



BSI Standards Publication

Railway applications — Track — Safety protection on the track during work

Part 1: Railway risks and common principles for protection of fixed and mobile work sites

National foreword

This British Standard is the UK implementation of EN 16704-1:2016+A1:2021. It supersedes BS EN 16704-1:2016, which is withdrawn.

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The UK participation in its preparation was entrusted to Technical Committee RAE/2, Railway Applications - Track.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Applications ferroviaires - Voie - Protection et sécurité durant des travaux sur la voie - Partie 1: Risques ferroviaires et principes communs de protection des chantiers fixes et mobiles

Bahnanwendungen - Oberbau - Sicherungsmaßnahmen während Gleisbauarbeiten - Teil 1: Eisenbahngefährdungen und allgemeine Prinzipien zum Schutz ortsfester und ortsveränderlicher Baustellen

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European foreword

This document (EN 16704-1:2016+A1:2021) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2022, and conflicting national standards shall be withdrawn at the latest by April 2022.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes A1 EN 16704-1:2016 A1.

This document includes Amendment 1 approved by CEN on 9 August 2021.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

A1 This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document. A1

The purpose of this standard is to define a common approach to the safety of workers regarding the railway risks in relation to work on or in proximity of the track in the European Community.

National safety rules (for example national standards or company rules) should gradually be harmonized in line with this standard or be replaced by rules contained in this standard but according to directive 89/391/EEC it is not allowed to reduce the existing level of safety measures given by national safety rules. The current situation, in which, national safety rules continue to play a role, should be regarded as a transitional stage, leading ultimately to a situation in which, European rules described here after, will apply.

This European Standard is one of the series EN 16704 “*Railway applications – Track – Safety protection on the track during work*” as listed below:

- *Part 1: Railway risks and common principles for protection of fixed and mobile work sites*
- *Part 2-1: Common solutions and technology – Technical requirements for Track Warning Systems (TWS)*
- *Part 2-2: Common solutions and technology – Technical requirements for barriers*
- *Part 3: Competences of personnel related to work on or near the railway track*

A1 Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website. A1

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia,

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1 Scope

This European Standard provides requirements and measures to deal with the significant and specific railway risks during works on or in proximity of the track and with common principles for the protection of fixed and mobile work sites with trains and/or machines circulating on the working track and trains circulating on the adjacent track(s). Railway risks and protection measures for access and egress to/from the work site are considered in the same way as railway risks and protection measures for work itself.

This European Standard is applicable to all operations related to work activities on rail guided systems. Infrastructure of metro, tram and other light rail systems is excluded from the scope¹⁾.

The following specific railway risks are taken into consideration:

- Risk 1: Personnel being struck by a train or injured due to wind drag from a train on open working track (safety of the worker);

NOTE 1 Risk 1 includes injuring of a worker by machines, material or equipment being struck by a train on the working track.

- Risk 2: Personnel being struck by a train or injured due to wind drag from train on adjacent track (safety of the worker);
- Risk 3: Personnel being struck by machine or train on blocked track (safety of the worker);
- Risk 4: Machines, material or equipment being struck by a train on the adjacent track (safety of the operation/safety of the worker);
- Risk 5: Personnel being electrified or electrocuted by fixed electrical equipment (safety of the worker).

NOTE 2 Risk 5 includes hazards caused by pantographs of passing trains.

This European Standard also provides requirements to the process of installing basic preventive measures when planning new infrastructure or installing corrective measures when adapting existing infrastructure.

This European Standard may be extended to third parties when it is considered appropriate and reasonable by the infrastructure manager, if one or more of the five significant risks described inside this standard, arise as a result of their activities in proximity of the track.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[A] EN 14033-2:2017, *Railway applications - Track - Railbound construction and maintenance machines - Part 2: Technical requirements for travelling and working*

EN 14033-3:2017, *Railway applications - Track - Railbound construction and maintenance machines - Part 3: General safety requirements*

EN 15746-2:2020, *Railway applications - Track - Road-rail machines and associated equipment - Part 2: General safety requirements*

¹⁾ See Directive 2008/57/EC.

prEN 15955:2020, *Railway applications - Infrastructure - Demountable machines, trailers and associated equipment - General safety and technical requirements for travelling and working*

EN 16704-2-1:2016, *Railway applications - Track - Safety protection on the track during work - Part 2-1: Common solutions and technologies - Technical requirements for Track Warning Systems (TWS)*

EN 16704-2-2:2016, *Railway applications - Track - Safety protection on the track during work - Part 2-2: Common solutions and technology - Requirements for barriers*

EN 16704-3:2016, *Railway applications - Track - Safety protection on the track during work - Part 3: Competences for personnel related to work on or near tracks*

prEN 50122-1:2020, *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*

EN 50110-1:2013, *Operation of electrical installations - Part 1: General requirements*

EN 50126-1:2017, *Railway Applications - The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Generic RAMS Process*

prEN ISO 20345:2020, *Personal protective equipment - Safety footwear (ISO/DIS 20345:2020)*

EN ISO 20471:2013, *High visibility clothing - Test methods and requirements (ISO 20471:2013, Corrected version 2013-06-01)* ^{A1}

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

^{A1} ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

^{A1}

3.1 accident

unplanned, uncontrolled event giving rise to death, ill health, injury or other loss to persons or damage to material

3.2 adjacent track

track beside the working track or beside the working place where it is possible to get into the danger zone during work

Note 1 to entry: The actual work takes place on the working track/work site near an open track and is not planned to take place in the danger zone of the adjacent track, or the presence of the person in the danger zone of the adjacent track is not intended.

3.3 announcement time

period between the moment the warning starts and the moment a train passes the beginning of the work site

3.4

announcement distance

distance between the point of detection of the train and the beginning of the work site

3.5

Automatic Track Warning System

ATWS

TWS that detects approaching trains or rail vehicles by technical means (mobile technical measure)

3.6

barrier

technical solution to realize preventive separation by a set of components to separate working zone and danger zone and to prevent workers from entering the danger zone unintentionally

3.7

blocked track

track closed for normal traffic

Note 1 to entry: Engineering trains/rail bound machines are not considered as normal traffic.

3.8

clearing time

time needed to recognize the warning, to stop the work and clear the danger zone including portable equipment (in a normal manner/without hurrying) when a warning is given and reach a place of safety

3.9

danger

potential for injury or fatality

3.10

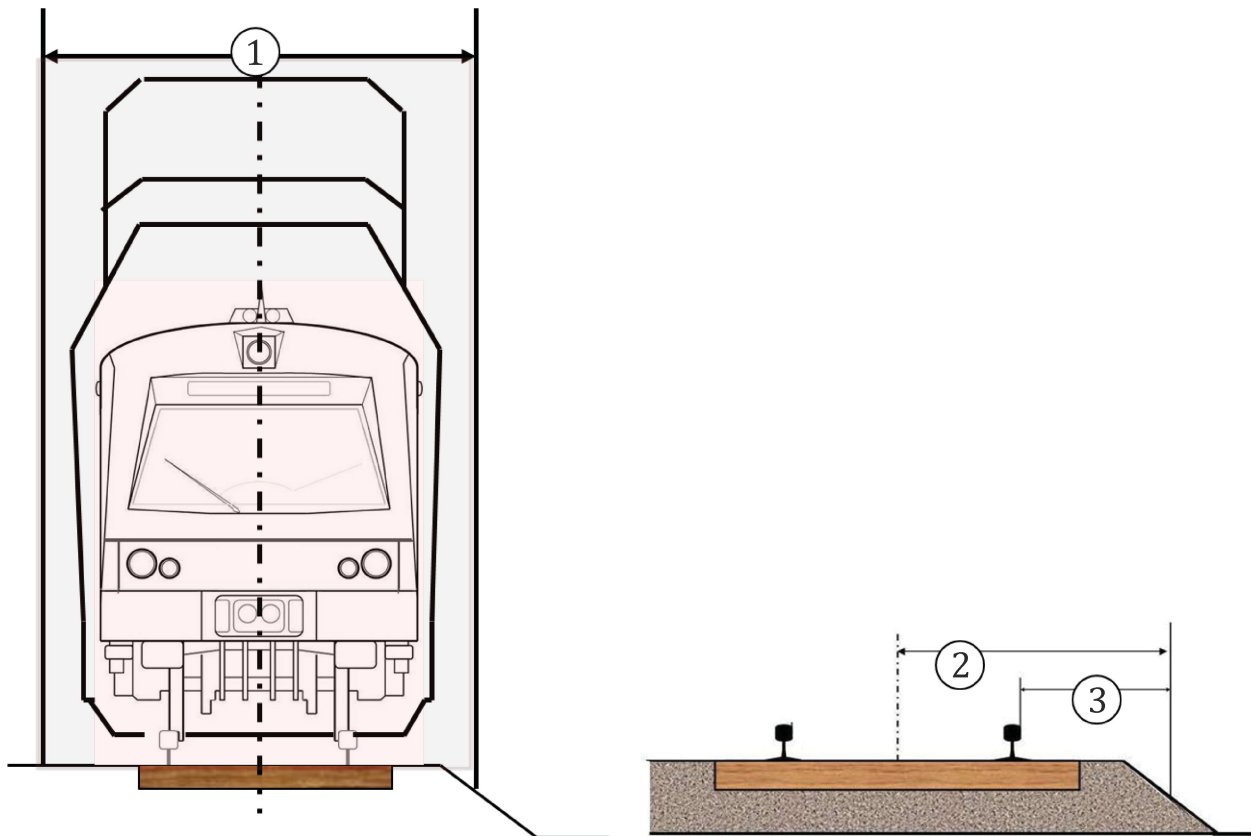
Danger Zone

area where a person, material or equipment can be struck by a railway vehicle or exposed to injury or fatality due to wind drag

Note 1 to entry: The danger zone includes the working track and extends on both sides over a distance measured from the axis of the track or the outside edges of the rail, see Figure 1. This distance is specified by national rules and is dependent on:

- the speed of the train circulation;
- the characteristics of the rolling stock (gauge and profile).

Note 2 to entry: Danger zone in tunnels is described in 7.1 and 7.2.



Key

- 1 danger zone
- 2 measurement of the danger zone of the track axis
- 3 measurement of the danger zone of the outside edge of the rail

Figure 1 — Definition of the danger zone

3.11

designated competent person

person being responsible for supervising e.g. of the formal inquiry, formal investigation or local investigation

3.12

emergency

unforeseen or unplanned event which has life-threatening or extreme loss implications and requires immediate attention

3.13

fixed electrical equipment

electrical equipment for traction current as far as it is under the control of the infrastructure manager

Note 1 to entry: This includes the overhead line system (see Figure 2, “safe distance”), third rail, landlines and base stations.

3.14

hazard

potential source of harm

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

3.15

incident

work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred, may also be referred to as a “near-miss”, “near-hit”, “close call” or “dangerous occurrence”

[SOURCE: OHSAS 18001:2007, 3.9]

3.16

infrastructure

all systems, equipment, materials or structures, that, combined or alone, form part of the operational railway

Note 1 to entry: Including but not limited to: the permanent way, land within the line side separation, the installations exclusively used for operational purposes, overhead electrified lines and all other systems equipment, materials or structures up to the boundaries of the railway site

Note 2 to entry: For further information see also 2598/70/EEC.

3.17

Infrastructure Manager

IM

any body or firm responsible in particular for establishing, managing and maintaining railway infrastructure, including traffic management and control-command and signalling; the functions of the infrastructure manager on a network or part of a network may be allocated to different bodies or firms

[SOURCE: 2012/34/EC, definition (2)]

3.18

lookout

person who gives warning to persons working on or near the track (observing, signalling, warning)

3.19

Lookout operated warning system

LOWS

TWS with train detection provided by a suitably qualified lookout triggering the warning

Note 1 to entry: LOWS includes hand operated TWS and chain of lookouts.

Note 2 to entry: If a warning is given solely by lookouts there is no technical component.

3.20

maintenance

combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function

[SOURCE: EN 13306:2010, definition 2.1]

3.21**method statement**

statement in a required format of the methods, systems, tools, plant and equipment and competence of persons to be used in performing a particular task, for the purpose of demonstrating that safety is not compromised or violated

Note 1 to entry: Developed following an assessment of the hazards/risk arising from undertaking the activity in the context of the operational railway and if appropriate the location at which the activity will be undertaken.

3.22**portable equipment**

portable machines, tools, devices and material designed or adapted to be worked on the track, transportable by hand with or without trolleys or separate supports for movement on rails

3.23**processing time**

time period between detection of the train (input) and giving the warning signal to the work site (output)

Note 1 to entry: The maximum processing time is a parameter of the warning process.

3.24**risk**

combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, definition 3.2]

3.25**risk assessment**

overall process comprising a risk analysis and a risk evaluation

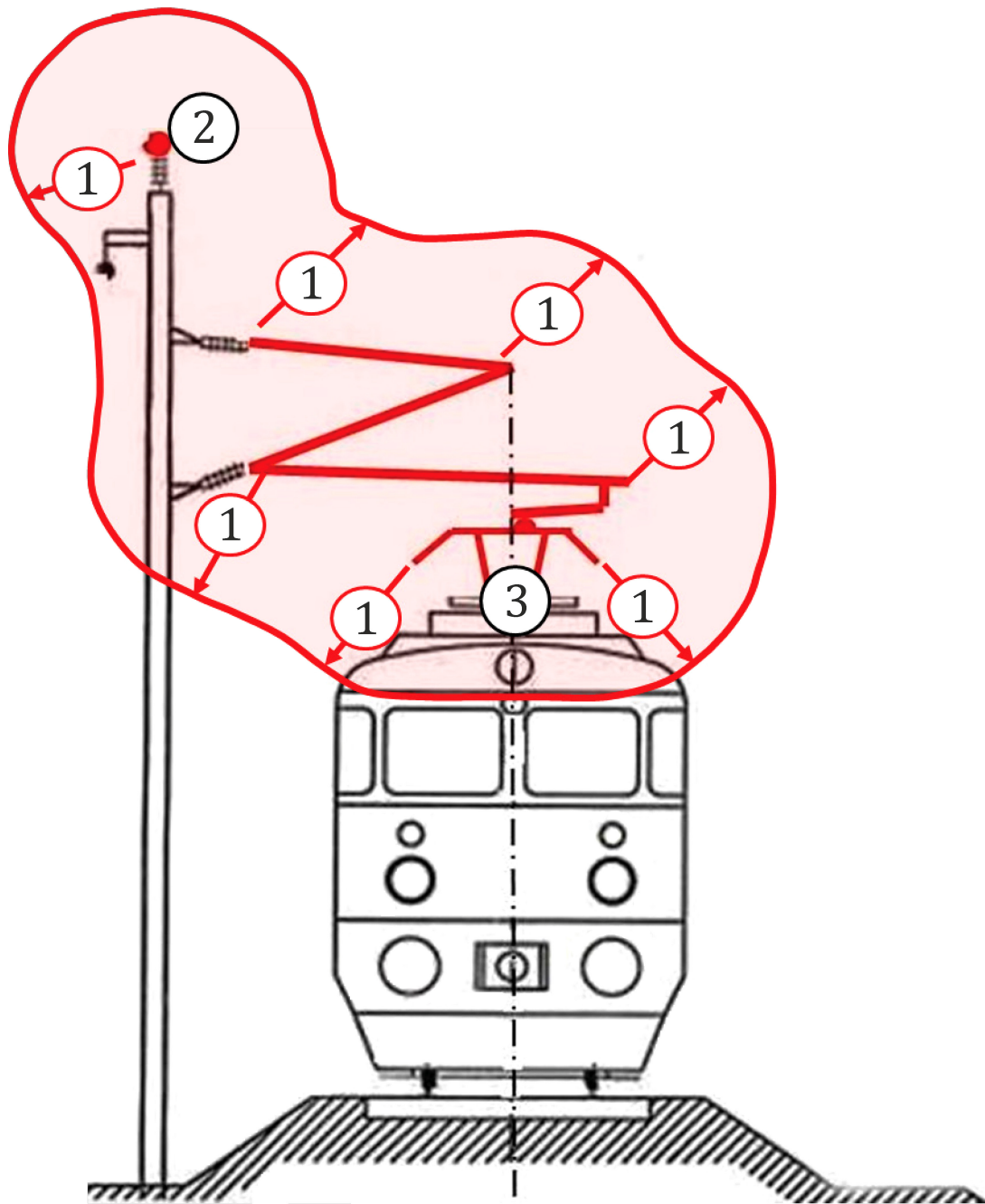
[SOURCE: ISO/IEC Guide 51:2014, definition 3.12]

3.26**safe distance**

closest working limit where persons, tools or equipment can come near a live part of the fixed electrical equipment without danger arising

Note 1 to entry: The safe distance is the border of the vicinity zones, see EN 50110-1. For the overhead line system, see the following figure²⁾.

²⁾ The outer "limit" of the vicinity zone as defined in EN 50110-1, is the demarcation line of "safe distance".



Key

- 1 safe distance
- 2 feeder
- 3 pantograph

Figure 2 — Illustration of the safe distance for bare live parts of overhead line, feeder and pantograph

3.27**safety**

freedom from risk which is not tolerable

[SOURCE: ISO/IEC Guide 51:2014, definition 3.14]

3.28**safety margin**

period of time in order to take into account reasonable unexpected events that may occur in reaching the place of safety

3.29**separation**

method to keep apart the work process on the work site and the danger zone of the adjacent track/open track

Note 1 to entry: Separation prevents workers or machines/materials from entering unintentionally into the danger zone.

Note 2 to entry: Measures of separation are e.g. barriers, walls, work wagons or movement limiting devices.

3.30**place of safety**

area where workers are protected from the railway risks 1 to 3, see Clause 1

Note 1 to entry: A place of safety is outside the danger zone, easy and directly accessible and has a flat base with a minimum size of 50 cm and with a sufficient height.

Note 2 to entry: National conditions for the place of safety apply.

3.31**safety plan for railway risks**

document issued as a part of a safe system of work and used to control the risk associated with working on or near the track, see Annexes H and J

Note 1 to entry: It contains details of arrangements for each work site to be taken to avoid or reduce the risks 1 to 5 (see Clause 1) identified at the risk assessment stage.

3.32**Signal Controlled Warning System****SCWS**

TWS that detects approaching trains or rail vehicles by data from the signalling system

3.33**third party (3rd party)**

entity and its personnel that does not belong to the organisation that controls the infrastructure or to the direct contractor or any subcontractor and which may impair the safe railway operation or the safety of the workers due to their activities

3.34

Track Warning Systems

TWS

system which warns people on or near the track of approaching trains or rail vehicles

Note 1 to entry: These systems may be able to influence the approaching of trains and rail vehicles. The influence could be a stopping, passing or other function.

Note 2 to entry: The used term TWS (Track Warning System) in this standard for the protection of fixed and mobile work sites includes the technical systems ATWS (Automatic Track Warning System) and SCWS (Signal Controlled Warning System) and LOWS (Lookout Operated Warning System). See Figure 3 and EN 16704-2-1:2016.

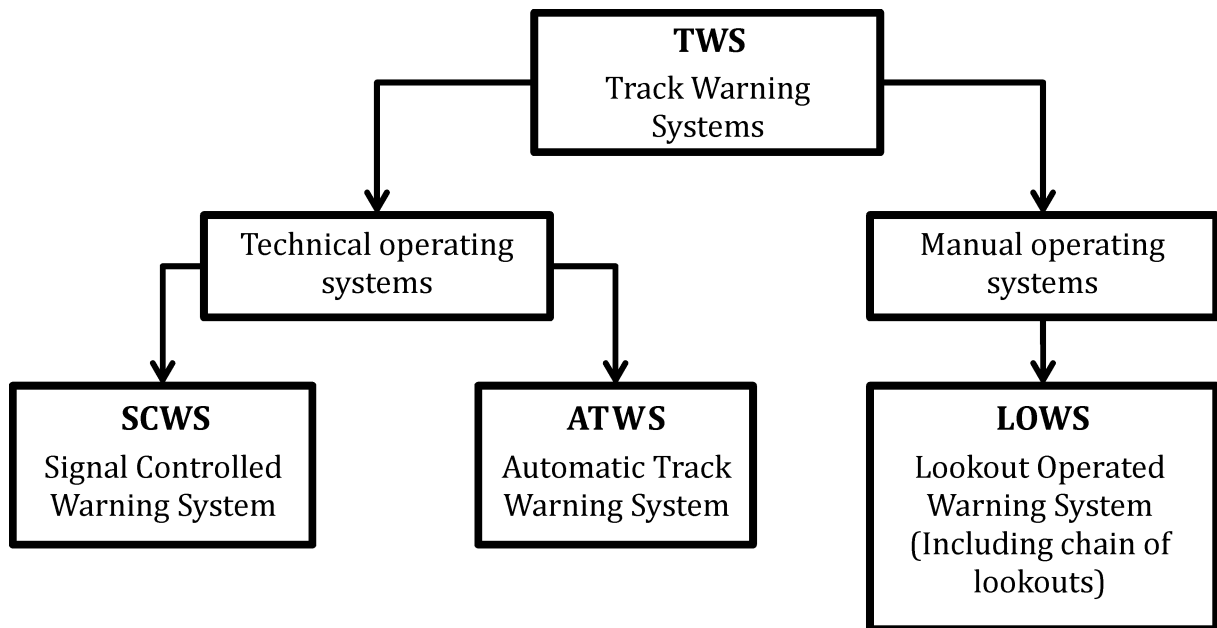


Figure 3 — Overview to track warning systems

3.35

vicinity zone

limited space outside the live working zone

[SOURCE: EN 50110-1:2013, 3.3.3]

Note 1 to entry: In the vicinity zone an electrical hazard can exist.

3.36

warning

signals for the timely perception of approaching railed vehicles

3.36.1**collective warning**

warning which reaches persons working on the work site independently of how they individually behave

Note 1 to entry: A “simple human misconduct” does not lead to the failure of the safeguarding system. The concept of “simple human misconduct” does not include the situation in which system security features or protective measures are avoided consciously or deliberately or used ineffectively.

3.36.2**individual warning**

warning which reaches persons working on the work site based on the correct use of the individual warning devices

Note 1 to entry: The simple human misconduct can lead to the failure of the safeguarding system for the person in question. Therefore it is recommended to consider the individual human behaviour of all people to be protected.

3.37**tunnel**

confined area where railway risks 1 to 5 are more significant or where working poses specific hazards (i.e. wind drag, exhaust fumes, dust, noise, objects falling from passing trains and being ricocheted by the tunnel walls, etc.)

3.38**visual demarcation line**

measure by which the boundary between working zone and danger zone is indicated (i.e. line on the ground, flexible band, etc.)

3.39**work site**

area situated on or near³⁾ a railway line which is protected by safety measures according to this standard in order to carry out activities

3.40**working platform**

platform on a vehicle dedicated for working at heights

3.41**working track**

track including its danger zone where planned activities are performed

3.42**work wagon**

closed railway vehicle used for working on the infrastructure with work places in the closed unit only where people are protected against wind forces and drag and it is not possible to get into a danger zone unintentionally⁴⁾

³⁾ Possibility that personnel and equipment can come into the danger zone.

⁴⁾ e.g. access to the tracks is possible only by self-locking doors which can be opened by additional conscious action only.

4 Common principles

4.1 General

This clause contains common principles for the safety protection of fixed and mobile work sites (including access and egress) with trains circulating on the adjacent track and/or working track.

The protection of workers on the track begins with establishing worker safety as a clear priority for all rail organisations.

Avoiding the exposure of workers to hazards including moving rail vehicles and electrical traction currents shall be the objective of all those involved in the design, management and operation of the railway.

The employer shall organize the work in such a way that it does not have any adverse effect on the safety and health of the employee.

The infrastructure manager shall make sure that appropriate measures are in place to manage the safety of the workers (and the circulation) before the beginning of the work is authorized. Collective protection measures shall have priority over individual protective measures; technical/automatic systems shall have priority over human operated systems.

The infrastructure manager shall decide about the safety measures that are within its influence for each work site on the basis of this standard, generally accepted principles (i.e. "State of the Art") and a risk assessment which considers the principles of the EU Directives⁵.

Therefore, for the protection of work sites in the track area, organisational and technical measures, such as blocking tracks or separating adjacent tracks from the working area by barriers independent of the behaviour of the workers, shall have priority over measures where workers have to react immediately with the right behaviour such as warning by warning systems or lookouts.

Adequate measures shall be taken to enable the employee, if a situation arises that represents a direct threat to safety or health, to quickly render himself safe. The policy of parties involved in work activities shall be regularly tested against the experiences gained with its application and the measures shall be adapted as often as those experiences indicate that such adaptation is required.

All work shall be carried out in compliance with relevant regulations and documentation as mentioned or specified in the contract by the infrastructure manager

NOTE Such regulations could refer to storage of material, use of tools and machines near the track and requirements for working at remote controlled parts of the track, e.g. switches.

Before going in or near the danger zone or/and near the vicinity zone at least the following activities shall be demonstrably completed and made available for review:

- Formal authorization shall be given before accessing the line;
- Permission shall be obtained before starting to work (in general);
- The risk analysis/risk assessment and safety measures are completed and documented;
- Responsibilities for safety (i.e. nominated person), including eventual interfaces are defined and agreed;
- Personnel shall be competent, trained and properly equipped;

⁵ See 89/391/EEC, 2004/49/EEC and 92/57/EEC. See Annex L.

- Personnel shall be instructed on specific working procedures, the local/specific situation and safety procedures;

The use of mobile communication equipment and any other equipment as for example tablets is not allowed if it may cause distraction to the user or compromises safety. Equipment to maintain necessary communication may be used. This shall be done outside the danger zone, except when the specific activity to be performed requires communication and presence in the danger zone:

- Tools, equipment, machines or devices provided for the purpose of the work are suitable, maintained for that use and approved if necessary. Tools, equipment, machines or devices which are not in use should at all times at least be kept at a minimum distance from the nearest rail on which a train may approach. They shall not be left in a place where they obstruct or become a tripping hazard to people (working/passing the work site);
- As additional measure in case of emergency, a type of alarm or signal is available on site (emergency signals are specified by national practice) to announce an unexpected obstacle or danger to a train approaching the work site.

4.2 Work done by 3rd party

If work will be done by a 3rd party the organization responsible for the safety of the system/operation and availability shall make sure that the aspects according to 6.1 shall be followed by the 3rd party. Therefore:

- the operating conditions and safety measures according to this standard shall be stated (blocked tracks, reduced speed, disconnected catenary);
- the 3rd party needs to get information with regard to the specific railway risks. It is the responsibility of a 3rd party (in his role as employer) who works near the track, to use the standard, because it lays down the way in which railway risks should be managed.

5 Principles of risk assessment

5.1 General

In this clause the general principles of risk assessment that apply to each railway risk and safety measures (Clause 6) therein, are stated.

- The classification of the risk for workers (railway risks 1, 2, 3, 5) according to 4.6 of EN 50126-1:1999 for the methodology of risk assessment leads to:
 - a hazard severity level: “critical” or “catastrophic”;
 - a frequency of occurrence of a hazardous event: “probable” or “frequent”.

The result of the risk evaluation is “intolerable” (see Table 6 of EN 50126-1:1999).

- The classification of the risk for the running traffic (railway risk 4) according to EN 50126-1 leads to:
 - a hazard severity level: “catastrophic”;
 - a frequency of occurrence of a hazardous event: “occasional” or “probable” or “frequent”.

The result of the risk evaluation is “intolerable” (see Table 6 of EN 50126-1:1999).

The parameters and criteria for the risk assessment which shall be used are given in this clause and in Clause 6. By applying the parameters and criteria stated in this paragraph, risk shall be eliminated or reduced to a level that is as low as reasonably practicable and as minimum acceptable. The conclusion that the risk is eliminated or reduced to a level that is as low as reasonably practicable and acceptable, shall be recorded in the safety document for planning (see Annex H).

NOTE The safety plans for the railway risks 1 to 4 and railway risk 5 are in connection with the safety and health plan according Directive 92/57 EEC and with assessment of the risks to safety and health at work according to Directive 89/391 EEC as follows.

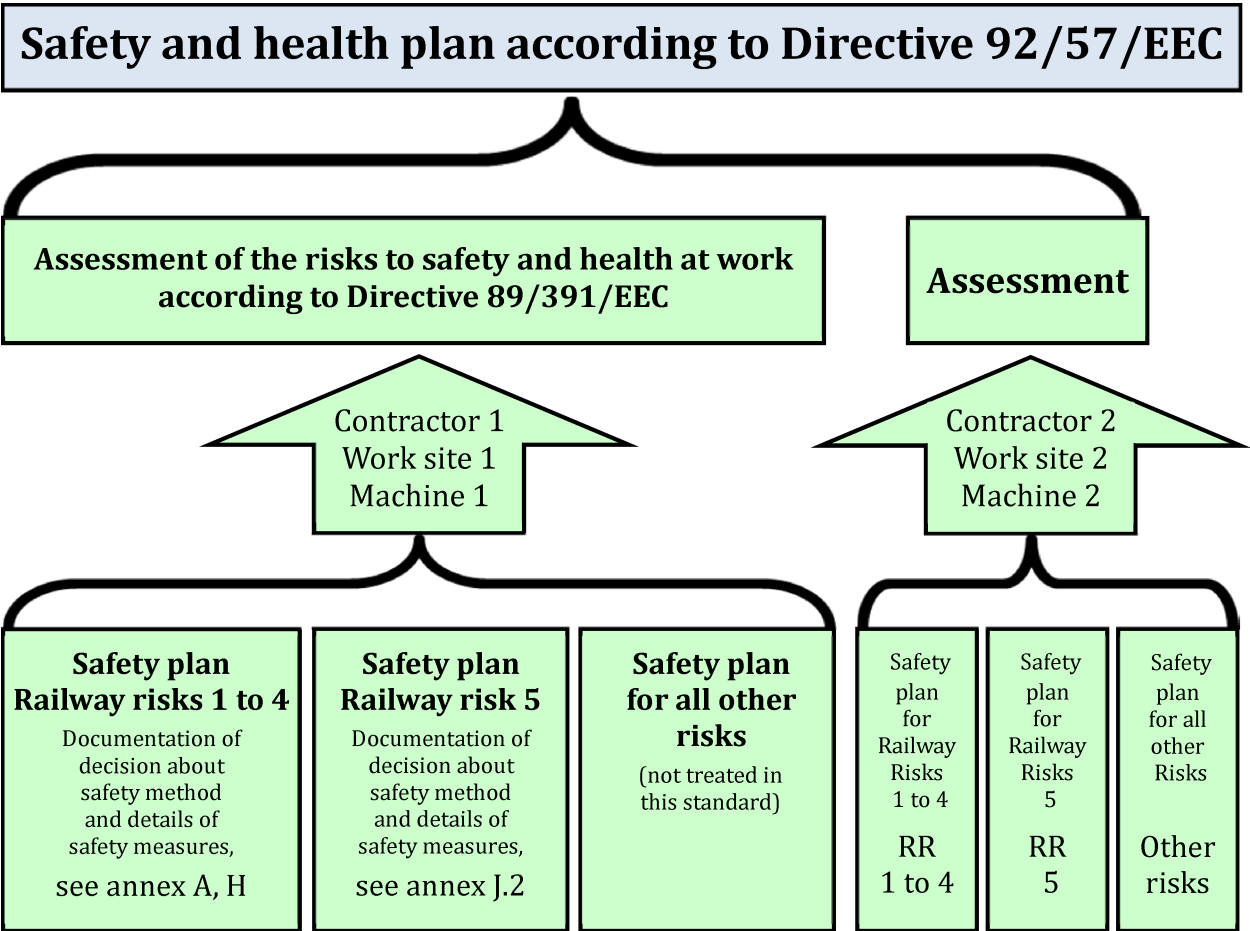


Figure 4 — Safety plan for railway risks according to Directives 92/57/EEC and 89/391/EEC

5.2 Decision about safety measures

For all work in the danger zone of a track or work near the danger zone of a track where workers, machines or equipment can get into the danger zone (even unintentionally), safety measures shall be taken.

These safety measures shall follow the hierarchy according to Clause 6⁶ adapted to safety protection during work on the track with the following principles:

- avoiding risks,
- evaluating the risks which cannot be avoided,

⁶ Based on the Directive 89/391/EEC.

- combating the risks at source,
- adapting the work to the individual, especially as regards the design of work places,
- adapting to technical progress,
- developing a coherent overall prevention policy which covers technology, organization of work, working conditions, and the influence of factors related to the working environment,
- giving collective protective measures priority over individual protective measures,
- giving appropriate instructions to the workers.

To make the decision on safety measures, the parameters and criteria according to Clause 6 and relevant (normative) annexes shall be used.

A measure of a lower level of the hierarchy may only be applied if all higher levels of hierarchy are not appropriate according to Clauses 6 and 7, and Annex A. If measures of a lower level of the hierarchy are decided this standard specifies mandatory requirements (see Annex A). These requirements are justified because they make the measures on a lower level as safe as reasonably possible. For specific situations some lower levels of hierarchy are excluded and not acceptable.

Ultimately, the organization in charge of the work shall decide if it is able to perform the work safely under the actual conditions (see 5.7).

5.3 Lines with more than one track

Measures are necessary for the work site handling the danger of railway operation on working tracks and adjacent tracks.

At first the measure for the working track should be decided, then the measure for the first adjacent track, then the measure for the second adjacent track and so on (see Figure 7, Clause 6). If persons need to get into the danger zone of the adjacent track, this track shall be considered as working track.

5.4 Supervision

There shall be supervision of the safe execution of the work (with regard to the railway risks 1 to 5) by a competent and recognizable (according to national regulations) supervisor.

5.5 Documentation

The decision for each safety measure applied to a work site shall be documented. The justification shall be based on the hierarchy; parameters and criteria stated in Clauses 6 and 7.

The process of deciding on/planning of safety measures and the taking/taking away of safety measures shall be traceable. In Clause 9 the minimum requirements for the contents of the safety plan for railway risks are specified.

5.6 Consideration of human behaviour

For the choice of the safety measures, individual human failure shall be considered too.

Human behaviour also comprises unintended or thoughtless behaviour of the workers and machine drivers, not perceiving warning signals by concentration on the work, unintentional getting into the danger zone, convenience of the workers (i.e. possibility of not using individual safety equipment or simplifying work methods because it is easier/convenient).

5.7 Actualization of risk assessment

Risk assessment shall be kept up to date during preparation and executing of activities and shall be re-evaluated and actualized (if necessary) if circumstances have changed.

5.8 Remote controlled equipment of the track

Before starting work at remote controlled equipment of the track (e.g. remote controlled switches), measures shall be taken to protect these against moving. Movement is allowed as far as necessary for the work.

6 Hierarchy of Safety Measures and parameters for the five railway risks

6.1 General

This clause states the hierarchy of the safety measures in which the five railway risks shall be managed and the parameters/criteria that are used in deciding about safety measures.

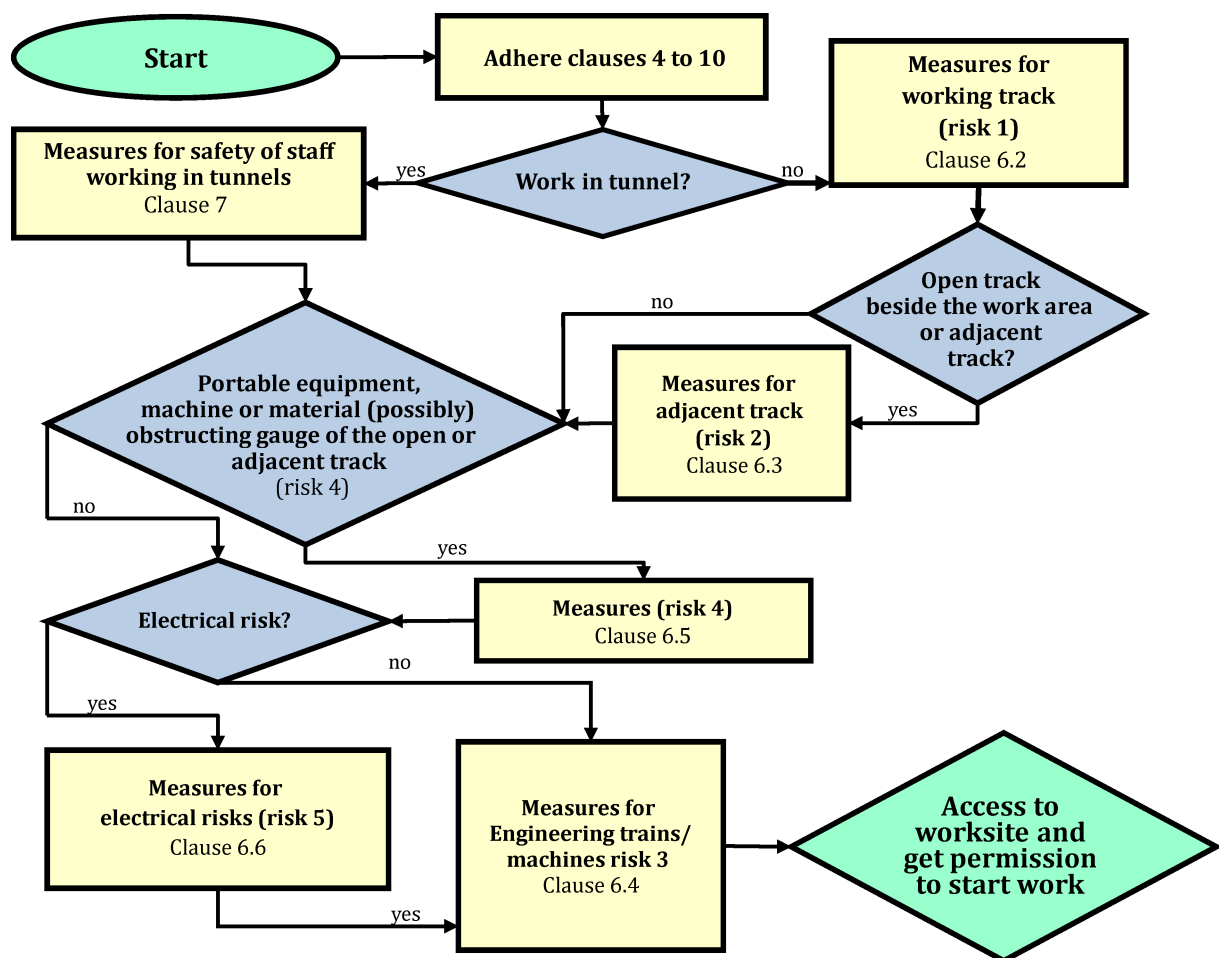


Figure 5 — Flowchart for taking measures for the safety of workers

If appropriate⁷⁾, the following aspects are specified:

- Safety measures
- Parameters used within the risk assessment
- Criteria for the use of the parameters: criteria which lead to or exclude the use of the safety measure
- Details of the procedure/conditions/requirements to manage the safety measures (see Annex A)

6.2 Risk 1 – Personnel being struck by a train or injured due to wind drag on open working track (safety of the worker)

6.2.1 General

The hierarchy of measures is as follows:

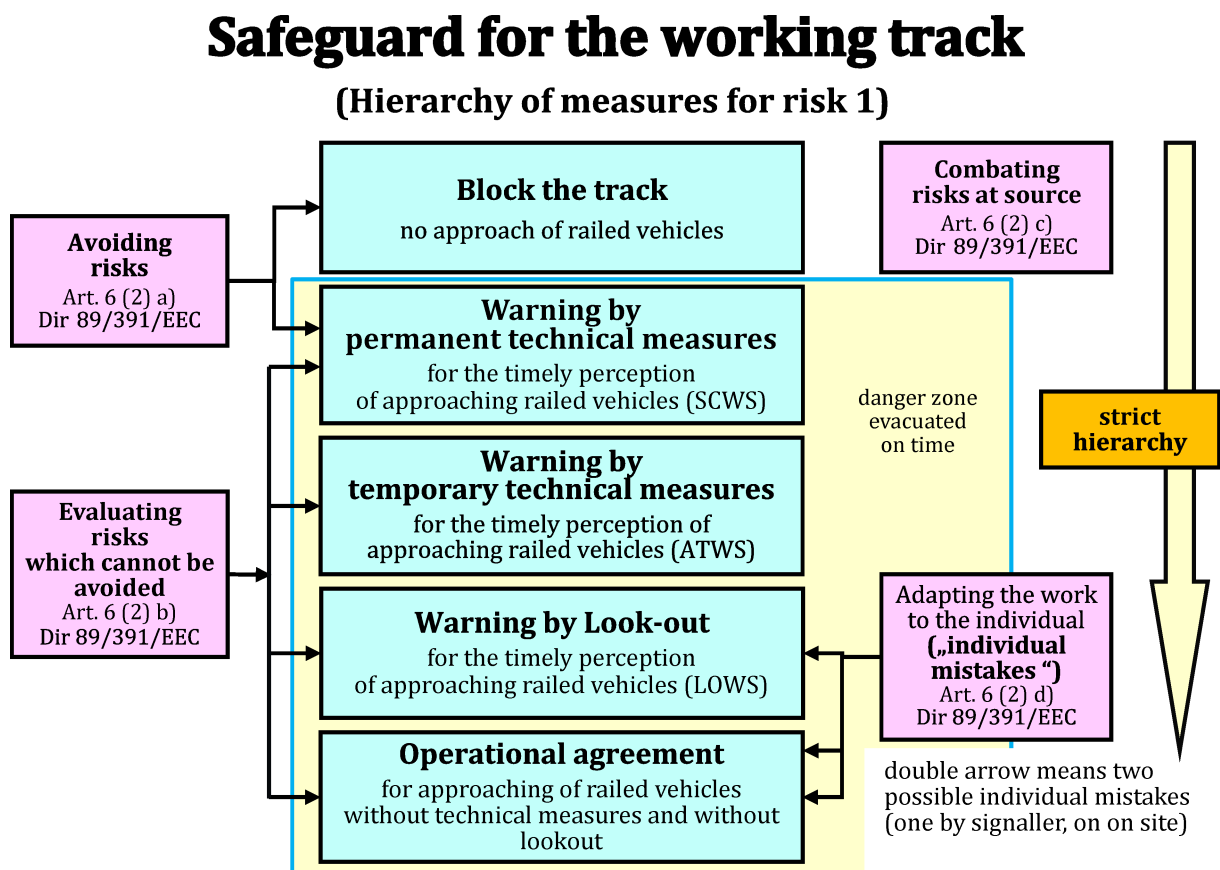


Figure 6 — Safeguard for the working track

⁷⁾ For different railway risks different aspects are relevant.

6.2.2 Blocking

6.2.2.1 Parameters used for the decision “blocking or not blocking a track”

The following parameters especially shall be used for the decision “blocking or not blocking the track”:

- a) maximum local line speed;
- b) time to clear the working track;
- c) place of safety;
- d) kind of machines and portable equipment used in the track: weight of equipment and possibility to clear the track;
- e) noise level of machines in use/noise level of environment: if the planned safety measure is “warning” and hearing the signals is not possible (see Annex D);
- f) track layout (working and adjacent track(s)): consequence of the fact that there is one (or two) adjacent track(s) may be that the working track shall be blocked;
- g) kind of work;
- h) number of workers in the danger zone and exposure time in the danger zone;
- i) length of the working area;

In the risk analysis a difference should be made between parameters for which planning is possible and parameters for which planning is not possible (e.g. weather conditions, noise of environment, visibility conditions of environment).

6.2.2.2 Criteria for blocking the working track

If any of the following parameters/criteria are fulfilled the working track shall be blocked. If blocking of a track is not possible, the work shall be postponed.

Table 1 — Criteria that force the blocking of the line

Parameter	Criteria which force to block the track
Delay of running trains	If the delay of running trains is acceptable the working track shall be blocked with the permission of signaller if the work can be done effectively between two trains ⁸⁾ , ⁹⁾ .
Ability to run trains on the track being worked on	track shall be blocked in order to be able to carry out the work (for instance track cutting).
Availability of a place of safety	<ul style="list-style-type: none"> — Place of safety not available for all workers; — Place of safety not reachable for all workers within the defined clearing time (e.g. work on a bridge without a place of safety); — The working track is necessary to be used as a place of safety.
Kind of portable equipment ¹⁰⁾	<ul style="list-style-type: none"> — The weight of the portable equipment is more than 25 kg; — The portable equipment cannot be extracted from the track by one person; — Use of portable equipment which is fixed on the track or components of portable equipment are within the track construction.
Noise level	It is impossible to set the sound pressure level of the warning signals at the work site at least +3 dB louder than the noise level of the environment (working machines on the site and other sources) ¹¹⁾ , ¹²⁾ .
Speed of trains	The speed of the trains is exceeding the speed limits for working in a not blocked track. See Annex F for national conditions.
Length of the work site	One person is not able to control the reaction of the workers.
NOTE Each bullet is a criterion for the decision about blocking.	

If blocking of tracks is not required by the parameters/criteria of Table 1, the decision of “not blocking a track” shall be justified and documented.

6.2.3 Warning

6.2.3.1 Priority in warning systems

In A.3.2 the priority in warning systems is stated.

6.2.3.2 Decision about the possibility of warning

To decide about the possibility of warning the following parameters shall be considered.

⁸⁾ If it is not necessary to switch off catenary, blocking is regarded as possible if the time between two trains is approximately 20 min at least. “Temporary suspension of traffic” combined with additional measures (according to national rules) is a special form of “blocking of tracks”.

⁹⁾ The infrastructure manager has to develop the timetable under consideration of time periods which allow the execution of the work.

¹⁰⁾ See annex I for a guideline on the decision about blocking the working track in relation to the use of portable equipment.

¹¹⁾ See Annex D, for noise values of machines.

¹²⁾ For the use of personal protective equipment, see Clause 10.

Table 2 — Criteria for using a TWS

Parameter	Criteria
Announcement time/announcement distance (SCWS, ATWS, LOWS)	Announcement time calculated according A.3.3 shall comply with national rules.
Duration of the work (lookout)	Maximum duration of the work for which a lookout is allowed: reference to “specific requirements for lookout” (see A.3.9).
Number of trains (TWS)	If TWS warns without interruption this is no “warning”. In this case the infrastructure manager shall decide about measures concerning train circulation (e.g. do the work on time with lower train circulation – e.g. at night or weekend – or reduce the number of trains on the track).
Noise level	See A.3.5
Time to install/de-install (ATWS)	See A.3.2

If it is necessary, but not possible to use a TWS, the work shall be postponed or cancelled; only in exceptional cases the measure “operational agreement” (see Figure 6) may be used according to national rules. This decision shall be justified and documented.

The requirements for warning are given in A.3.

For specific requirements for LOWS see A.3.9.

6.3 Risk 2 – Personnel being struck by a train or injured due to wind drag from a train on adjacent track (safety of the worker)

6.3.1 General

Risk 2 exists when the following three items are fulfilled:

- The actual work takes place on the working track/worksites near an open track;
- The work is not planned to take place in the danger zone of the adjacent track;
- The presence of the person in the danger zone of the adjacent track is not intended.

The hierarchy of measures is as shown in Figure 7.

Safeguard for the adjacent track

(Hierarchy of measures for risk 2)

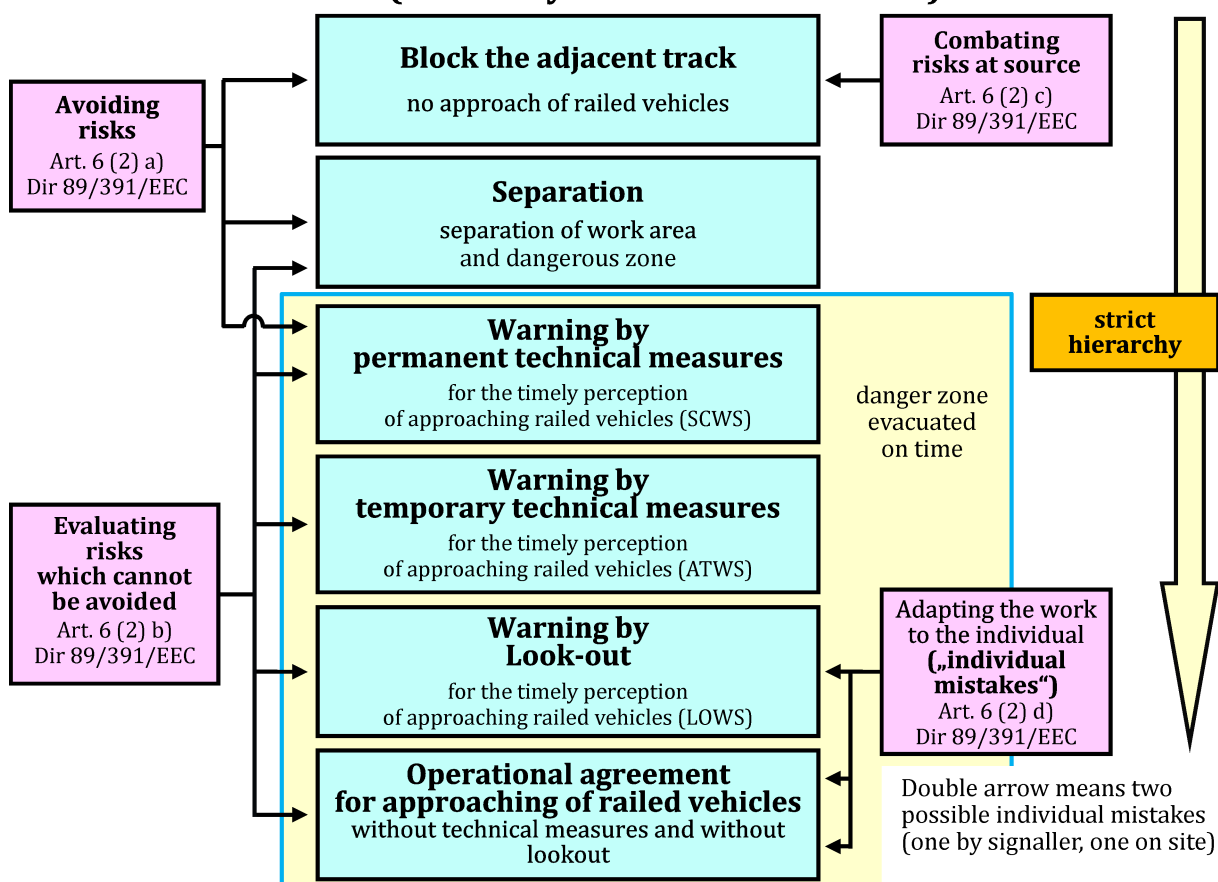


Figure 7 — Safeguard for the adjacent track

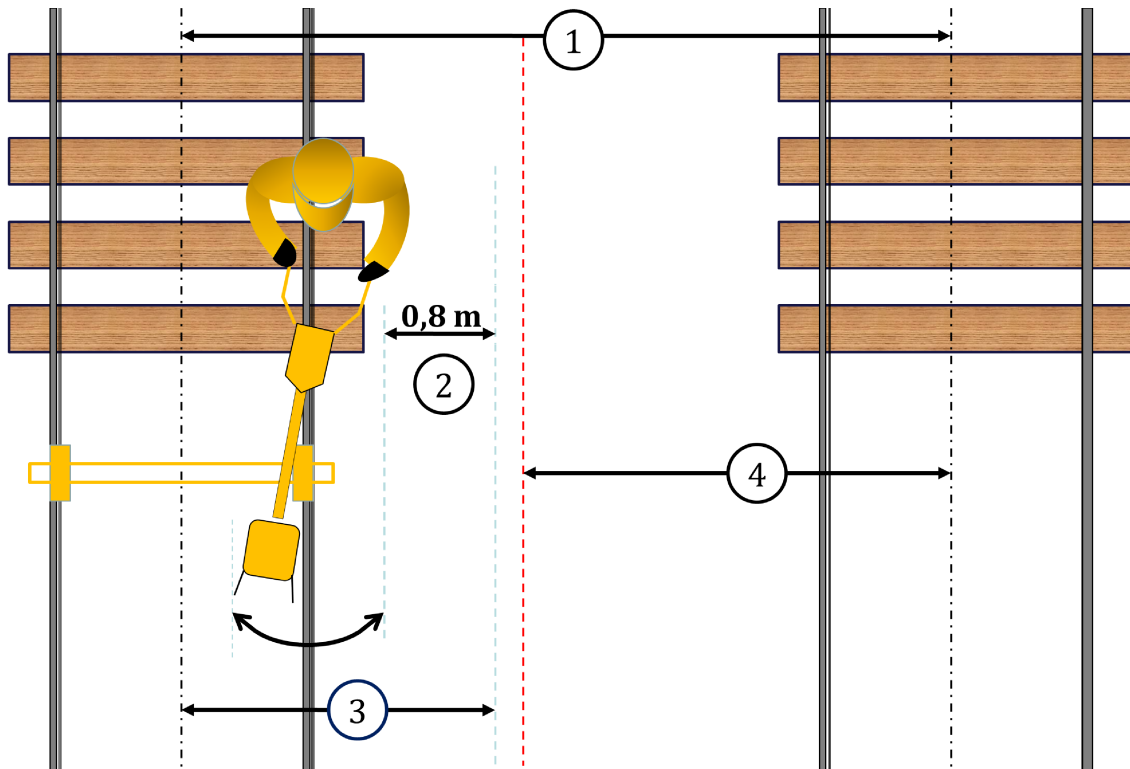
Because personnel, portable equipment and/or machines on the working track/work site near an open track can enter the danger zone of the adjacent track by “unintentional movement”, safety measures according to this clause shall be taken.

If clearing of the danger zone of the adjacent track is necessary (planned and intended work) safety measures according to risk 1 shall be taken too. If a machine (possibly) touches the danger zone of the adjacent track safety measures according to risk 4 shall be taken too.

The necessary work space shall be specified by the organization that carries out the work.

According to the nature of work, track and the type of machine when manual guidance is used, it is necessary to determine the space of the working area. This includes an additional space of minimum 0,80 m from the edge of the machine in the direction of the adjacent track (see Figure 8). If this additional space engages the danger zone of the adjacent track, safety measures against the risk of being struck shall be taken.

NOTE The additional working room is necessary to consider foreseeable human behaviour (moving room for the operator, one step beside the machine can be necessary to change tools, to look for malfunction or machine defects, to pick up track fixing material). The additional working room considers adaption of the safety measure to the human (influence of individual human failures according to European directive 89/391/EEC).



Key

- 1 track distance
- 2 additional working room
- 3 necessary workspace
- 4 danger zone of the adjacent track

NOTE Figure 8 is schematic, not scaled.

Figure 8 — Additional working room and necessary workspace for a hand-guided machine

6.3.2 Blocking¹³⁾

If any of the following parameters and criteria apply, an adjacent track shall be blocked. In this case alternative measures are not allowed. If blocking of an adjacent track is not possible, the work shall be postponed.

¹³⁾ The procedure for blocking is laid down in A.1.2.