

# **Substructure: Design and construction. Fencing**

## **1 Purpose and scope**

This chapter describes the regulations for the design and construction of fencing and gates along the course of the line.

Fencing along the line can serve one or more of the following functions:

- protection against general trespass
- distinguishing between public roads and the railway line
- protection against access by grazing livestock
- protection against access by wildlife
- protection against landslides/avalanches onto the line
- boundary mark
- protecting high voltage installations (overhead contact line installations)

### **1.1 Requirements for the provision of fencing**

#### **1.2 Duty to fence**

The duty to fence the railway line may stem from a specific legal basis. This could be:

- ministerial resolution
- land planning provisions and zoning plan in accordance with the Planning and Building Act
- requirement for measures to be implemented to reduce the risk of collisions with wildlife
- the provision of fencing resulting from general or special discretionary measures
- the provision of fencing has been agreed with land owners or other parties
- fencing is already in place
- regulatory requirement stipulating that high voltage installations must be fenced in

Further, the duty to fence may result from general requirements stipulating that installations must be adequately protected. Based on the premise that there is no general duty to fence a railway line (the Norwegian Fencing Act does not apply to railway lines, cf. Section 1), it is the railway authority that decides whether fencing should be erected and whether the installation, as such, is adequately protected. Any assessment of what constitutes 'adequately protected', must take into account the general public.

#### **1.3 Fences as protection against general trespass**

The provision of fencing must be evaluated in built-up areas, close to schools and pre-schools, as well as areas where illegal trespass on the railway line constitutes a special risk and concern.

The provision of fencing may be waived where access to the track is difficult, as in the case of steep embankments, etc. For tunnel portals, culverts, bridges, etc., special consideration must be given to track access and fencing.

##### **1.3.1 Existing adjacent conditions**

The NNRA is responsible for the provision of fencing when activities on its adjacent properties lead to the risk of hazardous trespass on railway property. 'Adjacent conditions' refers to the relevant conditions, in terms of both built up areas and industrial areas. Adjacent properties that often require

fencing could be:

- built up areas
- residential areas
- schools
- pre-schools
- sports grounds
- car parks
- industrial areas
- service facilities

### **1.3.2 Changes to existing adjacent conditions**

When changes in use to the NNRA's adjacent properties lead to changes in fencing requirements with a greater risk of hazardous trespass onto railway land, the NNRA will generally expect the party responsible for the change in fencing requirements to defray the cost of erecting and maintaining new fencing of a satisfactory quality and height. In the event that the NNRA has a pre-existing fencing requirement at the location in question, it may contribute a certain proportion of fencing costs. Alternatively, where appropriate, instead of contributing to the cost of fence erection, the NNRA may assume responsibility for the entire future maintenance of said fencing.

Changes in fencing requirements resulting from changes in use normally occur upon the implementation of zoning cases pursued by building authorities, land owners or other interested parties.

### **1.3.3 Fencing between tracks**

Where fencing is used between tracks to prevent trespass on the track from one platform to another, the height of the fence must not exceed 1.10 m up to the uppermost fence wire.

## **1.4 Fencing between public roads and the railway line**

Where applicable, fencing between public roads and the railway line must be agreed between the involved parties (NPRA/municipality and NNRA).

If fencing must be taken down and re-erected due to the construction, realignment or improvement of public roads, the NPRA must bear all costs and expenses incurred.

Upon prior negotiation with the NPRA, the location of new property boundaries/fencing should be stipulated so that fencing is subject to minimal damage, e.g. during snow-clearing operations.

In certain cases, the NPRA will require fencing to be erected on top of safety barriers. In such cases, railway fencing may be omitted.

## **1.5 Fencing for protection against access by grazing livestock**

The NNRA will determine whether it is necessary to erect and maintain fencing for protection against access by grazing livestock.

The fence type and quality must be suitable for local conditions. Even though the Fencing Act does not apply to fence maintenance along a railway line, the provisions of the act should still be taken into consideration when designing fencing to protect against access by grazing livestock.

## **1.6 Fencing for protection against access by wildlife**

Fencing for protection against access by wildlife will be erected where this is necessary in order to reduce the number of collisions with wildlife. Wildlife fencing must be viewed in context with so-called 'fauna passages' in the form of crossings or underpasses where these have been built.

## **1.7 Fencing to protect against landslides/avalanches onto the line**

Fencing to protect against landslides/avalanches onto the line is described in more detail in [JD 520], chapter 6.

## **1.8 Fencing as a boundary mark**

As well as protecting against hazardous trespass onto railway land, fencing also represents an excellent line of demarcation of railway property. Fencing should generally be erected in accordance with Section 3.

Adjustments may, however, be made in order to achieve an appropriate boundary line and/or reduce costs. Minor boundary adjustments are undertaken in accordance with the provisions of the Norwegian Land Partition Act with resultant transfer of ownership. Greater deviations between boundary and fencing should be governed by a registered agreement.

It is important to be aware that railway fencing, whether it is adjacent to the property boundary or not, may well be regarded as a visual representation of the extent of the railway's right of ownership.

If fencing is removed, or is not erected adjacent to a property boundary, the boundary must be marked with boundary marks to the necessary degree.

## **1.9 Fencing as protection against overhead contact line installations**

Areas containing high voltage installations must be cordoned off from the surroundings by fencing constructed and erected in such a way that access to the area would not be possible without special equipment.

This also applies to areas that are accessible to the general public and where the distance from accessible locations to the closest live overhead contact line is less than 5 m; refer to chapter 4 [JD 540].

# **2 Design of fencing**

There are generally three types of fencing:

- wire fencing
- mesh fencing
- chain link fencing

There are also various types of wildlife fencing.

Where fencing terminates at bridges, tunnel portals, embankments, etc., it must be naturally adapted to the fencing's local function, the terrain and the structure.

## 2.1 Wire fencing

Wire fencing is used on cultivated and uncultivated land for marking the railway's boundaries and for protection against cattle.

Wire fencing most often comprises six fence wires attached to wooden or steel posts to a height of 1.10 m measured to the uppermost fence wire. The fence wire can either be spun or continuous and crimped (corrugated). Between the posts the fence wire is attached to wooden or steel fence rails, most often connected with binding wire.

The following applies to wire fencing with steel posts:

- the distance between posts must be approx. 3 m
- between the posts the fence wire must be attached to a steel fence rail
- the fence wire must be looped around every sixth post
- angle and end posts must be fastened with a backstay or braced
- the length of fence posts must be 2.4 m for soil and 1.3 m for rock
- the thickness of fence posts must be 80–120 mm (3"-5")

The following applies to wire fencing with wooden posts:

- the distance between posts must be approx. 4 m
- there must be 2 wooden fence rails and 3 lengths of binding wire in each post section
- posts and rails must be made of impregnated timber or juniper
- the length of fence posts must be 2.25 m for soil and 1.3 m for rock

The length of the fence rails must be 1 m for both wooden and steel fencing.

## 2.2 Mesh fencing

Mesh fencing is used on cultivated and uncultivated land especially as protection against sheep.

Mesh fencing is made from mesh sheets attached to steel or wooden posts. The fence height should be 1.1–1.5 m, depending on local conditions (livestock, snow, etc.).

## 2.3 Chain link fencing

Chain link fencing is used in town/cities and built up areas and other locations where it is important to prevent the general public from accessing railway land and to also prevent the general public from coming into contact with high voltage installations.

if the distance from live overhead contact lines is less than that specified in the requirements, chain link fencing must be erected. Alternatively, masts may be fitted with screens.

Chain link fencing is usually attached to steel fence posts with angle steel as end posts and bracing struts and T-steel as intermediate posts. The fence must have a minimum height of 1.8 m. At the top and bottom edges of the fence, the mesh sheet is attached to crimped tension wire. The top of chain link fencing may also be finished with a steel top rail. The lower edge of the mesh sheeting must make contact with the ground along the entire length of the fence to prevent the general public from accessing railway land. 2.8 mm steel wire with a 50 mm mesh aperture must normally be used.

If fencing is erected closer than 3.0 m to live components, fine-mesh netting of 2.8 mm galvanised steel wire with a 12 mm mesh aperture must be used. If protective fencing is to be erected closer than 1.0 m to live components, this must be implemented as bridge protection in accordance with [Bruer/Prosjektering\\_og\\_bygging/Overgangsbruur](#).

For all fencing erected as protection against live overhead contact lines, approved warning signs

manufactured in accordance with [NS 4210] must be erected in conspicuous locations at a minimum interval of 15 m.

It has been previous practice to fit barbed wire to the top of chain link fencing in locations where it was regarded as particularly necessary in order to secure railway property. In such cases, three rows of barbed wire would be used and the top of the posts must be angled in towards railway land.

Barbed wire must not now be used as fencing material when erecting new fences.

For fencing in outdoor high voltage installations, the following also applies:

<http://www.lovdatab.no/cgi-wift/ldles?doc=/sf/sf/sf-20051220-1626.html> Forskrift for elektriske forsyningsanlegg].

## 2.4 Wildlife fencing

Wildlife fencing should be used in areas with a high density of wildlife. Wildlife fencing consists of wire mesh attached to posts.

The choice of fence design must be viewed in context with planned section-specific measures to prevent collisions with wild animals.

Wildlife fencing must be combined with crossing options for large game, particularly where the railway line crosses the natural migration routes of the animals. When erecting wildlife fencing, provision must be made for large game to be directed to a bridge or underpass, or other suitable area, as an option to cross the line.

As part of wildlife fencing over longer sections, gaps (30–50 m long openings in the fence through which large game may cross the railway at line level) should be considered. The gaps should be located as close as possible to natural migration routes. Vegetation in and around the gaps must be cut back and the ground must be roughly levelled.

Wildlife fencing is normally attached to galvanised square tube fence posts. The length of the posts should be approx. 3.5 m and they should extend 0.75 m into the ground, with concrete foundations where applicable. The distance between the posts should be approx. 4 m. In terrain where major snow pressure may occur, the posts should be placed at shorter intervals. Fencing must have a minimum height of 2.5 m.

Fencing must be clearly visible. Therefore, approx. 5-10 m of ground must be cleared from either side of the fence.

In instances where double fencing along the course of the line is being considered, measures must be taken to prevent wildlife from passing through the fence opening. Double fencing combined with a warning system (photo cell, etc.) may also be considered to enable train traffic control to be alerted when wildlife passes inside the double fence.

If fencing is erected closer than 3.0 m to live components, fine-mesh netting of 2.8 mm galvanised steel wire with a 12 mm mesh aperture must be used. If protective fencing is to be erected closer than 1.0 m to live components, this must be implemented as bridge protection in accordance with [Felles\\_elektro/Prosjektering\\_og\\_bygging/Jording](#).

Barbed wire must not be used in areas where large game roams.

For a more detailed description of wildlife fencing and wildlife gaps, refer to [Statens vegvesen håndbok 242 Vegeter og dyreliv](#).

## 2.5 Protective earthing

Fencing made from conductive material located closer than 5 m to the centre of the track must be protectively earthed and segmented where applicable, cf.

## 3 Gates

Gates are used as road barriers where a road crosses a railway line (level crossing gates). Gates are usually made of impregnated timber. Gates at stations must be white, while other gates must remain unpainted.

Gate posts for level crossing gates must be 2.6 m long and extend 1.3 m into the ground in soil terrain. Old rails with added fittings may be used as gate posts or, alternatively, impregnated wooden posts measuring a minimum of 200 mm (8"). A gate post must not be used as an end post for fencing. Fencing leading up to the gate must end at a separate fence post placed in close proximity to the gate post. It must not be possible to pass between the gate post and the fence post.

It must be possible to close and lock the gates. The most common locking mechanisms are lever locks and flap locks. Lever locks are mainly used on private level crossings, while flap locks are used on larger gates such as station gates and gates for public roads. At pedestrian-only level crossings or adjacent to ordinary gates with a high level of pedestrian traffic, box gates must be used. A box gate is not fitted with a gate lock.

Where forest traffic crosses/has crossed the line or enters NNRA land, a wooden barrier may be fitted instead of a gate. A wooden barrier consists of a fence section without fence posts.