



## UIC CODE

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VII - WAY AND WORKS

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LAYING OF TELECOMMUNICATIONS AND  
SIGNALLING CABLES AND THEIR PROTECTION  
AGAINST MECHANICAL DAMAGE (1)

**NUMERISATION DANS  
L'ETAT DU DOCUMENT**

## I - INTRODUCTION

Under present technical conditions, cabling of telecommunications and signalling circuits is the most effective means of improving the quality and reliability of transmissions. Cabling is usually carried out as a result of modernisation of railway installations - e.g. installation of automatic block - particularly the electrification of lines.

(1) Recommendatory paragraphs are preceded by the letter "R".

(Reprint of 1.2.1988)

When compared with the cost of investment for the supply of the equipment, the operations connected with the laying of underground cables represent a large proportion of the total expenditure. It is therefore advisable to seek the most economic methods and conditions of laying, by resorting as far as possible to mechanised appliances. It is necessary, however, to provide effective protection for the underground cables against risk of damage resulting from the proximity of the railways ; for this purpose, it is essential for the depths and positioning of the cables to take into account modern methods of track maintenance.

The purpose of this leaflet is to give general information on the laying conditions and on the precautions to be taken to guarantee the good condition of the cables in the course of time, and finally, to bring to notice certain methods for increasing the output of the laying work by using various types of machines.

When laying shunt cables which terminate in installations situated in the track, it is not necessary, in specific cases, to comply with the recommendations in this leaflet.

## II - GENERAL CONDITIONS OF LAYING

## 2.1. - Position of the cables in relation to the tracks and railway installations.

Cables are generally less prone to risks of mechanical deterioration when they are laid along boundaries - i.e. usually 3 to 10 metres in relation to the centre of the nearest track.

In this way they are protected from track maintenance or electrification work, and are of easy access for repairs.

To facilitate laying or when the site is too steep, it may be advisable to place the cables near the tracks, e.g. between the line of pylons supporting catenaries and the track.

Laying between tracks should only be permitted in station areas. The laying of cables beneath tracks and in the ballast immediately adjacent to stretches of rails should be prohibited.

Certain economies can be achieved by laying telecommunications and signalling cables in the same trench.

When signalling cables include wires carrying electrical energy, such cables may only be laid in the same trench with other signalling cables provided steps have been taken to prevent direct contact of the two cables - suitable spacing of the cables, parpen walls, mechanical protection -, or if the telecommunications cables are of special construction - provided with a special screen, etc., or still more, if each cable has been very clearly marked to indicate its destination - signalling cable, telecommunications cable, to avoid any confusion of the cables during maintenance work. Any such confusion could constitute a serious danger to maintenance teams.

With this kind of marking, parpen walls separating the two types of cables may be dispensed with.

These recommendations should be complied with unless the regulations in force in each country provide otherwise.

When considering the path for the laying of cables, it is desirable to obtain the views of the Departments responsible for the maintenance of the track bed and the permanent way, which will be in a position to appreciate certain important factors : slopes to be modified, foreseeable extensions, etc.

#### R. 2.2. - Effect of the mechanisation of track maintenance on the siting of cables.

When cables are laid in the immediate proximity of a railway line or when they cross it, it is essential for them to be outside the range of any machines or appliances likely to be used for the maintenance of the track.

Railways are recommended to determine the working range of their machines in relation to their conditions of laying, and taking into account the following recommendations :

- a) When the cables are laid parallel to the track, the horizontal distance between the centre of the track and the cables should be at least 3,00m. In special cases - narrow sites, steep slopes - this distance may be reduced in exceptional cases to 200 m.
- b) When the track has to be traversed, it is recommended that the cables should be laid at a depth of more than 0,80 m in relation to the under surface of the sleepers. In special cases - rocky terrain - this depth may be reduced to 0,60 m, and even to 0,50 m in exceptional circumstances.

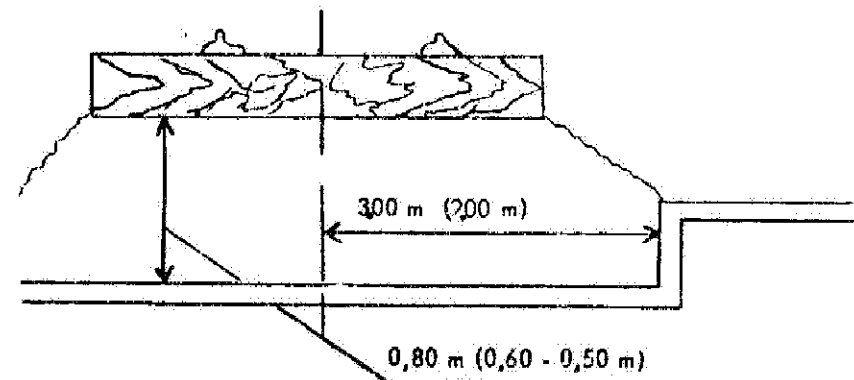


Fig. 1 - Gauge of the area without cables

#### R 2.3. - Distance between telecommunications and signalling cables and energy equipment.

Generally speaking, telecommunications and signalling cables should be at a distance from energy lines, lightning conductors, lines of trees or metallic masses likely to come into accidental contact with installations capable of carrying a high voltage.

In laying cables, particular attention should be paid to the following recommendations:

a) In connection with catenary supports :

If the voltage in the catenary is high ( $> 2000$  V) - it is necessary to take into account the gradient of potential round the support - and round the metal parts connected to it, such as, for example, conductors connected to the rails - in the case of an insulator winding. If it proves impossible to maintain a sufficient distance between the cable and the support - or the metal parts connected to it, it is advisable to provide special protection over a sufficient length - insulating tube, plastic sheath - possessing a certain quality of insulation and dielectric rigidity. In particular, it is necessary to take into account this phenomenon when the supports are not connected to the rails.

b) In relation to the high tension pylons:

If there are no national regulations in force, it is advisable to take into account the gradient of potential round the pylon in the case of winding of an insulator, and to use over a sufficient length, as necessary, special protection possessing a certain quality of insulation and dielectric rigidity.

c) In relation to sub-stations supplying the catenaries :

In the vicinity of sub-stations, it is advisable to provide protection to ensure a satisfactory quality of insulation and dielectric rigidity. It is essential to take these precautions when the voltage in the catenary exceeds 2000 V.

d) In relation to energy cables :

For economic reasons, it is advantageous, in certain cases, to lay telecommunications and signalling cables also energy cables, in the same

trench or conduit. Insofar as it is not prohibited by national regulations, these cables can be laid together if the following conditions are met :

- laying in the same trench should not give rise, in any case, to unacceptable electrical influences in the telecommunications and signalling cables, or cause danger to staff or installations,
- it is advisable to take the necessary steps to avoid deterioration of the telecommunications and signalling cables in the event of overheating of energy cables in conditions of overload or short-circuits,
- energy cables should be easily distinguished visually from telecommunications and signalling cables.

When anyone of these conditions is not met, the energy cables should be separated from the telecommunications and signalling cables by a par-pen wall, or laid at a distance of at least 0.50m from these latter.

e) - In relation to pipes carrying gas or liquids parallel to the cables:

Generally speaking, it is advisable to observe a minimum distance of 0.50 m. However, a greater distance may be required when the runs are parallel over greater lengths.

If the minimum distances stipulated by the regulations cannot be complied with, it is advisable to provide mechanical protection of the cables, e.g. in the form of pipes made of concrete, cement-asbestos, or ceramics.

#### 2.4. Method and depth of laying of cables

In principle, cables should be laid direct in the ground. The depth of laying should be a compromise taking into account the factors of the cost of laying and risk of damage.

Most Railways consider it normal to lay cables at a depth of 0.80 m, while certain Railways usually lay them at a depth of 0.60 m. In exceptional cases, this depth may be reduced to 0.50 m, provided that sufficient protection is given. It may then become necessary to take into account the effect of variations in temperature to which the cables are subjected.

When crossing tracks, platforms, and roads, use may be made of pipes of rigid plastic material encased or not in concrete depending on their material, multitubular slabs, plastic or timber plates, conduits, etc.

In the case of large engineering structures which usually carry cableways (conduits, tubes, etc.), it is necessary however, to take precautions against expansion and vibrations, in particular when cables with a lead sheathing are involved.

In tunnels, it is strongly recommended that cables should be laid in conduits.

### 2.5. - Mechanical protection of the cables

When laying takes place in trenches, no mechanical protection need be provided. However, it is essential to make the bottom of the trench level with sand or fine earth, when the terrain is rocky.

Most Railways consider it advisable to place a coloured indicator strip above the cable (at about 3.00 m).

In station areas, when crossing tracks, roads, etc., adequate mechanical protection may be provided by multitubular slabs, plastic pipes encased in concrete if necessary, or conduits.

The steel strips of armoured cables constitute an effective protection against rodents.

R. In the case of cables with thermoplastic coverings, in order to guard against the destructive action of rodents, it is advisable to avoid the use of protective mechanical elements leaving gaps between the cable and the elements surrounding it.

### R. 2.6. - Marking of the position of the cables

In order to avoid the risk of damaging the cables during work effected on the railway premises, it is advisable to make the position of the cables apparent to staff working on the tracks.

For this purpose, the path of underground cables can be marked on the surface of the ground by means of marks indicating changes of direction and special points along their path - junctions and branches, pupinization points, etc.

It is advisable to avoid the use of marks and pegs in stations, especially when the cables are laid close to the tracks, in the interests of safety of staff - danger of tripping.

It is desirable for the siting of the cables to be shown accurately on plans prepared at the time of laying, which are kept regularly up to date and placed permanently at the disposal of the departments responsible for the equipping and maintenance of the tracks.

When large-scale works are being effected near cables, it is worthwhile to mark the path of the cables by means of short temporary pegs placed at close intervals. In case of doubt, the path can be determined by means of cable detectors.

## III - LAYING OF CABLES BY MECHANISED METHODS

The use of mechanical methods for digging trenches and laying cables constitutes a definite economic factor.

The machines at present used are of two types as follows :

a) - conventional machines effecting separately the three operations of opening the trench, laying the cable and closing the trench,

b) - special machines effecting two or three of these operations simultaneously.

For digging purposes, cutters or excavators with buckets mounted on tracks, or light shovellers, also mounted on tracks or on wheels fitted with pneumatic tyres, are used.

The cables are laid from wagons or lorries carrying cable drums, and fitted with movable arms enabling the cable to be laid direct in the bottom of the trench.

Light bulldozers fill in the trench and level the excess earth.

The machines which carry out the three operations simultaneously are a type of plough coupled to powerful tractors, or drawn along by a static winch. When laying takes place in the immediate proximity of the outside rail, the machines can be mounted on the side of a wagon hauled by a locomotive. In this case, it is necessary to take steps to avoid any forces detrimental to the alignment of the track.

Apart from machines used for the laying of cables alongside the tracks, special machines are used for passing beneath structures ; these are drills of the auger type, which are not very often used however.

In order to construct underpassages of suitable width, it is necessary to increase the cohesion of the earth by the conical action of the drills, or to bore them by means of augers.

Where cables cross tracks, laying may be carried out, independently of drills, by means of special hydraulic appliances, which insert or draw, beneath the track bed, protective tubes through which the cables can then be passed.

Sometimes the use of mechanical appliances is restricted or prevented by the presence of engineering structures, cable crossings, conduits, the nature of the ground - large stones, rocks, etc., trees, difficulty in finding sufficient space, or too great a slope in the terrain, etc. A further obstacle arises when the appliances travel on the track, in that they are obliged to work during the interval between trains.

When the terrain presents numerous obstacles, the use of mechanical appliances for the laying of cables in stations is usually very difficult and may even become impossible.

The percentages of the lengths dealt with by machine vary considerably, depending on the sites. The same applies to the speeds of progress of the appliances, which can, however, be very fast - 2000 metres per hour - for machines of the "plough" type.

## APPLICATION

All Railways of the Union

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## RECORD REFERENCES

This leaflet, which was published in 1969 as No. 755, has been renumbered 755.1 with effect from 1.1.70, in connection with a renumbering of leaflets concerning telecommunications.

*Heading under which the question has been dealt with :*

- Exchange of views on economic methods of laying telecommunications and signalling cables, and effective measures against damage likely to result from the use of track maintenance and earthwork machines.

(7th Committee S.T. : Leipzig, May, 1965 ; Lisbon, May, 1966 ; Stockholm, June, 1967 ; Florence, May, 1968).

(Sub-Committees for Signalling and Telecommunications : Paris, January, 1969 ; Paris, January, 1970).