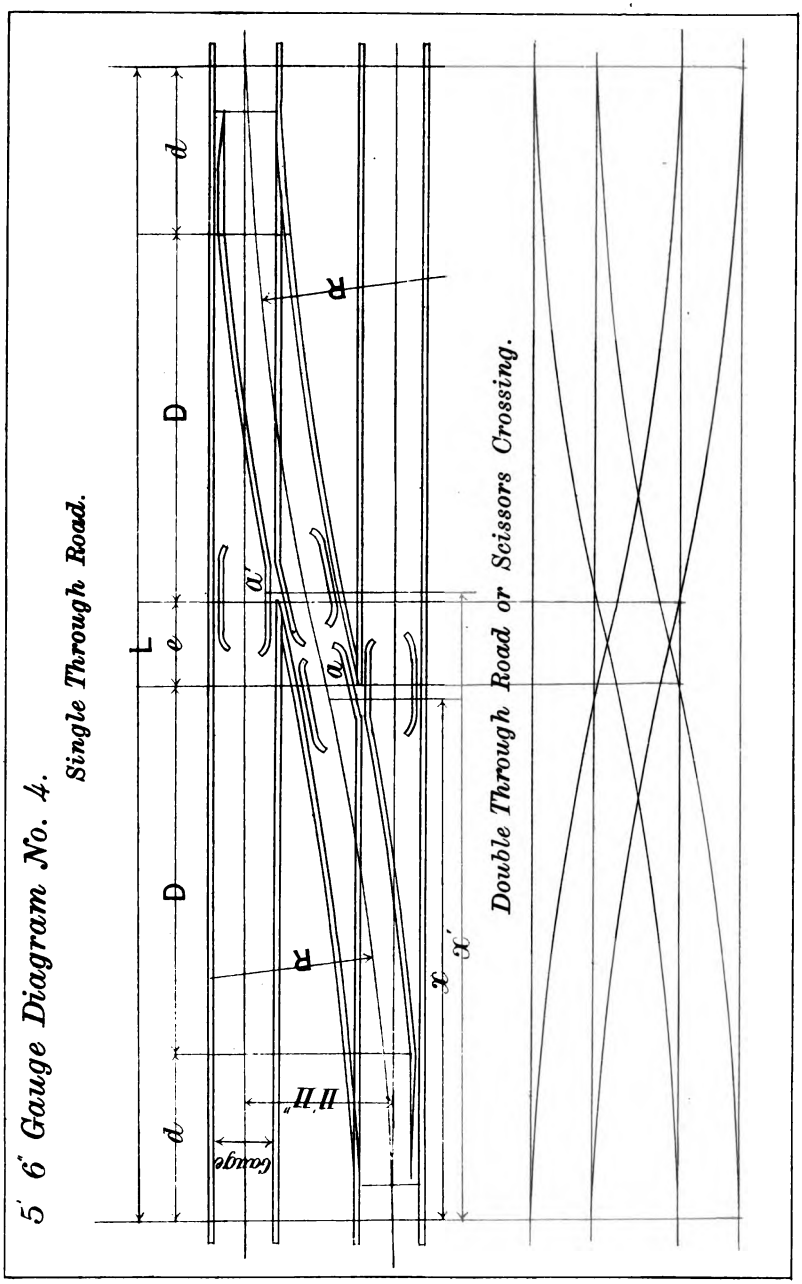
5′ 6″ Gauge Diagram No. 3.



THREE THROWS.

5 ft. 6 in. Gauge. Table No. 3.

Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a'	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a'	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
		Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.			Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1⅛	1 in 1·21	4 10	14 6	9 1	17 0	34 0	1 in 7½	1 in 5·29	20 9½	62 2	37 10⅛	310 0	619 0
1 in 2	1 in 1·39	5 6¼	16 7	10 4	22 0	44 0	1 in 8	1 in 5·65	22 2	66 3⅜	40 5	352 0	704 0
1 in 2¼	1 in 1·57	6 2⅛	18 8	11 7	28 0	56 0	1 in 8½	1 in 6·00	23 7	70 5	42 11	398 0	795 0
1 in 2½	1 in 1·75	6 11	20 8¾	12 9¾	34 6	69 0	1 in 9	1 in 6·36	24 11	74 7	45 6	446 0	891 0
1 in 2⅝	1 in 1·93	7 7⅛	22 9⅛	14 0⅝	42 6	84 6	1 in 9½	1 in 6·71	26 4	78 9	48 0	497 0	993 0
1 in 3	1 in 2·10	8 3⅝	24 10¼	15 3⅛	49 6	99 0	1 in 10	1 in 7·06	27 9	82 10	50 6	550 0	1100 0
1 in 3¼	1 in 2·28	9 0	26 11	16 6¼	58 6	117 0	1 in 10½	1 in 7·42	29 1	87 0	53 0	607 0	1213 0
1 in 3½	1 in 2·46	9 8½	29 0 ·	17 9⅜	67 6	135 0	1 in 11	1 in 7·77	30 6	91 0	55 6	666 0	1331 0
1 in 3⅝	1 in 2·64	10 4⅝	31 1	19 0¼	77 6	155 0	1 in 11½	1 in 8·12	31 11	95 3	58 0	728 0	1455 0
1 in 4	1 in 2·82	11 1	33 1⅜	20 3½	88 0	176 0	1 in 12	1 in 8·48	33 3	99 5	60 7	792 0	1584 0
1 in 4½	1 in 3·00	11 9⅛	35 2½	21 6½	99 6	199 0	1 in 12½	1 in 8·84	34 8	103 6	63 1	860 0	1719 0
1 in 4⅝	1 in 3·17	12 5⅛	37 3⅛	22 9⅛	112 0	223 0	1 in 13	1 in 9·19	36 1	107 8	65 7	930 0	1859 0
1 in 4¾	1 in 3·34	13 2	39 4⅛	24 1	124 0	249 0	1 in 14	1 in 9·89	38 10	116 0	70 8	1078 0	2156 0
1 in 5	1 in 3·52	13 10⅛	41 5	25 4	138 0	275 0	1 in 15	1 in 10·60	41 7	124 3	75 8	1238 0	2475 0
1 in 5⅛	1 in 3·88	15 3	45 7	27 10	167 0	333 0	1 in 16	1 in 11·31	44 5	132 6	80 9	1408 0	2816 0
1 in 6	1 in 4·23	16 7⅛	49 8⅛	30 4	198 0	396 0	1 in 17	1 in 12·02	47 2	140 10	85 9	1590 0	3179 0
1 in 6⅛	1 in 4·58	18 0⅛	53 10	32 10	233 0	465 0	1 in 18	1 in 12·72	49 11	149 1	90 10	1782 0	3564 0
1 in 7	1 in 4·94	19 6	57 11⅛	35 4⅛	270 0	539 0							



THROUGH ROAD.

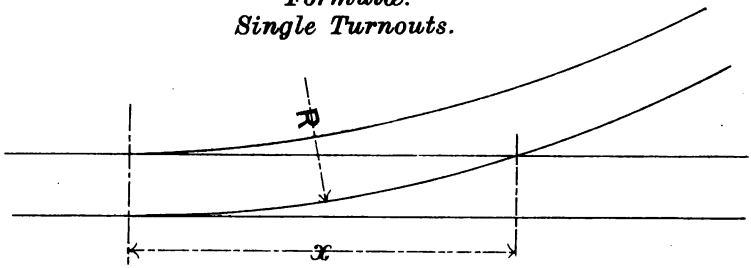
5 ft. 6 in. Gauge. Table No. 4.

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		e Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins	Ft.	Ins	Ft.	Ins	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	4	10	14	6	...		19	3	19	0	38	3	34	0
1 in 2	5	6¼	16	7	...		22	0	22	2½	44	2½	44	0
1 in 2¼	6	2½	18	8	4		24	9	25	4	50	1	56	0
1 in 2½	6	11	20	8¾	8		27	6	28	5½	55	11½	69	0
1 in 2¾	7	7½	22	9½	1	0¼	30	3	31	7	61	10	84	6
1 in 3	8	3¾	24	10¼	1	3½	33	0	34	7½	67	7½	99	0
1 in 3¼	9	0	26	11	1	6½	35	9	37	8	73	5	117	0
1 in 3½	9	8¼	29	0	1	9¾	38	6	40	8½	79	2½	135	0
1 in 3¾	10	4¾	31	1	2	1	41	3	43	9	85	0	155	0
1 in 4	11	1	33	1¾	2	4¼	44	0	46	9½	90	10	176	0
1 in 4¼	11	9½	35	2½	2	7	46	9	49	10	96	7	199	0
1 in 4½	12	5½	37	3½	2	10	49	6	52	10	102	4	223	0
1 in 4¾	13	2	39	4½	3	1	52	3	55	10	108	1	249	0
1 in 5	13	10½	41	5	3	3½	55	0	58	10½	113	10	275	0
1 in 5½	15	3	45	7	3	8½	60	6	64	10½	125	4	333	0
1 in 6	16	7½	49	8½	4	2	66	0	70	10½	136	10	396	0
1 in 6½	18	0½	53	10	4	7	71	6	76	10½	148	4	465	0
1 in 7	19	5	57	11½	5	0	77	0	82	10½	159	10	539	0

Angle of Crossings. a a'	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossings. a a'		e Nose to Nose of Crossings. a a'		x Spring of Curve to intersection of Gauge Lines at Crossing a		x' Spring of Curve to intersection of Gauge Lines at Crossing a'		L Spring of Curve to Spring of Curve.		R Radius of Curve.	
	Ft.	Ins	Ft.	Ins	Ft.	Ins	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	20	9½	62	2	5	5	82	6	88	10	171	4	619	0
1 in 8	22	2	66	3½	5	10½	88	0	94	10	182	10	704	0
1 in 8½	23	7	70	5	6	3	93	6	100	9	194	3	795	0
1 in 9	24	11	74	7	6	8	99	0	106	9	205	8	891	0
1 in 9½	26	4	78	9	7	1	104	6	112	8	217	2	993	0
1 in 10	27	9	82	10	7	6	110	0	118	8	228	8	1100	0
1 in 10½	29	1	87	0	7	11	115	6	124	8	240	2	1213	0
1 in 11	30	6	91	0	8	4	121	0	130	7	251	7	1331	0
1 in 11½	31	11	95	3	8	8	126	6	136	6	263	1	1455	0
1 in 12	33	3	99	5	9	1	132	0	142	6	274	6	1584	0
1 in 12½	34	8	103	6	9	6	137	6	148	5	285	11	1719	0
1 in 13	36	1	107	8	9	11	143	0	154	5	297	5	1859	0
1 in 14	38	10	116	0	10	9	154	0	166	4	320	4	2156	0
1 in 15	41	7	124	3	11	7	165	0	178	3	343	3	2475	0
1 in 16	44	5	132	6	12	4	176	0	190	2	366	2	2816	0
1 in 17	47	2	140	10	13	2	187	0	202	1	389	1	3179	0
1 in 18	49	11	149	1	13	11	198	0	214	0	412	0	3564	0

Formulæ.

Single Turnouts.

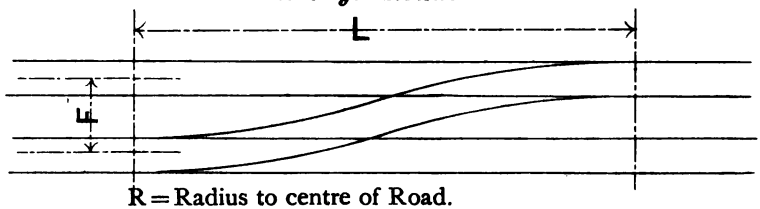


A = Angle of Crossing.
G = Gauge of Road.
R = Radius of Curve to Outside Rail.
x = Distance from Spring of Curve to intersection of Gauge Lines.

$$A = \sqrt{\frac{R}{2G} - \frac{1}{4}} \qquad R = 2G\,(A^2 + \tfrac{1}{4}) \qquad x = 2\,AG.$$

$$A = \frac{x}{2G} \qquad R = \frac{x^2}{2G} + \frac{G}{2}$$

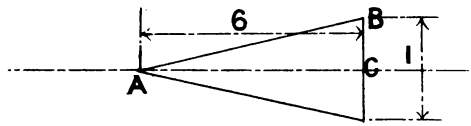
Through Roads.



R = Radius to centre of Road.
F = Distance, centre to centre of Roads.
L = Distance between springing of Curves.

$$L = 2\sqrt{RF - \frac{F^2}{4}} \qquad R = \frac{L^2}{4F} + \frac{F}{4}$$

These formulæ apply to angles measured as shown in the following diagram, which represents a 1 in 6 crossing.



The difference between measuring along the side A B, and along the centre A C, except for very obtuse angles (1 in $2\frac{1}{2}$ and under), is of no practical importance.

Table No. 6.

APPROXIMATE VERSED SINE, OR, SET OF RAIL AT CENTRE, FOR VARIOUS LENGTHS, AND RADII.

Radius in Feet.	Length of Rail in Feet. 18	21	24	27	30
	Inches.	Inches.	Inches.	Inches.	Inches.
30	$16\frac{1}{8}$	$21\frac{5}{8}$	$28\frac{3}{8}$	$35\frac{1}{2}$	44
35	$13\frac{7}{8}$	$18\frac{9}{16}$	$24\frac{1}{4}$	$30\frac{3}{8}$	$37\frac{5}{8}$
40	$12\frac{1}{8}$	$16\frac{1}{4}$	$21\frac{1}{4}$	$26\frac{5}{8}$	$32\frac{7}{8}$
45	$10\frac{13}{16}$	$14\frac{3}{8}$	$18\frac{7}{8}$	$23\frac{5}{8}$	$29\frac{1}{4}$
50	$9\frac{11}{16}$	13	17	$21\frac{1}{4}$	$26\frac{3}{8}$
55	$8\frac{13}{16}$	$11\frac{13}{16}$	$15\frac{3}{8}$	$19\frac{3}{8}$	24
60	$8\frac{1}{16}$	$10\frac{13}{16}$	$14\frac{1}{8}$	$17\frac{3}{4}$	22
65	$7\frac{7}{16}$	10	$13\frac{1}{8}$	$16\frac{3}{8}$	$20\frac{1}{4}$
70	$6\frac{15}{16}$	$9\frac{1}{4}$	$12\frac{3}{16}$	$15\frac{1}{4}$	$18\frac{3}{4}$
75	$6\frac{1}{2}$	$8\frac{11}{16}$	$11\frac{5}{16}$	$14\frac{1}{4}$	$17\frac{1}{2}$
80	$6\frac{1}{16}$	$8\frac{1}{8}$	$10\frac{5}{8}$	$13\frac{3}{8}$	$16\frac{1}{2}$
85	$5\frac{11}{16}$	$7\frac{5}{8}$	10	$12\frac{1}{2}$	$15\frac{1}{2}$
90	$5\frac{3}{8}$	$7\frac{3}{16}$	$9\frac{7}{16}$	$11\frac{13}{16}$	$14\frac{5}{8}$
100	$4\frac{13}{16}$	$6\frac{1}{2}$	$8\frac{1}{2}$	$10\frac{11}{16}$	$13\frac{1}{8}$
110	$4\frac{3}{8}$	$5\frac{7}{8}$	$7\frac{3}{4}$	$9\frac{11}{16}$	12
120	$4\frac{1}{16}$	$5\frac{7}{16}$	$7\frac{1}{16}$	$8\frac{7}{8}$	11

Radius in Feet.	Length of Rail in Feet. 18	21	24	27	30
	Inches.	Inches.	Inches.	Inches.	Inches.
130	$3\frac{3}{4}$	5	$6\frac{1}{2}$	$8\frac{3}{16}$	$10\frac{1}{8}$
150	$3\frac{1}{4}$	$4\frac{5}{16}$	$5\frac{11}{16}$	$7\frac{1}{8}$	$8\frac{3}{4}$
175	$2\frac{3}{4}$	$3\frac{11}{16}$	$4\frac{7}{8}$	$6\frac{1}{16}$	$7\frac{1}{2}$
200	$2\frac{7}{16}$	$3\frac{1}{4}$	$4\frac{1}{4}$	$5\frac{5}{16}$	$6\frac{9}{16}$
250	$1\frac{15}{16}$	$2\frac{5}{8}$	$3\frac{3}{8}$	$4\frac{1}{4}$	$5\frac{1}{4}$
300	$1\frac{5}{8}$	$2\frac{3}{16}$	$2\frac{13}{16}$	$3\frac{9}{16}$	$4\frac{3}{8}$
350	$1\frac{3}{8}$	$1\frac{7}{8}$	$2\frac{7}{16}$	$3\frac{1}{16}$	$3\frac{3}{4}$
400	$1\frac{3}{16}$	$1\frac{5}{8}$	$2\frac{1}{4}$	$2\frac{11}{16}$	$3\frac{5}{16}$
450	$1\frac{1}{16}$	$1\frac{7}{16}$	$1\frac{7}{8}$	$2\frac{3}{8}$	$2\frac{15}{16}$
500	$\frac{15}{16}$	$1\frac{5}{16}$	$1\frac{11}{16}$	$2\frac{1}{8}$	$2\frac{5}{8}$
550	$\frac{7}{8}$	$1\frac{3}{16}$	$1\frac{9}{16}$	$1\frac{15}{16}$	$2\frac{3}{8}$
600	$\frac{13}{16}$	$1\frac{1}{16}$	$1\frac{3}{8}$	$1\frac{3}{4}$	$2\frac{3}{16}$
800	$\frac{5}{8}$	$\frac{13}{16}$	$1\frac{1}{16}$	$1\frac{5}{16}$	$1\frac{5}{8}$
1000	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{7}{8}$	$1\frac{1}{16}$	$1\frac{5}{16}$
2000	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$
3000	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$

Formula for Versed Sines as above :—$V = \frac{C L^2}{R}$

V = Versed Sine. L = Length of Rail in Feet.
C = Constant. R = Radius of Curve in Feet.

Value of C { for 18 feet rails = 1·5. ,, 21 to 24 feet rails = 1·47. ,, 27 to 30 feet rails = 1·46.

Table No. 7.

TABLE GIVING SUPER-ELEVATION OF OUTER RAIL ON CURVES FOR VARIOUS RADII AND SPEEDS.

Radius of Curve in Feet.	2 Ft. 0 In. Gauge.					2 Ft. 6 In. Gauge.					3 Ft. 0 In. Gauge.					3 Ft. 3⅜ In. Gauge.					3 Ft. 6 In. Gauge.					4 Ft. 8½ In. Gauge.					5 Ft. 3 In. Gauge.					5 Ft. 6 In. Gauge.				
	Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hour.					Speed of Train in Miles per hous.				
	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50	10	20	30	40	50
20	2¾																																						
30	2¾					3⅜																																	
40	2 11/16					3⅜					4					4⅜										6¼					7					7 5/16				
50	2⅛					2 11/16					3 1/16					3½					3¾					5					5⅝					5⅞				
60	1¾					2 3/16					2 11/16					2⅞					3⅛					4 13/16					4⅝					4⅞				
90	1 3/16					1½					1¾					1 15/16					2 1/16					2⅛					3⅛					3¼				
120	⅞					1⅛					1 5/16					1 7/16					1 9/16					1⅝					2 5/16					2 7/16				
150	¾	2 13/16				⅞					1 1/16					1 3/16					1 1/4					1 1/16					1⅞					1 15/16				
200	9/16	2⅛				11/16	2 5/8				13/16	3 3/16				⅞	3½				15/16	3¾				1 1/16	5				1 5/16	5 9/16				1½	5 7/8			
300	⅜	1 7/16				7/16	1¾				9/16	2⅛				15/16	2 5/16				1 1/16	2½				1 5/16	3⅜				1 11/16	3¾				1	3⅞			
400	¼	1 1/16	2⅜			⅜	1 5/16	3			7/16	1⅝	3 15/16			7/16	1¾	3 15/16			9/16	2 1/16	4 3/16			1 11/16	2½	5⅝			2 1/16	2 13/16	6 5/16			¾	2 15/16	6 9/16		
600	3/16	¾	1 5/8	2 13/16		¼	⅞	2			5/16	1 3/16	2 5/8			¼	1	2 5/8			5/16	1 1/4	2 13/16	3¾	6 11/16	1/16	1 11/16	3¼	6 11/16		½	1⅞	4 3/16			½	1 15/16	4 3/8		
800	1/8	½	1 3/16	2 1/8		3/16	11/16	1½	2 11/16		1/16	1	1 15/16	3½		3/16	¾	1 15/16	3½		1/16	1	2 1/4	4	5	1/16	1	2 1/4	4	5	⅜	1⅜	3 1/8	5 1/16		⅜	1½	3 5/16	5⅞	
1000	1/8	1/4	15/16	1 11/16	2 11/16	1/8	1/4	3/16	2⅛		1/16	3/8	1 13/16	2 13/16		1/16	3/8	1 13/16	2 13/16		1/16	1/4	1 7/16	2 13/16	4	6¼	1/16	1/4	1 7/16	2 13/16	4	¼	1⅛	2½	4 7/16	7	¼	1	2 3/8	4 11/16	7 5/16
2000	1/16	1/4	½	⅞	1 5/16	1/16	1/4	9/16	1 1/16	1⅛	1/16	5/16	¾	1 7/16	2 3/16	1/8	3/8	¾	1 3/8	2 3/16	1/8	3/8	¾	1 3/8	2 3/16	1/8	½	¾	1 3/8	2⅛	1/8	3/16	1/4	2¼	3½	1/8	1/4	3/8	1 3/16	2 3/16
3000	1/16	3/16	5/16	9/16	1 5/16	1/16	3/16	3/8	11/16	1⅛	1/16	3/16	½	1 7/16	2 3/16	1/16	1/4	½	1 5/16	2 3/16	1/16	1/4	½	1 5/16	2 3/16	1/16	3/8	½	1 5/16	2 3/16	1/16	3/16	3/8	1 3/16	2 5/16	1/16	3/16	3/8	7/8	2 7/16