

## Level crossings - European Union common safety indicators (ref. Directive 2014/88/EU)

NB - not legal text, and may contain errors

### Common safety indicators<sup>1</sup>

#### 1. Indicators relating to accidents

1.1. Total and relative (to train-kilometres) number of significant accidents and a break-down for the following types of accidents:

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- level crossing accident, including accident involving pedestrians at level crossing, and a further break-down for the five types of level crossings defined in point 6.2,
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Each significant accident shall be reported under the type of the primary accident, even if the consequences of the secondary accident are more severe (e.g. a derailment followed by a fire).

1.2. Total and relative (to train-kilometres) number of persons seriously injured and killed by type of accident divided into the following categories:

- passenger (also relative to total passenger-kilometres and passenger train-kilometres),
- employee or contractor,
- level crossing user,
- trespasser,
- other person at a platform
- other person not at a platform

#### 5. Indicators to calculate the economic impact of accidents

Total in euro and relative (to train-kilometres):

- number of deaths and serious injuries multiplied by the Value of Preventing a Casualty (VPC),
- cost of damages to environment,
- cost of material damages to rolling stock or infrastructure,
- cost of delays as a consequence of accidents.

Safety authorities shall report the economic impact of significant accidents.

The VPC is the value society attributes to the prevention of a casualty and as such shall not form a reference for compensation between parties involved in accidents.

#### 6. Indicators relating to technical safety of infrastructure and its implementation

6.2. Number of level crossings (total, per line kilometre and track kilometre) by the following five types:

- (a) passive level crossing
- (b) active level crossing:
  - (i) manual,
  - (ii) automatic with user-side warning,
  - (iii) automatic with user-side protection,
  - (iv) rail-side protected.

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<sup>1</sup> Proposed amendment to Railway Safety Directive 2004/49/EC as amended by Directive 2009/149/EC

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### **Methodologies and relevant definitions:**

#### **1. Indicators relating to accidents**

- 1.1. "significant accident" means any accident involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in significant damage to stock, track, other installations or environment, or extensive disruptions to traffic, excluding accidents in workshops, warehouses and depots;
- 1.2. "significant damage to stock, track, other installations or environment" means damage that is equivalent to EUR 150 000 or more;
- 1.3. "extensive disruptions to traffic" means that train services on a main railway line are suspended for six hours or more;
- 1.4. "train" means one or more railway vehicles hauled by one or more locomotives or railcars, or one railcar travelling alone, running under a given number or specific designation from an initial fixed point to a terminal fixed point, including a light engine, i.e. a locomotive travelling on its own;
- 1.8. "level crossing accident" means any accident at level crossings involving at least one railway vehicle and one or more crossing vehicles, other crossing users such as pedestrians or other objects temporarily present on or near the track if lost by a crossing vehicle or user;
- 1.12. "passenger" means any person, excluding a member of the train crew, who makes a trip by rail, including a passenger trying to embark onto or disembark from a moving train for accident statistics only;
- 1.13. "employee or contractor" means any person whose employment is in connection with a railway and is at work at the time of the accident, including the staff of contractors, self-employed contractors, the crew of the train and persons handling rolling stock and infrastructure installations;
- 1.14. "level crossing user" means any person using a level crossing to cross the railway line by any means of transport or by foot;
- 1.15. "trespasser" means any person present on railway premises where such presence is forbidden, with the exception of a level crossing user;
- 1.18. "death (killed person)" means any person killed immediately or dying within 30 days as a result of an accident, excluding any suicide;
- 1.19. "serious injury (seriously injured person)" means any person injured who was hospitalised for more than 24 hours as a result of an accident, excluding any attempted suicide.

#### **3. Indicators relating to suicides**

- 3.1. "suicide" means an act to deliberately injure oneself resulting in death, as recorded and classified by the competent national authority;
- 3.2. "attempted suicide" means an act to deliberately injure oneself resulting in serious injury.

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### 5. Common methodologies to calculate the economic impact of accidents

5.1. The Value of Preventing a Casualty (VPC) is composed of:

- (1) Value of safety per se: Willingness to Pay (WTP) values based on stated preference studies carried out in the Member State for which they are applied.
- (2) Direct and indirect economic costs: cost values appraised in the Member State, composed of:
  - medical and rehabilitation cost,
  - legal court cost, cost for police, private crash investigations, the emergency service and administrative costs of insurance,
  - production losses: value to society of goods and services that could have been produced by the person if the accident had not occurred.

When calculating the costs of casualties, fatalities and serious injuries shall be considered separately (different VPC for fatality and serious injury).

5.2. Common principles to appraise the value of safety per se and direct/indirect economic costs:

For the value of safety per se, the assessment of whether available estimates are appropriate or not shall be based on the following considerations:

- estimates shall relate to a system for valuation of mortality risk reduction in the transport sector and follow a Willingness to Pay (WTP) approach according to stated preference methods,
- the respondent sample used for the values shall be representative of the population concerned. In particular, the sample has to reflect the age/income distribution along with other relevant socio-economic/demographic characteristics of the population,
- method for eliciting WTP values: survey design shall be such that questions are clear/meaningful to respondents.

Direct and indirect economic costs shall be appraised on the basis of the real costs borne by society.

5.3. Definitions

5.3.1. “Cost of damage to environment” means costs that are to be met by Railway Undertakings and Infrastructure Managers, appraised on the basis of their experience, in order to restore the damaged area to its state before the railway accident.

5.3.2. “Cost of material damage to rolling stock or infrastructure” means the cost of providing new rolling stock or infrastructure, with the same functionalities and technical parameters as that damaged beyond repair, and the cost of restoring repairable rolling stock or infrastructure to its state before the accident, to be estimated by Railway Undertakings and Infrastructure Managers on the basis of their experience, including also costs related to the leasing of rolling stock, as a consequence of non-availability due to damaged vehicles.

5.3.3. “Cost of delays as a consequence of accidents” means the monetary value of delays incurred by users of rail transport (passengers and freight customers) as a consequence of accidents, calculated by the following model:

#### **VT = monetary value of travel time savings**

*Value of time for a passenger of a train (an hour)*

$VT_p = [VT \text{ of work passengers}] * [\text{Average percentage of work passengers per year}] + [VT \text{ of non-work passengers}] * [\text{Average percentage of non-work passengers per year}]$

$VT_p$  is measured in EUR per passenger per hour

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“Work passenger” means a passenger travelling in connection with their professional activities excluding commuting.

*Value of time for a freight train (an hour)*

$$VT_F = [VT \text{ of freight trains}] * [(Tonne-Km)/(Train-Km)]$$

$VT_F$  is measured in EUR per freight tonne per hour

$$\text{Average tonnes of goods transported per train in one year} = (Tonne-Km)/(Train-Km)$$

### **CM = Cost of 1 minute of delay of a train**

*Passenger train*

$$CM_p = K1 * (VT_p/60) * [(Passenger-Km)/(Train-Km)]$$

$$\text{Average number of passengers per train in one year} = (Passenger-Km)/(Train-Km)$$

*Freight train*

$$CM_f = K2 * (VT_f/60)$$

Factors K1 and K2 are between the value of time and the value of delay, as estimated by stated preference studies, to take into account that the time lost as a result of delays is perceived significantly more negatively than normal travel time.

Cost of delays of an accident =  $CM_p * (\text{Minutes of delay of passenger trains}) + CM_f * (\text{Minutes of delay of freight trains})$

*Scope of the model*

Cost of delays is to be calculated for significant accidents, as follows:

- real delays on the railway lines where accidents occurred as measured at terminal station
- real delays or, if not possible, estimated delays on the other affected lines.

## **6. Indicators relating to technical safety of infrastructure and its implementation**

6.1. “Train Protection System (TPS)” means a system that helps to enforce obedience to signals and speed restrictions.

6.2. “On-board systems” mean systems assisting the driver to observe line-side signalling and in cab signalling and thus providing protection of danger points and enforcement of speed limits. On-board TPSs are described as follows:

- (a) Warning, providing automatic warning to driver.
- (b) Warning and automatic stop, providing automatic warning to driver and automatic stop when passing a signal at danger.
- (c) Warning and automatic stop and discrete supervision of speed, providing protection of danger points, where “discrete supervision of speed” means supervision of speed at certain locations (speed traps) at the approach of a signal.
- (d) Warning and automatic stop and continuous supervision of speed, providing protection of danger points and continuous supervision of the speed limits of the line, where “continuous supervision of speed” means continuous indication and enforcement of the maximal allowed target speed on all sections of the line.

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Type (d) is regarded as Automatic Train Protection (ATP) system.

- 6.3. "level crossing" means any level intersection between a road or passage and a railway, as recognised by the infrastructure manager and open to public or private users. Passages between platforms within stations are excluded, as well as passages over tracks for the sole use of employees.
- 6.4. "road" means, for the purpose of railway accident statistics, any public or private road, street or highway, including adjacent footpaths and bicycle lanes.
- 6.5. "passage" means any route, other than a road, provided for the passage of people, animals, vehicles or machinery.
- 6.6. "passive level crossing" means a level crossing without any form of warning system or protection activated when it is unsafe for the user to traverse the crossing.
- 6.7. "active level crossing" means a level crossing where the crossing users are protected from or warned of the approaching train by devices activated when it is unsafe for the user to traverse the crossing.
  - Protection by the use of physical devices includes:
    - half or full barriers,
    - gates.
  - Warning by the use of fixed equipment at level crossings:
    - visible devices: lights,
    - audible devices: bells, horns, klaxons, etc.

Active level crossings are classified as:

- (a) Manual: a level crossing where user-side protection or warning is manually activated by a railway employee.
- (b) Automatic with user-side warning: a level crossing where user-side warning is activated by the approaching train.
- (c) Automatic with user-side protection: a level crossing where user-side protection is activated by the approaching train. This shall include a level crossing with both user-side protection and warning.
- (d) Rail-side protected: a level crossing where a signal or other train protection system permits a train to proceed once the level crossing is fully user-side protected and is free from incursion.

## 7. Definitions of the scaling bases

- 7.1. "train-km" means the unit of measure representing the movement of a train over one kilometre. The distance used is the distance actually run, if available, otherwise the standard network distance between the origin and destination shall be used. Only the distance on the national territory of the reporting country shall be taken into account.
- 7.2. "passenger-km" means the unit of measure representing the transport of one passenger by rail over a distance of one kilometre. Only the distance on the national territory of the reporting country shall be taken into account.
- 7.3. "line km" means the length measured in kilometres of the railway network in Member States, whose scope is laid down in Article 2<sup>2</sup>. For multiple-track railway lines, only the distance between origin and destination is to be counted.
- 7.4. "track km" means the length measured in kilometres of the railway network in Member States, whose scope is laid down in Article 2. Each track of a multiple-track railway line is to be counted.

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<sup>2</sup> Railway Safety Directive 2004/49/EC as amended by Directive 2008/110/EC.