

KPI Infrastructure

Methodological guidelines

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KPI Infrastructure

Methodological Guidelines

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About Trendline

Trendline brings together 29 European countries (25 EU Member States and 4 countries as observers) for data collection, data analysis, delivery of road safety KPIs and for using these within road safety policies. Trendline is co-funded by the European Union and builds on the experience gained in the Baseline project. KPIs – Key Performance Indicators – are indicators that provide information about factors that are associated with crash and injury risks. At the core of Trendline project are eight KPIs:

Indicator	Definition
Speed	Percentage of vehicles travelling within the speed limit
Safety belt	Percentage of vehicle occupants using the safety belt or child restraint system correctly
Protective equipment	Percentage of riders of powered two wheelers and bicycles wearing a protective helmet
Alcohol	Percentage of drivers driving within the legal limit for blood alcohol content (BAC)
Distraction	Percentage of drivers NOT using a handheld mobile device
Vehicle safety	Percentage of new passenger cars with a Euro NCAP safety rating equal or above a predefined threshold
Infrastructure	Percentage of distance driven over roads with a safety rating above an agreed threshold
Post-crash care	Time elapsed in minutes and seconds between the emergency call following a collision resulting in personal injury and the arrival at the scene of the collision of the emergency services

These 8 KPIs originate from the Commission Staff Working Document 'EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero" SWD (2019) 283 final.' In addition, some new experimental and complementary indicators will be tested within Trendline (provisional names):

- Driving under the influence of drugs
- Share of 30km/h road lane lengths in urban zones
- Red-light negotiations by road users
- Compliance with traffic rules at intersections
- Helmet wearing of PMD (Personal Mobility Devices) riders
- Self-reported risky behaviour
- Attitudes towards risky behaviour
- Use of lights by cyclists in the dark
- Enforcement of traffic regulations
- Alternative speeding indicators.

For each of the original eight KPIs and the experimental KPIs, a 'KPI Expert Group' (abbreviated as KEG) has been established. Their main role is to draft the common methodological guidelines, to give feedback on questions, and to review the report of the KPI which they are covering.

Website Trendline: <https://www.trendlineproject.eu/>

Terms and definitions

Annual Average Daily Traffic (AADT)

The total number of road motor vehicles passing a point of a road, over a year, divided by 365.

Trans-European road network

The road network identified in Regulation (EU) No 1315/2013 of the European Parliament and of the Council.

Divided road

A road with two or more roadways/ carriageways separated by a median, physical barrier or intervening space to physically separate traffic travelling in opposite directions.

Motorway

(definition according to Directive 2019/1936/EC)

A road, specially designed and built for motor traffic, which does not serve properties bordering on it and which meets the following criteria:

- (a) it is provided, except at special points or temporarily, with separate carriageways for the two directions of traffic, separated from each other either by a dividing strip not intended for traffic or, exceptionally, by other means;
- (b) it does not cross at level with any road, railway or tramway track, bicycle path or footpath;
- (c) it is specifically designated as a motorway.

Primary road

(definition according to Directive 2019/1936/EC)

A road outside urban areas that connects major cities or regions, or both, belonging to the highest category of road below the category "motorway" in the national road classification that is in place on 26 November 2019.

Rural motorway

All motorways not classified as urban motorways (see relevant definition).

Rural road

Public road outside urban boundary signs, excluding motorways.

Urban motorway

A motorway (see relevant definition) located inside the boundaries of an urban area and designed according to standards specifically for urban motorways.

Urban road (or road inside urban areas)

Public road inside urban boundary signs

Road axis

A road within scope of Directive 2019/1936/EC to be assessed using a network-wide assessment methodology.

Road segment

Part of a road axis with homogenous characteristics, not including junctions (interchanges or at-grade intersections).

Road section

Part of a road axis for which a single assessment score (and classification) is obtained using a network-wide assessment methodology. It may include one or more segments and/ or junctions.

For details of the segmentation process see section 3.5 of "Network Wide Road Safety Assessment: Methodology and Implementation Handbook" (European Commission, 2023).

https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en

SWD

(Commission) Staff Working Document

EGRIS

(European) Expert Group on Road Infrastructure Safety.

Vulnerable Road User (VRU)

Pedestrians, cyclists, and powered two wheelers (including e-scooters and mobility scooters) as well as people with disabilities, the elderly, and children.

1. Introduction

1.1. Context

The Communication of the European Commission “Europe on the Move – Sustainable Mobility for Europe: safe, connected and clean” of the 13th May 2018 confirmed the EU's long-term goal of moving close to zero fatalities in road transport by 2050 and added that the same should be achieved for serious injuries. It also proposed new interim targets of reducing the number of road deaths by 50% between 2020 and 2030 as well as reducing the number of serious injuries by 50% in the same period. To measure progress, the most basic – and important – indicators are of course the result indicators on deaths and serious injuries.

In order to gain a much clearer understanding of the different issues that influence overall safety performance, the Commission has elaborated, in cooperation with Member State experts, a first set of key performance indicators (KPIs). The KPIs relate to main road safety challenges to be tackled, namely: (1) infrastructure safety, (2) vehicle safety, (3) safe road use including speed, alcohol, distraction and the use of protective equipment, and (4) emergency response. The aim of the KPIs is connected to EC target outcomes.

The Commission Implementing Decision C(2021)5763 final of 5.8.2021 concerning the adoption of the work programme for 2021-2023 and the financing decision for the implementation of the CEF foresaw a technical assistance action for the collection of Key Performance Indicators for road safety in EU Member States. The action builds on a previous CEF support action in 2020-2022 which established the Baseline project to collect 8 road safety Key Performance Indicators (KPIs) in 18 EU Member States. On the 10th of August 2022, a call was published with reference “MOVE/C2/2022-54— Technical Assistance for the development and collection of Road safety Key Performance Indicators (KPI)”. A consortium of 25 EU Member States proposed the “Trendline” project to continue and elaborate the work on key performance indicators.

1.2. Purpose and basis of this document

This document presents the methodological guidelines for the KPI Infrastructure. It describes the methodological requirements to derive this KPI, with **primary definition** as follows:

Percentage of the distance driven over roads rated in terms of safety as "class 1" of the EGRIS Network Wide Assessment (NWA) proactive methodology.

More information on the EGRIS Network Wide Assessment (NWA) proactive methodology and the respective safety classes is provided in Appendix 2.

Since some Member States do not yet have the data available for distance travelled, the Commission (European Commission, 2019) has introduced as a “*first (and necessary) step*” to gather data for the % of

network length that is above the agreed safety rating threshold, thus formulating an **alternative, simplified KPI definition** as follows:

Percentage of the road network length rated in terms of safety as "class 1" of the EGRIS Network Wide Assessment (NWA) proactive methodology.

The minimum requirements set by the EC for this KPI are described in the Commission Staff Working Document SWD 283 (European Commission, 2019), included in Appendix 1. This guideline document is compatible with the requirements of the Commission Staff Working Document SWD 283 for the Infrastructure KPI while also considering the new EGRIS methodology for Network Wide Road Safety Assessment (NWA methodology) that has been prepared for the Commission by external contractors further to an evaluation of existing safety assessment methodologies and data, pilot testing and extensive discussions in and feedback from the Expert Group on Road Safety Infrastructure (EGRIS).

It is noted that the scope of the KPI Infrastructure is limited to the road network for which compulsory network-wide road safety assessments are established in Directive 2019/1936/EC. Considering that this does not include urban roads (with the exception of urban motorways), a different experimental KPI on 30 km/h in urban zones will also be developed within Trendline. Aspects of urban road infrastructure safety will therefore be examined through this experimental KPI (i.e. outside the scope of this report).

Furthermore, Trendline participants interested in calculating an infrastructure KPI **for the part of the national road network that is not covered by Directive 2019/1936/EC** may use the Baseline definitions for KPI Infrastructure (Van den Berghe et al., 2021), in particular definition (4): "*Percentage of the road network length of roads either with opposite traffic separation (by barrier or area) or with a speed limit equal to or lower than xx km/h in relation to the total road network length*". Information on the Baseline method to calculate the KPI is provided in Appendix 3.

It is noted that no Trendline funding can be used for data collection and analysis in relation to this KPI.

In addition to the specification of the minimum requirements to deliver the primary Infrastructure KPI and the disaggregated indicators, this document also includes recommendations for optional additional activities. Member States can decide whether to follow the minimum requirements only or to extend (part of) their methodology, depending on available data and means and their own research questions.

The main target audience for this document are the persons in the participating countries that will collect and/ or analyse the data to derive the KPIs.

2. General considerations

2.1. Infrastructure assessment methodology

According to Article 5 paragraph 5 of the Directive 2019/1936/EC, the Commission has provided guidance to Member States on the methodology for carrying out systematic network-wide road safety assessments and safety ratings. A Network-Wide Road Safety Assessment (NWA) methodology has been developed under the supervision of the Commission and the Expert Group on Road Infrastructure Safety (EGRIS), and in the 13th EGRIS Plenary meeting of November 21, 2022 the methodology was considered endorsed by the EGRIS Members, with the following statement:

"The Expert Group supports that the methodology is to be used as a guideline, noting that Member States might envisage some specificities and consider some adjustments at national level. The Group also recommends that further work should be carried out to refine the methodology at a later stage to be able to demonstrate in the future the safety savings that the safety assessment might bring."

The EGRIS NWA methodology has been further disseminated in a dedicated workshop organised by the European Commission on January 16th, 2023, and is available on the Commission's website at: https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en. The core idea of this methodology (derived from the Directive requirements) is the integration of the two components applied over the same network: the assessment of the in-built safety of roads (proactive methodology, NWA-proactive) and the assessment of roads on the basis of crash occurrence analysis (reactive methodology, NWA-reactive).

According to commonly accepted theoretical background on Safety Performance Indicators (ETSC, 2001; SafetyNET, 2007; European Commission, 2022), performance indicators are causally related to crashes and injuries, they are used in addition to the number of crashes or injuries in order to indicate safety performance or understand the process that leads to crashes and as such they should not be heavily based on the final outcome a Road Safety Management System, i.e. the injury crash numbers. This would be the case if the Infrastructure KPI was based on the final, integrated results of this EGRIS Network-Wide Road Safety Assessment (NWA) that rely predominantly in the results of crash analysis.

Considering the above **the Infrastructure KPI estimation is based on the safety rating results (safety classes) of the proactive part of the EGRIS Network-Wide Road Safety Assessment (NWA) methodology.**

The use of the EGRIS NWA methodology is not mandatory for Member States in order to satisfy the requirements of the Directive 2019/1936/EC. If a Member State implements a different (but compatible) national methodology to meet the requirements of Directive 2019/1936/EC regarding network-wide road safety assessment, it is strongly recommended that supplementary results using the EGRIS NWA proactive methodology are also provided for the purpose of estimating the Infrastructure KPI(s).

2.2. Road types considered

The following background information is relevant for the consideration of different road types in the Infrastructure KPI:

- Member States (or regions within Member States which are responsible for the design and maintenance of road infrastructure) have different road classification systems.
- The aforementioned EGRIS Network-Wide Road Safety Assessment (NWA) methodology is applicable for road types within the scope of Directive 2019/1936/EC, and namely:
 - roads which are part of the trans-European road network,
 - motorways (rural and urban),
 - other primary roads (i.e., roads outside urban areas that are right below motorways in Member States' road functional classification system), and
 - other roads situated outside urban areas, which do not serve properties bordering on them and which are completed using Union funding.
- For the estimation of proactive road safety assessment scores and subsequently safety classes, the assessment models of the proactive EGRIS NWA methodology refer to the following road types:
 - rural motorways;
 - urban motorways;
 - primary divided roads;
 - primary undivided roads.
- According to Article 1, paragraph 4 of Directive 2019/1936/EC, each Member State should provide the Commission a list of motorways and primary roads within its borders by 17/12/2021.
- A commonly agreed European methodology for the network-wide safety assessment of urban roads (besides urban motorways) and of minor and local rural roads is currently not available.

The four aforementioned road types considered in the EGRIS NWA methodology (rural motorways, urban motorways, primary divided roads, and primary undivided roads) shall also apply to the estimation of the Infrastructure KPI(s).

2.3. Definitions of the Infrastructure KPI

The following section presents two alternative definitions of the Infrastructure KPI, based on the requirements defined in the Commission Staff Working Document SWD 283 (European Commission, 2019) - see also Appendix 1, while also considering the above general considerations and the initial methodological guidelines document (Van den Berghe et al., 2021) as developed within the Baseline project.

Further details and specific guidance regarding the estimation of KPI values in each case are provided in Chapter 3 of this report. The minimum methodological requirements for delivering the KPI values and potential additional values that may be provided by Member States are provided in Chapter 4.

2.3.1. Case 1: Considering road safety rating and exposure in roads within scope of DIR 2019/1936

The primary definition of the Infrastructure KPI, as follows:

Percentage of the distance driven over roads rated in terms of safety as "class 1" of the EGRIS Network Wide Assessment (NWA) proactive methodology.

More information on the EGRIS Network Wide Assessment (NWA) proactive methodology and the respective safety classes is provided in Appendix 2.

It is acknowledged that the use of the EGRIS NWA methodology is not mandatory for Member States to meet the requirements of the Directive 2019/1936/EC. Therefore, if a Member State has decided to apply a different national network wide road safety assessment methodology but still wishes to provide estimations for the Trendline Infrastructure KPI, there are two acceptable alternative options:

- the Member State may implement the EGRIS NWA-proactive methodology in parallel to the national network-wide assessment methodology (with minimum workload since some of the data requirements will most probably be identical), with the purpose of estimating the Infrastructure KPI, or
- the Member State may provide the required dataset for the EGRIS NWA-proactive implementation, and the KPI estimation will then be performed by the Trendline Consortium.

The scope of this definition is inevitably limited to the scope of the EGRIS Network Wide Assessment (NWA) methodology (i.e., scope of the Directive 2019/1936/EC), as mentioned in Section 2.2. Therefore, the percentage will be calculated in relation to the total distance driven on all roads within scope of the Directive.

Details on how to estimate this KPI and a breakdown per road type are further explained in Section 3.1.

2.3.2. Case 2: Considering road safety rating and network length in roads within scope of DIR 2019/1936

The primary KPI definition of Case 1 incorporates a desirable consideration of traffic exposure; the distance driven component (expressed in veh.km / year - see also Section 3.1) allows the safety ranking of high-volume roads to have a greater impact to the final KPI value compared to low volume roads. However, traffic volumes are not readily available on all roads in many countries. In accordance with Commission Staff Working Document SWD 283 (European Commission, 2019) - see Appendix 1, a simplified version of the previous primary definition is also provided, considering the road length per safety class as a rough proxy of traffic exposure (i.e., assuming in a simplified way that the traffic volume is equal on all roads). This simplified definition is as follows:

Percentage of the road network length rated in terms of safety as "class 1" of the EGRIS Network Wide Assessment (NWA) proactive methodology.

The scope of this KPI definition is inevitably limited to the scope of the EGRIS Network Wide Assessment (NWA) methodology (i.e., scope of the Directive 2019/1936/EC), as mentioned in Section 2.2. Therefore, the percentage will be calculated in relation to the total length of all roads within scope of the Directive as well.

Details on how to estimate this KPI and a breakdown per road type are further explained in Section 3.2.

3. KPI Infrastructure estimation

3.1. Case 1: Considering road safety rating and exposure in roads within scope of DIR 2019/1936, using the EGRIS NWA

This case concerns the primary definition of the KPI, as follows:

Percentage of the distance driven over roads rated in terms of safety as "class 1" of the EGRIS European Network Wide Assessment (NWA) proactive methodology.

In order to calculate the KPI values that reflect this definition, the following steps shall be followed:

1. Identify all roads (in the country, region, etc.) within scope of Directive 2019/1936/EC and classify them into one of the following road types (see also definitions for motorway and primary road in the beginning of this report):
 - a) Rural motorway
 - b) Urban motorway
 - c) Divided primary road
 - d) Undivided primary road
2. For each identified road axis, implement the EGRIS Network Wide Road Safety Assessment methodology - proactive part (NWA-proactive), as described in detail in the document "Network Wide Road Safety Assessment: Methodology and Implementation Handbook" (European Commission, 2023), available in: https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en

At the end of this step, a database should be available with the structure and indicative contents as presented in Table 3.1:

Table 3.1: Indicative structure and contents of results database from the implementation of NWA-proactive.

Section Number i	Road Type	Section Length L_i (km)	NWA-proactive score (%)	NWA-proactive Safety Class S_i
1	rural motorway	0.600	87	1 (low risk)
2	urban motorway	0.400	74	2 (intermediate risk)
3	primary divided	0.800	45	3 (high risk)
4	primary undivided	1.200	41	3 (high risk)
...

Acknowledging that the use of the EGRIS NWA methodology is not mandatory for Member States to meet the requirements of the Directive 2019/1936/EC, if a Member State has decided to apply a different national network wide road safety assessment methodology but still wishes to provide estimations for the Trendline Infrastructure KPI, there are two acceptable options:

- the Member State may implement the EGRIS NWA-proactive methodology in parallel to the national network-wide assessment methodology (with minimum workload since some of the data requirements will most probably be identical), with the purpose of estimating the Infrastructure KPI, or
- the Member State may provide the required dataset for EGRIS NWA-proactive implementation, and the KPI estimation will then be performed by the Trendline Consortium.

3. For each road section i of the NWA results database, traffic volume data in terms of Average Annual Daily Traffic (AADT) needs to be gathered. AADT, denoted as " T_i " shall refer to the year during which the NWA was performed. AADT is expressed in veh/day. Please note that traffic counts should not be weighted according to vehicle class to derive passenger car equivalents or units (PCE/PCU) but represent the actual number of vehicles.

If the assessment has been performed per direction of traffic (as is typical for motorways and divided primary roads), AADT for this direction will be used. If the assessment has been performed for both directions of traffic (as is typical for undivided primary roads), AADT for both directions will be used.

Further details for the calculation or estimation of AADT are provided in Chapter 5 of this report.

4. Subsequently, for each road section i the exposure factor, denoted as " E_i " will be estimated as the product of the length of the road section and the traffic volume on that road section, as follows:

$$E_i = L_i * T_i * 365 \text{ (veh. km / year)}$$

5. As a last preparatory step prior to KPI estimation, a dichotomization of the safety rating is required, i.e. distinguishing road sections that fulfil the safety rating criterion from those that do not. Therefore, a binary variable is introduced, denoted as " DS_i ", defined as follows:

$$DS_i = \begin{cases} 1, & \text{if the section is classified as class 1 - low risk,} \\ 0, & \text{if the section is classified as class 2 - intermediate risk or class 3 - high risk,} \end{cases}$$

6. At the end of step 5, the database (as presented in Table 3.1) should include, for each road section, the following additional columns:
 - T_i (veh/day): Average Annual Daily Traffic (AADT)
 - E_i (veh.km/year): Exposure factor, as calculated in step 4
 - DS_i (1 or 0): Dichotomization of safety rating, as defined in step 5
7. The KPI can then be estimated as the percentage of exposure on road sections classified as class 1 (low risk) divided by the total exposure on all sections of the same road type:

$$KPI (\%) = 100 * \frac{\sum_1^N E_i * DS_i}{\sum_1^N E_i}$$

where N = the total number of road sections belonging in the examined road type (within scope of Directive 2019/1936/EC).

Following the above methodology, the following five (5) values of the Infrastructure KPI (case 1) shall be estimated and provided, per road type and aggregate:

- Infrastructure KPI for rural motorways.
- Infrastructure KPI for urban motorways.
- Infrastructure KPI for divided primary roads.
- Infrastructure KPI for undivided primary roads.
- Infrastructure KPI for all roads within scope of Directive 2019/1936/EC.

3.2. Case 2: Considering road safety rating and network length in roads within scope of DIR 2019/1936

This case concerns the simplified definition of the KPI for roads within scope of Directive 2019/1936/EC, and is applicable when traffic data is not available by Member States:

Percentage of the road network length rated in terms of safety as "class 1" of the European Network Wide Assessment (NWA) proactive methodology.

In order to calculate the KPI values, the procedure (steps) is similar to Case 1 presented above, differing only in Step 4, where the exposure factor, denoted as "Ei" is now estimated as equal to the length of the road section:

$$E_i = L_i$$

Following the above methodology, five (5) values of the Infrastructure KPI (case 2) shall be estimated and provided, per road type and aggregate:

- Infrastructure KPI for rural motorways.
- Infrastructure KPI for urban motorways.
- Infrastructure KPI for divided primary roads.
- Infrastructure KPI for undivided primary roads.
- Infrastructure KPI for all roads within scope of Directive 2019/1936/EC.

4. Minimum requirements and additional information

4.1. Minimum requirements

As a minimum requirement, the following values for the Infrastructure KPI should be provided:

1. Infrastructure KPI - Case 1 for rural motorways.
2. Infrastructure KPI - Case 1 for urban motorways.
3. Infrastructure KPI - Case 1 for divided primary roads.
4. Infrastructure KPI - Case 1 for undivided primary roads.
5. Infrastructure KPI - Case 1 for all roads within scope of Directive 2019/1936/EC.

If traffic data is not available and cannot be estimated based on data already existing or collected for other KPIs and using sampling or extrapolation techniques, the above values may be substituted by the respective KPI definitions that consider road length instead of exposure (Case 2).

If a sampling methodology has been used for traffic volumes estimation, both the point estimate for the KPI and the 95% confidence interval should be provided.

4.2. Possibilities for additional information and breakdowns

Although none of the possibilities that are listed under this heading are mandatory, Member States are invited to consider providing one or more of those values (in addition to the formal, country level KPI value), in particular if such data is easily available.

4.2.1. Provision of background datasets

For all KPI definitions originating from the results of the network wide road safety assessment as per Article 5 of Directive 2019/1936/EC, it is strongly recommended that the cleaned NWA-proactive dataset (at section level) is provided alongside the KPI value. An indicative structure of such a dataset has been presented in Chapter 3, Table 3.1.

If a Member State has implemented a national NWA methodology, instead of the EGRIS NWA methodology, and a conversion has been applied in order to estimate the Infrastructure KPIs, both the original and the converted datasets should ideally be provided, accompanied by an explanatory note clearly explaining how the conversion was performed and what assumptions were potentially required and applied.

The data tables and supporting information mentioned above should allow an independent researcher to calculate the KPI values and compare with the value proposed by the Member State. If for privacy

reasons or other legal restrictions such section-level data cannot be provided, the Member State should provide aggregated values at the highest level of disaggregation possible.

4.2.2. Provision of metadata

An explanatory document should be provided clearly explaining how traffic volume data (specifically AADT) has been derived (or estimated) per section of the examined road network. The following aspects should be discussed in this document:

- what traffic data collection method has been used (e.g., loop detectors, manual spot counts, counts from toll stations, other),
- to which weeks/ months/ years do the traffic data refer to,
- what methodology was used to estimate AADT from the collected traffic data,
- what methodology was used to assign AADT values to the segments,
- (ideally) a 95% confidence interval of AADT estimations,
- any other information considered useful.

4.2.3. Disaggregation by region

Disaggregation by region is not a requirement. Member States are free to choose supplementary stratifications according to country regions (e.g., NUTS 1 regions) if considered appropriate. In that case countries can consider the estimation of provision of disaggregated KPI values for each region or groups of regions.

4.2.4. Possible complementary indicators

Complementary indicators that may be considered by Member States are:

1. Percentage (%) of the road network length within scope of Directive 2019/1936/EC in relation to the total road network length of the Member State.
2. Percentage (%) of each of the following road types in relation to the total road network length of the Member State:
 - a) rural motorways
 - b) urban motorways
 - c) primary divided roads
 - d) primary undivided roads
 - e) urban roads
3. For the part of the national road network that is not covered by Directive 2019/1936/EC, a complementary KPI according to definition (4) of the Baseline KPI Infrastructure (Van den Berghe et al., 2021) may be estimated, as follows: "Percentage of the road network length of roads either with opposite traffic separation (by barrier or area) or with a speed limit equal to or lower than xx km/h in relation to total road network length". See also Appendix 3 for guidance on how to estimate this KPI.

If such information is available, it can be added to the Trendline database. However, these values should not be used as a substitute but rather as a complement for the Trendline Infrastructure KPI.

5. Data requirements

5.1. Roads within scope of Directive 2019/1936/EC

Required data for KPI estimation on roads within scope of the Directive 2019/1936/EC, using the EGRIS NWA are:

- the safety rating results (safety classes) of the proactive part of the EGRIS methodology for network wide road safety assessment (NWA-proactive), with database structure and indicative contents as presented in Table 3.1, and
- traffic volume data.

Both data sets are to be provided as disaggregated data at road section level and separately per road type.

According to Article 5 paragraph 3 of Directive 2019/1936/EC, Member States are expected to complete the first network wide assessment of their road network and provide relevant results by the end of 2024. Subsequent network-wide road safety assessments shall be sufficiently frequent in order to ensure adequate safety levels, but in any case shall be carried out at least every five years. These datasets will provide the basis for Infrastructure KPI estimations within Trendline.

Therefore, by the end of 2024 (i.e. within the Trendline project timeframe) all Member States will have developed datasets of input parameters and results from the implementation of either the EGRIS NWA-proactive methodology or a similar, national methodology compatible to the requirements of Article 5 of the Directive 2019/1936/EC. It is strongly recommended that Member States which decide to implement a national methodology for the network wide assessment, also provide the input parameters of geometric infrastructure characteristics of the EGRIS NWA-proactive methodology to the Trendline Consortium (either collected in parallel to the national methodology, or derived by computation and assumptions from it) in order to produce a compatible and comparable Infrastructure KPI for all.

With regard to traffic data, if not readily available, it is possible to use inferred data from existing sources or spot counts, as described in section 5.3.1. Otherwise it is also possible to consider road length as a measure of exposure (KPI Case 2).

5.2. Sampling and weighting of traffic data

In some cases, data on traffic and data on speed limits and separation of VRUs from motorized traffic (on urban roads) may only be available for part of the road network. In cases where traffic and related data is not available, it might nevertheless be possible to derive an estimate of the KPI at national level using sampling techniques, provided that the sample is sufficiently representative and appropriate weighting factors can be defined.

Sampling and weighting is not considered for the road safety ranking of roads within the scope Directive 2019/1936/EC, as it is anticipated that Member States will have completed the first assessment of their road network (end of 2024 according to the Directive) and the results of this assessment will be utilized for KPI estimations.

Traffic volumes can either be obtained from existing national mobility data, from toll station counts (in tolled roads), or estimated by using traffic counts on a selected sample of road sections. Statistical analysis techniques and tools should be determined by each Member State and clearly described in the method section. When using sampling, project participants should indicate very clearly what principles the sampling design was based on and how traffic data were obtained for both weighting within each road type and weighting across road types.

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Appendix 1 Extracts from the SWD document in relation to KPI Infrastructure

Reference: COMMISSION STAFF WORKING DOCUMENT - EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero, SWD (2019) 238, <https://ec.europa.eu/transport/sites/transport/files/legislation/swd20190283-roadsafety-vision-zero.pdf>

Extract from section 4.1: Infrastructure -safe roads and roadsides

In a recently agreed revision of EU infrastructure safety rules, the EU has mandated risk mapping and safety rating for roads of the strategic Trans-European Transport Network (TEN-T), motorways and primary roads, without prescribing a specific methodology. The Commission will however work closely with Member State experts towards a common methodology.

As regards **infrastructure safety**, the Commission

- is establishing an expert group to elaborate a framework for road classification that better matches speed limit to road design and layout in line with the Safe System approach;
- will facilitate exchange of experience on Safe System methodologies between practitioners (e.g. in a Forum of European road safety auditors);
- will publish the results of the network-wide safety assessment (safety ratings) to be carried out by Member States by end 2024 in accordance with the revised EU Road Infrastructure Safety Management Directive; and
- will analyse the need for further research and innovation on infrastructure safety e.g., on new technology for monitoring infrastructure conditions.

A KPI for road infrastructure should show the **safety quality of a road network** independent of road user behaviour or vehicle technology. Ahead of the network-wide safety rating required under new EU rules (with a first complete assessment expected by end 2024), and in the absence of an agreed common rating methodology, such an indicator has proved difficult to establish, and further work is needed to shape it.

The Commission services will work with Member States to define an infrastructure indicator on the following basis:

KPI for infrastructure:

Percentage of distance driven over roads with a safety rating above an agreed threshold

The indicator will be based on a network rating or assessment methodology and take into account distance driven or other proxy for exposure. This will be reviewed in ongoing work at expert level and eventually replaced by the network-wide safety rating under the new EU infrastructure safety rules.

Extracts from the Annex to the SWD document

General considerations for all KPIs

A number of methodological considerations set out below apply to all indicators:

- Geographical coverage: In principle the indicator should be representative of the whole Member State territory. If there are exceptions (e.g., for islands) they should be precisely defined and communicated by the Member States concerned to the Commission.
- Sampling: when sampling is used to derive the value of the indicator, Member States can define their own sampling methodology. Obviously over time it would be helpful for Member States to work together with the Commission to come up with common bases for sampling. And in the meantime, it should be based on well-established statistical techniques aimed at achieving a properly representative result - for example:
 - Sampling should as far as possible be random (precise methodology would remain for Member States to decide)
 - Sample size: Member States to decide on the size needed.
 - If aggregation methods are used they should aim at weighting the results by distances travelled.
- Relationship of the indicators with traffic rules:

It is worth pointing out that some indicators refer to behaviour which is regulated by traffic laws while in a number of cases the laws differ amongst Member States. For example, Blood Alcohol Content (BAC) limits are different and this should be born in mind when looking at the results. The use of cycling helmets is a similar case, as it is generally not an obligation except in some cases for children. Other areas, such as safety ratings of vehicles above the type approval minima, are not related to legal obligations.

In all cases a methodological note will be attached to the indicator results to clarify this situation.

KPI 7: Key Performance Indicator for infrastructure safety

Rationale

Layout, design (including signals) and maintenance are aspects of infrastructure that determine its 'road safety' quality.

A safety performance indicator for road infrastructure is intended to provide a quantified representation of the safety quality of a road network, which is independent of road user behaviour or vehicle technology. However, further work is needed to shape the indicator.

Definition of the KPI for infrastructure

The Commission services will work with Member States to define an infrastructure indicator on the following basis:

*Percentage of distance driven over roads with a safety rating above an agreed threshold
(still to be defined)*

leaving the rating methodology to the choice of Member States until an agreement on the threshold is reached.

However, this indicator is technically challenging. Many Member States do not yet have the data available for distance travelled, so as a first (and necessary) step it is proposed to gather data for the % of network length that is above the agreed safety rating threshold.

Temporarily, a simplified version of the KPI may be used where no rating methodology is available which is defined as follows:

Percentage of distance driven over roads either with opposite traffic separation (by barrier or area) or with a speed limit equal to or lower than xx km/h (limit left to the discretion of MS) in relation to total distance travelled.

Work with experts will continue in the CARE expert group or in another appropriate set-up to define the data collection procedures and the rating methodology.

In the first phase, urban areas could be excluded by Member States to reduce the overall complexity of this KPI, but we should not exclude the infrastructure question for urban areas in the future.

Appendix 2 Synopsis of EGRIS Network-Wide Road Safety Assessment (NWA) proactive methodology

Reference: European Commission (2023). Network Wide Road Safety Assessment: Methodology and Implementation Handbook. Written by National Technical University of Athens, University of Zagreb, FRED Engineering s.r.l.

https://road-safety.transport.ec.europa.eu/eu-road-safety-policy/priorities/infrastructure/road-infrastructure-guidelines_en

Overview

The EGRIS Network-Wide Assessment (NWA) methodology comprises two assessment approaches: one for the assessment of the in-built safety of roads (proactive methodology, NWA-proactive) and one for the assessment of roads on the basis of crash occurrence analysis (reactive methodology, NWA-reactive). The two methodologies are both applied over the same network and the resulting assessment outcomes are combined via an integration methodology to provide the final road network rating and ranking.

Proactive methodology

The implementation of the proactive methodology consists of the parts shown in the following flowchart (Figure A-2.1). The methodology differentiates between the road type, i.e., rural or urban motorway, divided rural road or undivided rural road. The network also needs to be segmented for the implementation of the proactive methodology. Sections are formed by segments and junctions, and are not necessarily identical to the segments of the reactive methodology, as segmentation criteria are different.

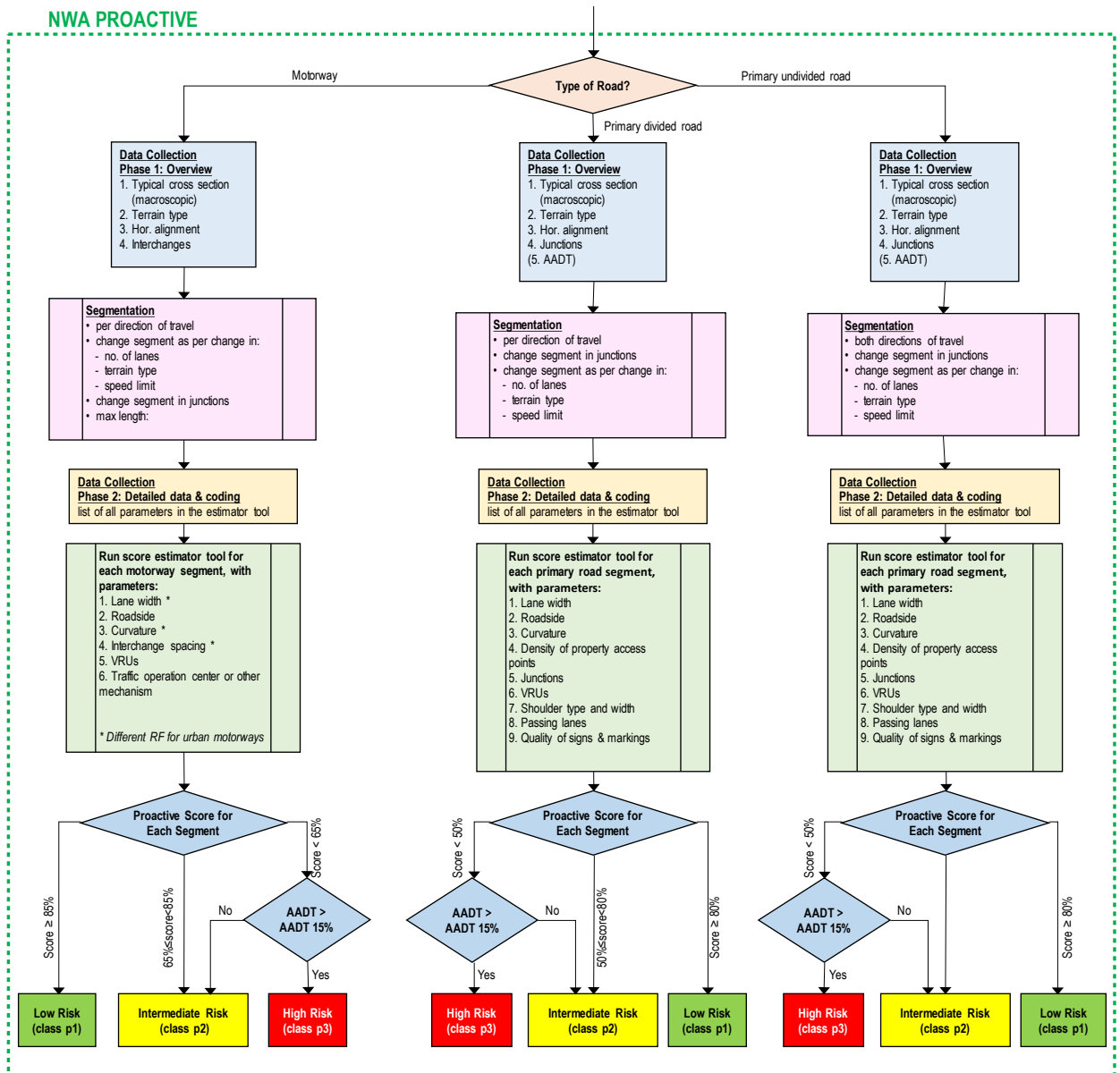


Figure A-2.1: NWA-proactive flowchart.

Each road section is assessed based on a set of design or operational characteristics. Different characteristics are considered for motorways and primary (or other¹) rural roads, but the overall logic of the assessment is the same. An ideally safe road section receives a safety score equal to 100 points. Less safe sections get a lower score, and reduction is determined with the use of Reduction Factors (RF). Each RF corresponds to a parameter used for the assessment of roads and expresses the safety level of the specific parameter. RFs range from zero (without being equal to zero) to one and one corresponds to the safest condition.

$$Score_i = 100 \times RF_{1i} \times RF_{2i} \times \dots \times RF_{ni}$$

¹ Roads that are below primary rural roads in a Member State's road functional classification system, are outside of urban areas and have received EU funds.

Based on the score, a road section is classified as “low-risk”, “intermediate-risk” or “high-risk. Both motorway and primary (or other rural) road sections are assessed based on a procedure that relies on Reduction Factors and three safety classes; however, different parameters and different scores are used for the assessment of each road type as they have significant differences in design and operational characteristics. Specifically, the distinguished road types are: rural motorways, urban motorways, primary divided roads, primary undivided roads. Scores between different road types are not comparable.

Parameters considered for the in-built safety assessment of roads differ for motorways and for primary (or other) rural roads and are as follows (Table A-2.1):

Table A-2.1: Considered in-built safety parameters for EGRIS NWA-proactive

Number	Parameter
Motorways	
1	Lane width *
2	Roadside (clear zone width, obstacles, presence of barriers)
3	Curvature *
4	Interchanges *
5	Conflicts between pedestrians/ bicyclists and motorized traffic
6	Traffic operation centres and / or mechanisms to inform users for incidents
Primary Roads	
1	Lane width **
2	Roadside (clear zone width, obstacles, presence of barriers) **
3	Curvature
4	Density of property access points **
5	Junctions
6	Conflicts between pedestrians/ bicyclists and motorized traffic
7	Shoulder type and width **
8	Passing lanes **
9	Signs and markings

Notes: 1. Parameters noted with one asterisk are treated differently for urban and rural motorways.
2. Parameters noted with two asterisks are treated differently for divided and undivided primary roads.

In addition to the above assessment parameters, operational characteristics such as traffic volume - AADT (if data is available), speed limit and presence of automated speed enforcement (or operation speed V_{85} , if data is available), affecting either the safety scoring (Reduction Factors) of selected parameters or the final ranking.

At the end of the proactive methodology implementation, every road section is assigned to a safety class, based on the final score value. Lowest performing sections are classified as "High Risk" - Class 3 (colour coded as red), medium performing as "Intermediate Risk" - Class 2 (colour coded as yellow) and best performing as "Low Risk" - Class 1 (colour coded as green).

Appendix 3 Complementary infrastructure KPI for the part of the road network not covered by Directive 2019/1936/EC (from Baseline project)

Reference: Van den Berghe, W., Stijn, D., Dragomanovits, A., Schermers, G., Irzik, M. (2021). Methodological guidelines - KPI Infrastructure - Version 2.5. Baseline project, Brussels: Vias institute.

Introduction

The Baseline project, funded partially by the European Commission, aimed to assist participating Member States' authorities in the collection and harmonized reporting of these KPIs and to contribute to building the capacity of Member States which have not yet collected and calculated the relevant data for the KPIs. Within this project, minimum methodological requirements to qualify for the Baseline KPI for infrastructure were described and several possible definitions for the KPI on infrastructure were defined.

The Trendline Infrastructure KPI is limited to the road network for which compulsory network-wide road safety assessments are established in Directive 2019/1936/EC. For Trendline participants interested in calculating an Infrastructure KPI for the part of the national road network that is not covered by Directive 2019/1936/EC, it is recommended to use Baseline definition (4) for KPI Infrastructure "Percentage of the road network length of roads either with opposite traffic separation (by barrier or area) or with a speed limit equal to or lower than xx km/h in relation to total road network length".

In this Appendix, a synopsis of the Baseline method to calculate this KPI is provided.

Baseline Infrastructure KPI definition (4)

Based on the directions for a simplified version of the KPI according to the Commission Staff Working Document SWD 283 (European Commission, 2019 - see also Appendix 1), the following KPI definition - further called "Baseline KPI definition (4)" - was proposed during the Baseline project:

(4) Percentage of the road network length of roads either with opposite traffic separation (by barrier or area) or with a speed limit equal to or lower than xx km/h in relation to the total road network length.

According to this definition, the threshold of the safety rating (of the primary KPI definition) is assumed to be achieved when either (a) the road has opposite traffic separation, or (b) has a speed limit equal or lower than a defined threshold. This speed limit threshold is not prescribed in the Commission Staff Working Document SWD 283 (European Commission, 2019).

In Baseline project the following speed limit thresholds were proposed, in line with Safe System principles (ITF, 2016; SWOV, 2016; European Commission, 2020):

- 30 km/h for roads with the possibility of a collision between a vulnerable road user and a motorized vehicle (this includes all roads in built-up areas, except for roads where vulnerable road users are separated from motorized vehicles).
- 50 km/h for roads in built-up areas with facilities to separate vulnerable road users from motorized traffic.
- 50 km/h for roads with the possibility of a right angle collision between motorized vehicles (typically for interurban roads with a high density of intersections and/or where the density of accesses to private properties is high).
- 70 km/h for roads with the possibility of a head on collision between passenger vehicles (typically for interurban or rural roads with long road segments without intersections).

Please note that these speed limits are suggestions and Member States can choose other ones. These speed limits were proposed by Baseline project in the context of the KPI on infrastructure safety, and they do not imply any commitment from the European Commission to these limits.

In order to calculate this KPI, there is need for road length data (as a rough proxy for traffic exposure) and a classification of roads into three groups:

- RL: Roads on which the speed limit is equal or **lower** than the threshold (30 km/h, 50 km/h and 70 km/h, depending on the road type). We can make a further distinction in road types RL₃₀, RL₅₀ and RL₇₀.
- RH: Roads on which the speed limit is **higher** than the threshold, **without** opposite traffic separation (by barrier or area). We can make a further distinction in road types RH₃₀, RH₅₀ and RH₇₀.
- RS: Roads on which the speed limit is **higher** than the threshold, but **with** opposite traffic separation (by barrier or area).

Denoting:

LRL_i as the length of a road segment of type RL,
LRH_i as the length of a road segment of type RH, and
LRS_i as the length of a road segment of type RS,

the formula for the KPI is as follows:

$$KPI (4) = \frac{\sum_1^N LRL_i + \sum_1^N LRS_i}{\sum_1^N LRL_i + \sum_1^N LRH_i + \sum_1^N LRS_i}$$

It is useful and recommended to also report the components of this indicator:

- Percentage of the length of RS roads (with opposite traffic separation) in relation to the total road network length.
- Percentage of the length of RL roads (other roads with a safe speed limit 30/50/70 km/h) in relation to the total road network length.

It could also be interesting to calculate the following proportions:

- Percentage of the total length of RL₃₀ roads as part of the length of RL₃₀ and RH₃₀ roads combined.
- Percentage of the total length of RL₅₀ roads as part of the length of RL₅₀ and RH₅₀ roads combined.

- Percentage of the total length of RL70 roads as part of the length of RL70 and RH70 roads combined.

One should be aware that speed limits are subject to frequent changes, including work zones, constructions, etc. It is hence important to use of an inventory of speed limits that is regularly updated.