Australian Model Railway Association

Minimum track radius standard

Version 2.0
February 2009

Aim

The aim of this standard is to provide a set of practical dimensions that will give the model railway builder a minimum track radius suitable for reliable operation of locomotives and rolling stock without the need for excessive deviation from prototype vehicle dimensions.

Definitions

Vehicle: Any railway or tramway locomotive, wagon or carriage.

Fixed axles: Axles that do not swivel in the horizontal plane.

Radial axle: An axle supported in curved guides to allow horizontal curved movement.

Bogie: A frame that swivels in the horizontal plane holding 1 or more axles. Also called a truck.

Wheel base: The distance from centre to centre of axles.

Wide swing coupling: Couplings allowing unrestricted end movement of vehicle on minimum radius curves.

Restricted swing couplings: Couplings with end movement that is less than the width of the vehicle.

Unrestricted swing bogie: A bogie that can rotate in the horizontal plane at least 45 degrees from the centre line of the vehicle.

Reverse curve: 2 joined curves diverging in opposite directions.

Procedure

Identify the largest vehicle of each type.
Calculate minimum radii using the formulae A, B and C.
Use the largest resultant radius of formulae A, B or C as the minimum radius.
Calculate reverse curve radius using minimum radius resultant using formula D.

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Formula A: Use for bogie vehicles with restricted swing couplers and 4 wheel vehicles with restricted swing couplers

R= 3xL

Where
R= Minimum track radius
L= Length of body of railway vehicle

Formula B: Use for vehicles with 3 or more fixed axles with or without leading or trailing bogies and for vehicles with 2 fixed axles with leading or trailing bogies.

R= 5xL

Where
R= Minimum track radius
L= Length of body of railway vehicle

Formula C: Use for 2 axle vehicles with wide swing couplers and for unrestricted swing 2 axle bogie vehicles using wide swing couplers

R= 5xW

Where
R= Minimum track radius
W= Wheel base of single bogie or wheel base of 2 axle vehicle

Formula D: Use for reverse curves

Rt= 1.2xR

Where
Rt= Minimum track radius for reverse curves
R= Minimum track radius calculated using formula A B or C

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Notes

1. The resultant radii in the formulae above are less than the minimum prototype radius curve in most cases and are not suitable for models using scaled hook and link couplings relying on buffers. If using these couplers the minimum radius curve should be that of the prototype to avoid buffers locking.
2. Radial axles shall be considered for calculation purposes as fixed axles.
3. For articulated vehicles, each section is to be treated as a separate vehicle for calculation purposes.
4. For calculation purposes a reverse curve includes reverse curves joined by a tangent or transition curve that is less than the length of the longest vehicle.

Worked examples

Example 1

A 1:160 scale club layout is to be designed to allow large prototypes. The longest vehicles members own are selected to calculate the minimum radius. The longest bogie vehicle is a passenger carriage, 170mm in 1:160 scale. Using formula A the minimum radius is 170mm x 3 = 510mm. The longest steam locomotive club members have is a Union Pacific Big Boy, it's boiler and cab section is 148mm long in 1:160 scale. This locomotive has fixed axles on the boiler section as per the prototype, therefore formula B is used. Using formula B the minimum radius is 148m x 5 = 740mm. Therefore the minimum radius for our layout is the largest result, 740mm. The minimum radius for a reverse curve is calculated using formula D, 740mm x 1.2mm = 888mm.

Example 2

A steam era NSW mainline prototype layout is to be built in 1:87.1 scale. The longest bogie vehicle is 263mm in 1:87.1 scale. Using formula A the minimum radius is 263mm x 3 = 789mm. The longest non articulated NSW steam locomotive is 165mm in 1:87.1 scale. (The articulated sections of the NSW Garratt are shorter). Using formula B the minimum radius is 165mm x 5 = 825mm. Therefore the minimum radius for our steam era NSW prototype H0 gauge layout is the largest result, 825mm. The minimum radius for a reverse curve is calculated using formula D, 825mm x 1.2mm = 990mm.

Example 3

A model street tram layout is to be built in 1:32 scale. All the trams have wide swing couplers, and have only 2 axle bogies or 2 fixed axles, therefore formula C is selected. The longest wheel base to be run is 95mm. Using formula C the minimum radius is 95mm x 5 = 476mm. Therefore the minimum radius for our 1:32 scale tram way is 476mm. The minimum radius for a reverse curve is calculated using formula D, 476mm x 1.2mm = 571mm