

1. Purpose of the standard

The use of longitudinal track gradients on model railway layouts serves to overcome height differences, usually for the purpose of level-free crossing of tracks or superstructure of track systems with other tracks.

The gradient values (1 : n or in ‰ or %) must be limited upwards in order to be able to move the intended trains with the available traction equipment.

The immediate driving safety is not directly affected by this.

The rounding radii r_a , which can also be represented as rounding lengths depending on the gradient difference, must be limited downwards in order to prevent wheels from lifting beyond their existing (sprung) height clearance so that sufficient safety against derailment and traction capability are maintained.

Inclination changes in roll-of humps, ferry docks and other special cases are not covered by this standard.

2. Longitudinal gradients

Applicable inclinations depend on the interplay between the load of the trains to be run and the traction capacity of the traction units and can and should be tested with typical vehicles.

Narrow radii in inclined tracks increasingly reduce the train load that can be carried. Therefore, the recommended limit values for inclinations should not be reached in tight curves (or vice versa).

Limiting the maximum permissible longitudinal gradients serves to maintain a certain closeness to the prototype and provides the vehicle manufacturer with reference points for the drive design.

For station tracks on which trains without traction units are to remain stationary or which are used to park vehicles without traction, the maximum permissible longitudinal gradient should prevent the vehicles from rolling independently, unless longitudinal gradients can be dispensed with entirely.

Table 1: Recommended maximum longitudinal gradient

	Standard gauge		Narrow gauge	
	‰ / %	1 :	‰ / %	1 :
for branch lines	30 / 3.0	33	40 / 4.0	25
for main lines	25 / 2.5	40	33 / 3.3	30
for tracks in stations	4 / 0.4	250	5 / 0.5	200

3. Rounding of the slope changes

Differences in gradient of less than 1 ‰ do not need to be rounded off.

The track break points of such crests only need to be ground slightly.

At the break points of such troughs, the track can easily lift off the track board at the bend point over a short length.

G is the track gauge according to NEM 010 as a calculation factor.

Table 2: Rounding values for inclination changes:

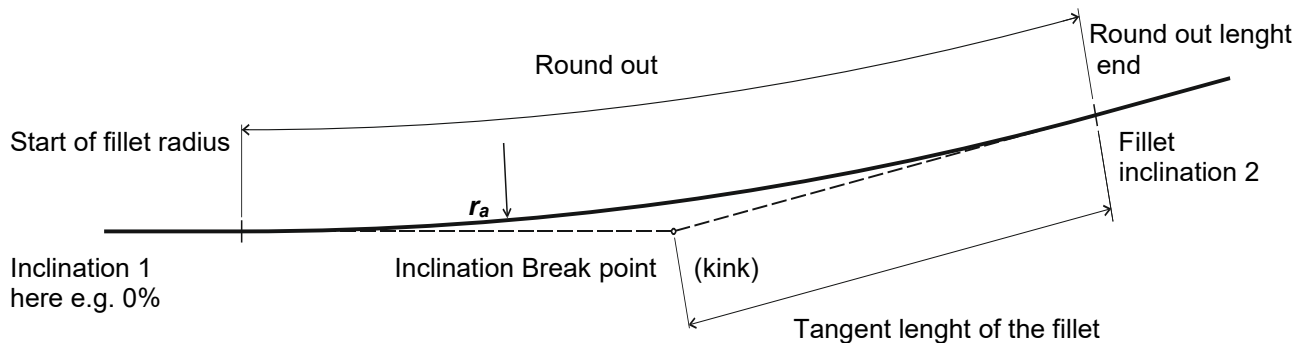
	r_{amin} generally	Inclination kink		
		2.0% = 1:50	2.5 % = 1:40	4.0 % = 1:25
Minimum fillet radius	300 G			
Minimum fillet lenght		6 G	7.5 G	12 G
Recommended minimum values				
- for branch lines	500 G	10 G	12.5 G	20 G
- for main lines	700 G	14 G	17.5 G	28 G

Values not mentioned can be interpolated or extrapolated, even towards 0%.

Inclination changes that do not connect an inclination with a horizontal can be considered together, whereby the fillet length is then to be determined from the sum of the two inclination values.

The same results if the two individual fillets are placed directly next to each other.

For changes in inclination, where only the amount of inclination changes but not the direction of the inclination, the difference between the two inclinations is used to determine the fillet length.



The minimum values of the fillet lengths and thus the fillet radii realised therein should ensure safe driving on the changes of inclination.

The vehicle manufacturers are required to design the vehicles to be suitable in terms of the vertical mobility of the non-supporting wheelsets, the vertical mobility of the couplings and the mobility of the gangway equipment (bellows, rubber beads, etc.).

The recommended larger roundings serve to make the design more prototypical and the vehicle run more elegantly, as well as keeping a sensible distance from the limit values.

4. Production of the fillets

For the realisation of curves of the inclination changes, the use of a continuous track board is recommended, which inserts itself into the desired bend.

For this purpose, the track board must continue for a certain length on both sides into the flat position in order to fix it in these flat sections without bending, e.g. by means of a stable longitudinal strip underneath. In the fillet length, the track board floats freely and thus fits into the specified bend. The radius is formed with sufficient accuracy by maintaining the fillet length corresponding to the difference in inclination.

The appropriate thickness of the track board must be determined by testing.

For simple conditions, especially when using solid track sections, a fillet can be replaced by several kinks between the track sections instead of the track bend if necessary. The bends should not provide more than 1% difference in gradient and the (not vertically bent) track sections in between should not be shorter than 6 x **G**, but preferably 10 x **G** long. The minimum length results in an acceptable mediation of the inclinations, which corresponds to a radius of curvature of approx. 600 x **G**.