Recommendation **Dimensions in mm** **Edition 2016**
(First English Edition)

1. Purpose and Terms

The immediate attachment of an arc onto a straight or onto a counter arc affects passing vehicles through

- a sideways jolt through the sudden directional change as well as
- a counter displacement of the neighboring vehicle ends

In order to minimize these disturbing occurrences it is recommended to install transition curves (TC) on open track and in the through tracks of stations.

The TC is a curve of steadily changing radius, beginning at infinite radius at the transition from the straight, down to the radius of the connected curve.

TCs are especially advantageous on curves with small radius, whereas one can forgo TCs on curves with a radius of > 60 G [1], [2].

2. Description

One half of the TC replaces a corresponding length of straight as well as curve.

For the connection of the TC to the straight and to the curve we

- either offset the straight by a value of ***f*** (Figure 1)
- or reduce the radius of the curve by a value of ***f*** (Figure 2).

Figure 1:

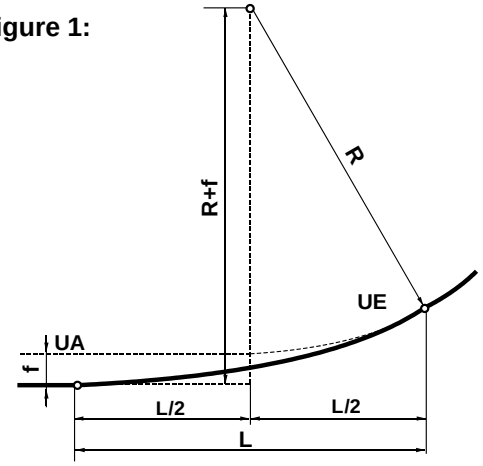
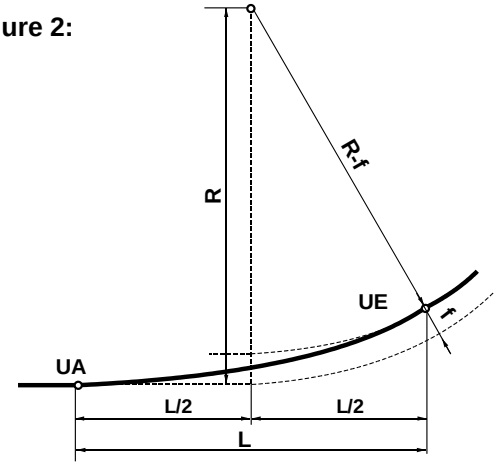


Figure 2:



Counter arcs with TC can connect to each other directly without needing an intermediate straight.

If super-elevation is intended in the track curve, pay attention to NEM 114.

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[1] G = Gauge

[2] This simplification is not valid when applying NEM 111, section 3.2.

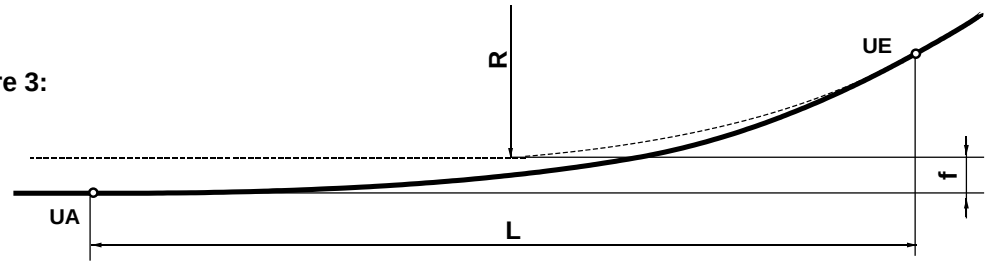
3. Dimensions

The characteristic dimensions of the TC are, in accordance with Figure 3

L = Length of the TC,

f = Offset of the straight or reduction of the radius

Figure 3:



In order to determine the combination of values of ***L*** and ***f*** for a particular arc of radius ***R***, two methods are presented.

3.1 Applying recommended values

With this method, a constant value of ***f*** is determined per Table 1 for each gauge.

Table 1:

Gauge **G**	6.5	9	12	16.5	22.5	32	45	64
Value **f**	3	4	6	9	13	18	25	36

The TC length, ***L***, can be computed with the formula

$$L = \sqrt{f \bullet 24\ R}$$

or can be read from Table 2 for selected arc radii:

Table 2:

G \ R	150	175	200	250	300	350	400	500	600	700	800	1000	1200	1400	1600	2000	2500	3000
6.5	100	110	120	135	145	160												
9		130	140	155	170	185	195	220										
12				190	210	225	240	270	295	320								
16.5						275	295	330	360	390	415	465						
22.5								395	430	465	500	560	610	660				
32										550	590	655	720	780	830	930	1040	1140
45												775	850	915	980	1095	1225	1340
64														1100	1175	1315	1470	1610

3.2 Applying arbitrary TC lengths

The TC length, ***L***, can be selected feely and independent of arc radius under the following conditions:

- ***L*** must be smaller than ***R***, ideally < 0.8 ***R***,
- ***L*** should be no less than the length of the longest passing vehicle.

The value ***f*** is computed per Table 3, dependent on the ratio ***L*** **:** ***R***.

Table 3:

L/R	< 0.6	0.6 – 0.8	> 0.8 (avoid)
f	$\frac{L^2}{24\ R}$	$\frac{L^2}{23\ R}$	$\frac{L^2}{22\ R}$

4. Implementation [3)]

After the values ***L*** and ***f*** have been determined, one can mark the endpoints of the TB ***UA*** and ***UE*** by

- drawing a line parallel to the straight at its determined final location, at a offset of $y_E = 4\ f$, which intersects the arc at the point UE (Figure 4),

- the TC length, L, with the straight at its determined position, measured back from the perpendicular from point UE, determines point UA.

For depiction of the TC on can choose between two methodologies:

4.1 Construction via intermediate points

The intermediate values y_i are computed as part of the end value y_E from Table 4.

Figure 4:

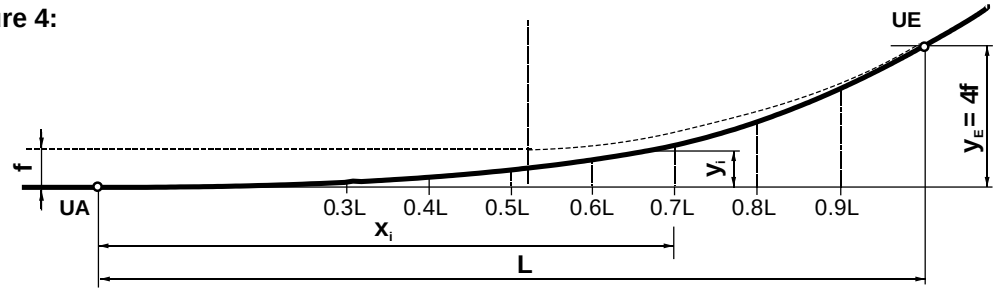


Table 4:

x_i	0	0.3 L	0.4 L	0.5 L	0.6 L	0.7 L	0.8 L	0.9 L	1.0 L
y_i	0	0.03 y_E	0.06 y_E	0.125 y_E = 0.5 f	0.21 y_E	0.33 y_E	0.49 y_E	0.72 y_E	1.0 y_E = 4 f

Examples: Given: Gauge G = 16.5 und Arc radius R = 600

Method 3.1		**Method 3.2**	
Value ***f*** per Table 1:	**f** = 9	Chosen TC length:	**L** = 0,7 **R** = 420
TC length per Table 2:	**L** = 360	Value ***f*** per Table 3:	$\mathbf{L}^2$ / 23 **R** ≈ 13
End value:	y_E = 4 **f** = 36	End value:	y_E = 4 **f** = 52

Computation of the values y_i for the intermediate point x_i = 0.7 L (Table 4):

$x_i = 0.7 \cdot 360 = 252$	$x_i = 0.7 \cdot 420 = 294$
$y_i = 0.33 \cdot 36 \approx 12$	$y_i = 0.33 \cdot 52 \approx 17$

(similarly for other intermediate points)

Note:
For smaller gauges it is generally sufficient to mark the intermediate points at 0.3 / 0.5 / 0.7 ***L***.

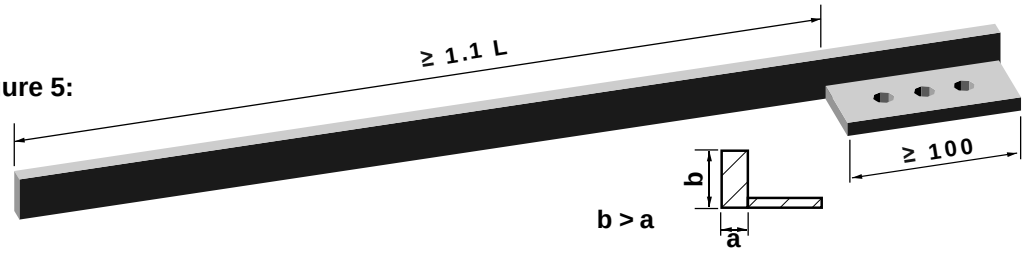
[3)] Because railroad modelers will generally limit themselves to a selected set of arc radii, it is recommended that one make a template for the required TC using one of the described methods.

4.2 Utilization of a flexible guide

The TC can be drawn with a flexible guide prepared per Figure 5. Best suited is a rectangular elastic metal bar which naturally returns to its original position, of dimensions approximately that of the rail profile.

The end of the guide is reinforced with a plate, which simultaneously serves as a way to affix it to the underlayment.

Figure 5:



The guide is laid tangential to the arc at point UE and affixed via the plate to the underlayment. By bending the guide toward point UA one obtains an arc that can be traced to draw the TC (Figure 6).

Figure 6: