Recommendation **Dimensions in mm** **Edition 2013** (20170903)
(First English Edition)

1. General Information

The recommendations contained within this standard serve as construction aids for the dimensioning of tunnel profiles. They produce tunnel profiles suited to the conditions, especially for difficult circumstances such as tight radius curves or large track spacing.

Preferably one should place tunnel portals on straights or on such track curves where there is little to no need to expand the clearance areas defined by NEM 103, in order to avoid the use of tunnel openings that appear overly large.

The tunnel walls should be modelled at a minimum in the visible areas inside of a tunnel opening.

The size of the tunnel profile is determined by

- mode of operation (with or without overhead operation),
- the curve radius,
- the length of deployed rolling stock and
- the track spacing on multi-track stretches.

To determine the dimensions we also consider the following:

NEM 102 – Area Clearance on Straight Track,

NEM 103 – Area Clearance on Curved Track,

NEM 112 – Track Spacing.

With rectangular tunnels, narrow side spaces are considered between the tunnel wall and the perimeter of the area clearance, which are typically present among the prototype for safety space or fixtures. With vaulted tunnels these side spaces are created through the vaulting.

With layout of modern era tunnels such as after epoch V, which are mostly circular in cross-section, one can recreate the relatively large safety space by enlarging the prototype profiles.

It is recommended that with overhead operation, the overhead wire be run in the lowest position permissible according to NEM 201.

The cross-sections recommended in this standard must be extended upwards where appropriate for the chosen overhead line design (assembly height).

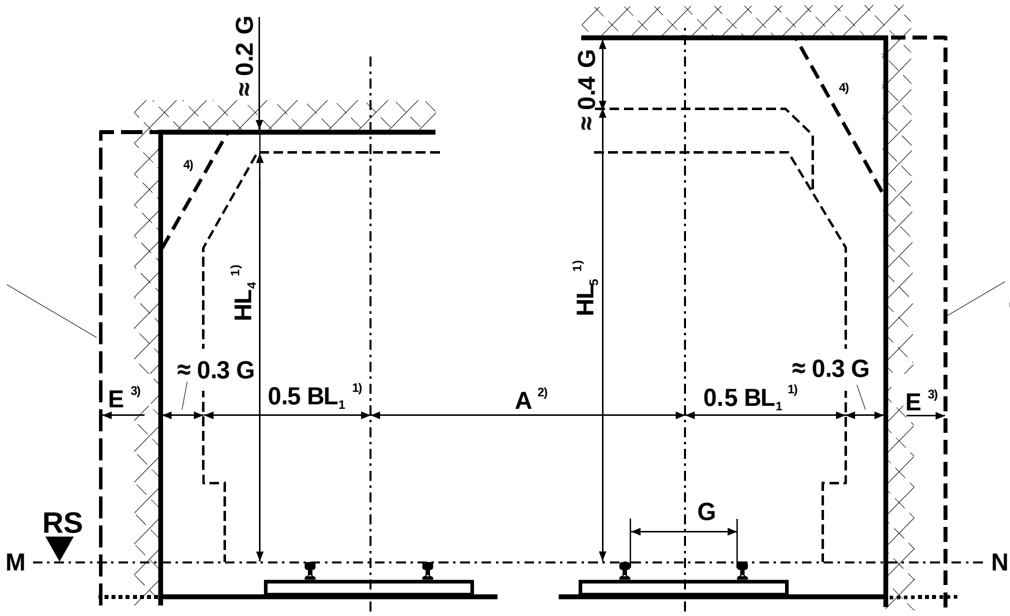
A curve dependent expansion of the area clearance addition in order to account for pantographs is not necessary (see NEM 202).

The profiles for rectangular tunnels are also applicable for bridge crossings.

The depicted tunnel profiles allow for the eventual superelevation in curves according to NEM 114.

2. Depiction

2.1 Rectangular Tunnel



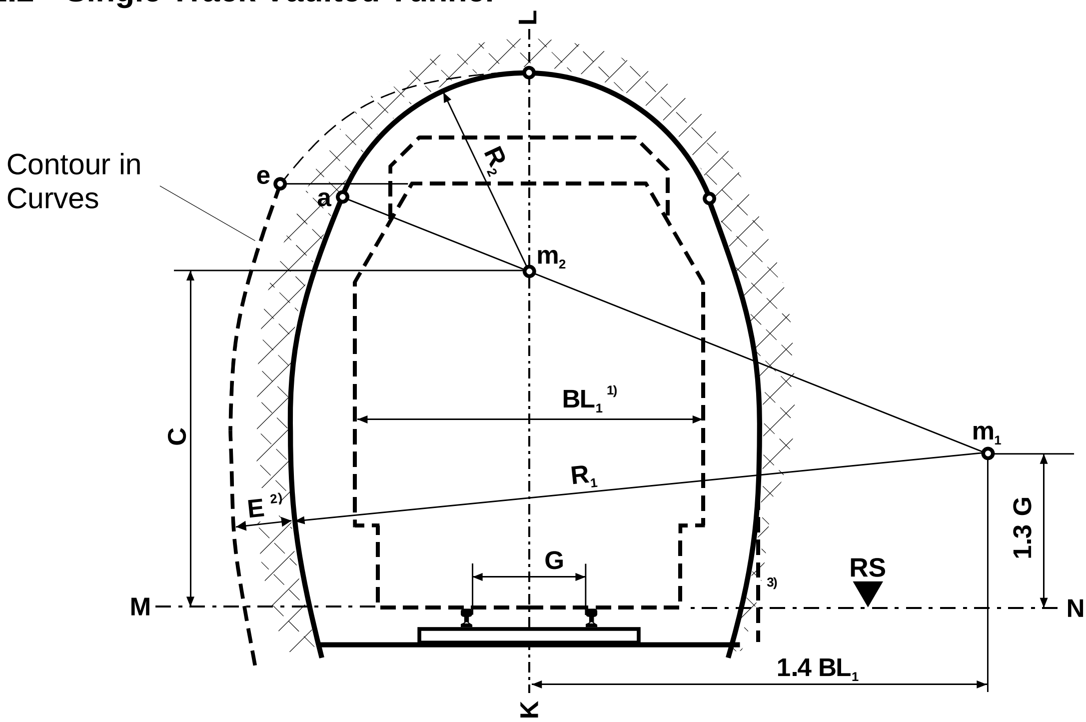
Notes:
1) Dimensions ***BL₁***, ***HL₄*** and ***HL₅*** of the perimeter of the area clearance according to NEM 102
2) Track spacing ***A*** per NEM 112
3) Extension ***E*** per NEM 103
4) The tunnel wall may be beveled in the upper area.

Construction

1. The tunnel height is composed of the various dimensions depicted in the figure.
2. The tunnel width is composed of the width dimension, ***BL₁***, (with multi-track tunnels accounting for the track spacing according to NEM 112) as well as the side spacing of 0.3 ***G*** on both sides.

With curved track the identified tunnel width should be expanded on both sides by dimension ***E*** (NEM 103).

2.2 Single Track Vaulted Tunnel



Notes:

1) Dimension ***BL₁*** of the perimeter of the area clearance per NEM 102
2) Extension ***E*** per NEM 103
3) In the lower area the tunnel wall can also be vertical.
4) The extension of space above the point ***e*** can have any design since there is no need to expand for pantograph and overhead operations.

Construction

1. Draw the tunnel axis **K** - **L** and the horizontal over the running surface (RS) **M** - **N**.
2. Determine points $\mathbf{m_1}$ and $\mathbf{m_2}$ according to the diagram.

   Sizing chart for the value of **C**:

for Tunnel without overhead wire:	**C** = 2.2 ***G***
for Tunnel with overhead wire:	**C** = 2.8 ***G*** on straight track,
	C = 2.3 ***G*** on curved track.

3. With straight track: draw arc with radius $\mathbf{R_1} = 2\ \boldsymbol{BL_1}$ around point $\mathbf{m_1}$ (creates tunnel wall in the lower region up to point **a**).

   With curved track: increase $\mathbf{R_1}$ by the dimension ***E*** (NEM 103).

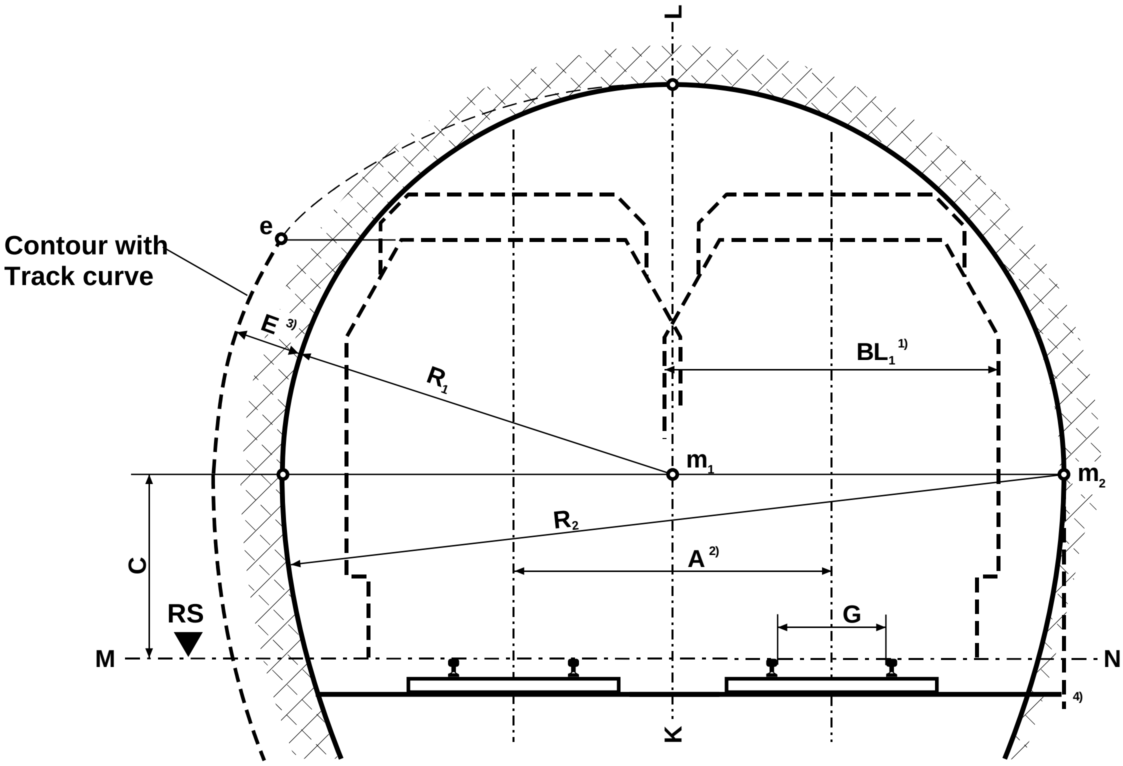
   Example for H0: Curve radius 700, BL1 = 48, ***E*** = 7 mm

   $\boldsymbol{R_1} = 2\ \boldsymbol{BL_1} + \boldsymbol{E} = 96 + 7 = 103$ mm

4. To create the opposing tunnel wall, repeat steps 2 and 3 in mirror image fashion.

5. Draw an arc with radius $\mathbf{R_2}$ (= line $\mathbf{m_2}$ **– a**) about point $\mathbf{m_2}$ (creates tunnel wall in the upper region).

2.3 Dual Track Vaulted Tunnel



Notes:

1) Dimension ***BL_1*** of the perimeter of the area clearance per NEM 102
2) Track spacing ***A*** per NEM 112
3) Extension ***E*** per NEM 103
4) In the lower area the tunnel wall can also be vertical.
5) The extension of space above the point ***e*** can have any design since there is no need to expand for pantograph and overhead operations.

Construction

1. Draw the tunnel axis **K** - **L** and the horizontal over the running surface (RS) **M** - **N**,

   Determine track spacing ***A*** according to NEM 112.

2. Determine point **m_1** on the tunnel axis and draw the horizontal through ***m_1***.

   Sizing chart for the value **C**:

for Tunnel without overhead wire:	**C** = 1.5 ***G*** on straight track,
	C = 1.7 ***G*** on curved track,
for Tunnel with overhead wire:	**C** = 1.8 ***G*** on straight track,
	C = 1.7 ***G*** on curved track.

3. With straight track: draw arc with radius ***R_1*** = 0.5 ***A*** + 0.6 ***BL_1*** around point **m_1**.
   (creates tunnel wall above the horizontal through **m_1**).

   With curve track, enlarge **R_1** by the dimension ***E*** (NEM 103).

   Example for H0: Curve radius (inner track) 700, ***A*** = 52, ***BL_1*** = 48, ***E*** = 7mm

   R_1 = 0.5 ***A*** + 0.6 ***BL_1*** + ***E*** = 26 + 29 + 7 = 62 mm

4. Draw arc with radius **R_2** = 2 **R_1** about point **m_2**
   (creates tunnel wall below the horizontal through **m_1**).

5. To create the opposing tunnel wall, repeat in mirror image fashion.