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Guidance on the automatic operation of level crossings

Directives applicables aux systèmes automatiques des passages à niveau
Richtlinien für den automatischen Betrieb von Bahnübergangs-Sicherungsanlagen

UNION INTERNATIONALE DES CHEMINS DE FER
INTERNATIONALER EISENBAHNVERBAND
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1st edition, January 1955	This leaflet, numbered 731 in 1952 and corresponding to previous leaflet No. B 32, has been re-numbered 761 as from 1st January 1955
3rd edition, January 1967	
4th edition, January 2004	Complete overhaul of leaflet

The person responsible for this leaflet is named in the UIC Code

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Summary

The leaflet gives an overview of basic parts of a level crossing system and of their functionality. It contains also recommendations for level crossing operation.

The leaflet consists of two main sections:

The first section lists basic physical parts of a level crossing system and describes their purpose.

The second section gives a functional overview including basic conditions to be fulfilled by a level crossing system. This section includes additional features to be considered when designing a level crossing system.

1 - Basic parts of a level crossing system

1.1 - General

1.1.1 - The basic parts of an automatic level crossing system should be:

- System kernel
- Strike-in/out devices
- Warning signals (light signals, barriers)
- Power supply
- Lineside signals
- Manual control
- Interface to an interlocking system
- Interface to an Automatic Train Protection system (ATP)
- Diagnostics

1.1.2 - Not all the mentioned parts have to be used for a level crossing system. This depends on the specific conditions both from a railway and a road point of view.

1.2 - System kernel

The system kernel is the core of the level crossing system that ensures safety-related level crossing functions. Electronic and/or relay signalling systems should be used for these purposes.

1.3 - Strike-in/out devices

1.3.1 - The strike in/out devices mounted in the track can be as follows:

1. a track circuit or an axle counter for continuous train detection
2. a short track circuit or a vehicle loop
3. a wheel sensor
4. a balise

1.3.2 - The location of the strike-in devices depends on local level crossing conditions (length of crossing, maximum length of a road vehicle, use of barriers), on the type of level crossing supervision and on the line speed.

1.3.3 - The strike-out devices shall be located at a level crossing or near a level crossing.

1.3.4 - A command (e.g. radio...) transmitted from a train can also be used to control the level crossing.

1.4 - Warning signals

Requirements for warning signals for road users (including barriers) are specified in detail in *UIC Leaflet 760*.

1.5 - Power supply

1.5.1 - Each power supply source has to cover the power consumption of given level crossing components for a given time period. A back-up power supply (if used) ensures a power supply for a limited time period according to power supply requirements. The following possibilities can ensure level crossing system power supply:

1. A single power supply source through alternating current supply. This means that special requirements shall be fulfilled for this kind of power supply, for example a supply line for signalling purposes only and continuous power supply status monitoring in an adjacent control centre

2. Two independent power supply sources (main and back-up) that are automatically switched over when the main power supply source is turned on/off:

    - Alternating current power supply (main power supply), which also charges the accumulator (back-up power supply)
    - Two independent alternating power supplies

3. Stand-alone power supply (e.g. solar panel, accumulator, battery)

1.5.2 - Switching from main to back-up power supply should not influence a functionality of the level crossing.

1.6 - Lineside signals

1.6.1 - Lineside signals can only show a proceed aspect if all required level crossing conditions are fulfilled. These signals have to show a warning aspect in other cases. Lineside signals can take a form of dedicated level crossing signal or of suitable main signal or of another technical device.

1.6.2 - It should be possible to allow train movement continuation (by a main signal or by another technical device), even if some required level crossing conditions are not fulfilled; in this case an extra technical or administrative operation shall be carried out. This means that a driver has to know (before train movement is allowed) that a level crossing condition is not met.

1.7 - Manual control

1.7.1 - Level crossing system should allow manual control. The level crossing status should be visible from a manual control post. A possibility of manual level crossing closure at least has to be provided. A possibility of manual emergency level crossing opening is recommended.

1.7.2 - An appropriate technical and/or administrative operation has to be carried out in the above cases to avoid a hazardous operational status. Manual emergency level crossing opening has to be indicated according to given requirements.

1.8 - Interface to an interlocking system

1.8.1 - The level crossing system should provide an interface to an interlocking system (including line block). It shall be possible to control the level crossing system and/or to supervise the level crossing system states through this interface.

1.8.2 - The level crossing shall be safely closed and cleared of road traffic before the front of the train reaches the level crossing. Train movement should be possible, however, even if some of the required conditions are not fulfilled (see 1.6.2 - page 3).

1.8.3 - The interlocking or line block system may use the interface between the automatic level crossings and the signalling system when a stop signal is situated in the warning zone, in order to avoid a dangerous increase in the warning time when a train comes to standstill.

1.9 - Interface to an Automatic Train Protection system (ATP)

The level crossing system should provide an interface to an ATP system. At least fail-safe level crossing status information should be provided to the ATP system. It is also possible to control the level crossing system through the ATP system if the level crossing system and the ATP system provide this option. The ATP speed profile shall consider the status of a level crossing as the train approaches.

1.10 - Diagnostics

1.10.1 - The level crossing system should provide diagnostic data about level crossing component behaviour. Diagnostics is particularly useful for electronic level crossing systems. It must not have any negative influence on the safety-related parts and functions of the level crossing system.

1.10.2 - Diagnostic data can be provided continuously and/or it can be recorded for later analysis purposes. A time stamp and unambiguous assignment of diagnostic data to individual level crossing components shall be ensured.

1.10.3 - Diagnostics serves as a means to speed up and improve the possibility of level crossing system fault detection or prediction and/or to allow later system and staff behaviour analysis in the event of an accident occurring.

2 - Conditions to be fulfilled by a level crossing system

2.1 - Warning time

2.1.1 - The warning time is the interval between the instant at which warning aspect appears on the level crossing warning signals and the time when the train reaches the level crossing.

2.1.2 - The minimum warning time may vary in relation to a certain number of local factors, especially the nature of the road traffic using the level crossing (including maximum length of a road vehicle), the distance over the crossing and the line speed.

2.1.3 - The maximum warning time should be calculated to prevent an increase in the risk of impatient road users attempting to cross the track while the warning signals are still operating.

2.1.4 - Devices that ensure that the warning times are kept constant whatever the speed of the train can be considered when the maximum warning time is several times longer than the minimum warning time.

2.1.5 - An interface to an ATP system or adjacent interlocking system can produce a link with the level crossing system such that actual train speed is related to the instant at which the warning signals appear.

2.2 - Intervals for closing barriers

2.2.1 - The interval between the warning aspect being displayed and the commencement of lowering of the full barriers is determined in accordance with the characteristics of the road traffic. This interval shall be calculated in a way that will ensure that the slowest and longest road vehicle, a cyclist or a pedestrian can safely leave the level crossing.

2.2.2 - In case of half barriers the interval shall be calculated in a way that will ensure that the slowest and longest road vehicle, a cyclist or a pedestrian can safely pass the barriers before the commencement of lowering.

2.2.3 - When using pairs of poles as full-barriers, the interval between the commencement of lowering of the first pair and the second pair shall be fixed.

2.2.4 - The lowering time (time interval of poles movement) shall not be less than 6 seconds.

2.3 - Failure management

2.3.1 - The level crossing system should be able to handle two categories of failures: safety critical and non-safety critical.

2.3.2 - A means of informing a control post about an operational and/or failure status of the level crossing system should be provided.

2.3.3 - Proper measures have to be taken when a failure occurs - especially in the case of a safety critical failure - to avoid a potentially dangerous situation.

2.4 - Additional features

In cases where railways consider it advisable and compatible with railway operating requirements, the following arrangements are possible:

1. Adoption (on double-track lines) of devices for preventing the opening of the barriers after the passage of a train, when the second train following on the same track or about to cross on the other track approaches the striking-in point. A minimum time interval can be defined for open level crossings.

2. A means of informing a control post whether the barrier(s) is (are) in the correct end position can be provided. The time interval for correct end position achievement should be verified.

3. A means of informing a control post whether the barrier(s) has (have) been burst opened can be provided.

4. Counting of the following trains shall be ensured wherever a spot detection strike-in device is used. Any following train(s) shall close the level crossing.

5. The level crossing system shall be protected from opening when shunting movements are undertaken (e.g. banking movement and return of a banking traction unit back over a point strike-in device).

6. An interface to a traffic light system. It ensures interaction between a level crossing system and a traffic light system that controls traffic lights in the vicinity of the level crossing. It ensures that road user movements are not only controlled by the level crossing warning signals, but also by the traffic lights. The above interaction prevents:

   - The unintentional occupation of a crossing by cars when the level crossing is closed
   - The unintentional occupation of the level crossing after the barriers have opened because of a stop signal at the traffic light system

   Implementation of an interface to traffic lights may not have any negative influence on safety-related level crossing functions.

7. Adoption of obstacle detectors. These devices locate obstacles (cars) on a level crossing after a given time interval of the level crossing closing period and after the barriers have closed. If the level crossing is occupied, a warning message shall be sent to the approaching train or to the signaller. Obstacle detectors can be used in specific cases, but their use ex-tends the warning time.

2.5 - Wrong running direction

2.5.1 - When running in the wrong direction on unidirectional track, it is possible, depending on the importance of the line and of the level crossing, either to provide a device to operate the automatic signals of the level crossing, as on a track normally used for running in both directions, or to apply standard regulations to guarantee safe passage over the level crossing.

2.5.2 - If the running direction set for a given section of line does not correspond to the real direction of the train journey, the following options have to be considered:

- Automatic protection of the level crossing using a dedicated device
- Manual protection (manual closing) of the level crossing based on the regulations in force
- Use of regulation principles only

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