KPI Enforcement of traffic regulations

Methodological guidelines on data collection and analysis

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About Trendline

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

At the core of the Trendline project are the following 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, methodologies for some new experimental and complementary indicators have been developed and tested within Trendline:

- Driving under the influence of drugs
- 30km/h on urban roads
- Compliance with traffic rules on signalized pedestrian crossings and intersections
- Compliance with traffic rules on unsignalized pedestrian crossings and intersections
- Helmet wearing by PMD (Personal Mobility Device) riders
- Self-report behaviour
- Attitudes
- Light use by cyclists in the dark
- Enforcement of traffic regulations
- Alternative speeding KPIs.

For each of the original eight KPIs and the experimental KPIs, a 'KPI Expert Group' (KEG) was established, consisting of European experts. The main role of the KEGs was to draft the common methodological guidelines, to answer methodological questions, and to supervise the pilot tests of the new methodologies.

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

Terms and definitions

Vehicle type (European Commission, 2021):

- **Car or taxi**
  Motor vehicle with 3 or 4 wheels, mainly used to transport people, seating for no more than 8 occupants (excluding the driver). Motor vehicles with these characteristics used as taxis as well as motor caravans are also included.
- **Light goods vehicle**
  Goods vehicle under 3.5t maximum gross weight: Smaller motor vehicle used only for the transport of goods. (=also van for transport of equipment by workers such as electricians, plumbers…)
- **Heavy goods vehicle**
  includes road tractors and goods vehicle over 3.5t maximum gross weight. Road tractor: road motor vehicle designed, exclusively or primarily, to haul other road vehicles which are not power-driven (mainly semi-trailers). Goods vehicle over 3.5t mgw: larger motor vehicle used noly for the transport of goods.
- **Bus/coach**
  Bus: passenger-carrying vehicle, most commonly used for public transport, having more than 16 seats for passengers.
  Coach: passenger-carrying vehicle, having more than 16 seats for passengers. Most commonly used for interurban movements and touristic trips. To differentiate from other types of bus, a coach has a luggage hold separate from the passenger cabin.

Road type (European Commission, 2022):

- **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.
- **Expressway**
  Road specially built for motor traffic, which does not serve adjacent properties, and:
  (a) is accessible only from interchanges or controlled junctions;
  (b) is specially sign-posted as an express road and reserved for specific categories of road motor vehicles;
  (c) on which stopping and parking on the running carriageway are prohibited.
  Entry and exit lanes are included irrespective of the location of the sign-posts.
  Urban express roads are also included.
- **Rural road**
  Public road outside urban boundary signs, excluding motorways and expressways.
- **Urban road** (or road inside urban areas)
  Public road inside urban boundary signs.

Time of the week / day (European Commission, 2022):

- **Week – daytime**
  Monday to Friday 6.00 a.m. to 9.59 p.m.
- **Week – nighttime**
  Monday 10 p.m. to Tuesday 5.59 a.m., Tuesday 10 p.m. to Wednesday 5.59 a.m., Wednesday 10 p.m. to Thursday 5.59 a.m., Thursday 10 p.m. to Friday 5.59 a.m.
- **Weekend – daytime**
  Saturday to Sunday 6.00 a.m. to 9.59 p.m.
- **Weekend – nighttime**
  Friday 10 p.m. to Saturday 5.59 a.m., Saturday 10 p.m. to Sunday 5.59 a.m., Sunday 10 p.m. to Monday 5.59 a.m.

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 Connecting Europe Facility (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. Complementary and experimental indicators, would be defined by the consortium and agreed by the Commission. As a minimum, an indicator related to enforcement should be included. However, the definition of this indicator was not specified.

1.2 Background

Enforcement of traffic regulations can be defined as the **entire penal procedure** designed to persuade road-users to obey traffic laws and regulations through threat of detection of violation and the imposition of a penalty (European Commission, 2024). Enforcement of traffic regulations is an **effective intervention** to achieve a substantial improvement in road safety in a relatively short period of time, especially in the case of internationally recognised **key dangerous behaviours** of road users, such as:

- speeding of all vehicle types
- non use of seat belt by drivers and passengers
- non use of helmet by riders
- mobile phone use while driving
- driving under the influence of alcohol or drugs

The main goal of enforcement programs is **to reduce the number and severity of road crashes** and to **change the driving behavior** of users which is linked to a change in attitudes towards dangerous driving behaviours. Systematic checks at appropriately selected locations and time periods lead to more perceived enforcement by drivers, resulting in a change in their behavior and a **reduction in lawbreaking.**

The reduction of lawbreaking contributes to the reduction of the number and severity of road crashes and for this reason the systematic **monitoring of lawbreaking** is necessary. The monitoring of lawbreaking concerns on one hand the **recording** of **existing** lawbreaking (i.e. lawbreaking operations and equipments etc), and on the other hand the **certified** lawbreaking (i.e. the number of violations already recorded through traffic controls).

More specifically and with regard to the systematic recording of lawbreaking, the following are proposed with an emphasis on the most dangerous offenses:
- Regular investigations to **establish existing** lawbreaking.
- Continuous **recording of certified** lawbreaking.
- Systematic recording of **traffic controls**.
- Monitoring and analyzing **enforcement effectiveness**.

An integrated system for **monitoring and evaluating** the implementation of road safety actions and performances including enforcement, involves:
- Monitoring the **implementation** of road safety actions
- Monitoring the **performance** of road safety in terms of targets for progress on specific road safety issues, based on key performance indicators (**KPIs**),

The latter concerns the monitoring of road safety performance, for which the systematic recording and analysis of road safety data is required. Some of this data is available in various databases of State agencies or other agencies, while other data are collected occasionally through field surveys.

Evaluation of actions can take several forms, one or more of which may be appropriate, depending on the objectives of the action to be evaluated. Two possible forms of actions' evaluation are formative evaluation and impact assessment.

Systematic evaluation during an action with the aim of improving it is called **formative evaluation**. It is a continuous process that unfolds while the road safety action is in progress and enables the progress of implementation of the action to be assessed, as well as it can also function as a form of quality control of the action. Formative assessment determines whether an action is appropriate for the specific road safety issue it was chosen to address. This type of evaluation is not based on the assessment of road safety results (e.g. reduction of road accident fatalities) but examines whether the action is implemented as originally planned and identifies the strong and weak points of implementation so that it can be further improved in the future. In order to achieve this, systematic monitoring, data collection and utilization of a set of indicators is required, with which the progress of the action is controlled and evaluated (GRSP, 2023a).

For example, the **evaluation of the enforcement of traffic regulations** can be based on whether the traffic police accepted a system of more intensive checks, whether they had the necessary resources, manpower and equipment, or whether the offending drivers they complied with the imposition of the

penalty and the procedure for imposing and paying the fine was completed. Based on these, indicative indicators for the monitoring and evaluation of this action are the total number of hours of traffic offense checks by the police, the number of surveillance cameras in operation, the number of patrol cars available for traffic offense checks, the percentage of fines that have not been paid, etc.

Impact assessment is a means of measuring the effectiveness of an action by investigating the significance of the changes brought about by its implementation. It is useful to perform in order to improve or adapt an action or to make decisions about whether to continue, stop, replicate or scale up. The impact assessment of the implementation of an action focuses on the outcomes of the intervention carried out, while impact assessment is likely to cover a wider range of issues, such as the appropriateness of the intervention design, the effectiveness of the intervention, the economic, social or environmental costs/ benefit, its undesirable effects and the experience gained to improve the design of a future action.

In order to carry out an impact assessment study, it is necessary to collect sufficient data before and after the implementation of the action, the selection of a satisfactory sample as well as the definition of those indicators on the basis of which the changes that will occur following the implementation of the action will be measured and evaluated (GRSP, 2023b). For example, an indicator for monitoring speed management interventions is an increase or decrease in the speed of moving vehicles. A critical indicator in this context is the level of **compliance with legal speed limits**, while alternative indicators are average speed and speed variation.

Worldwide, the intensification of road safety enforcement has proven to be the primary measure which can lead to an immediate improvement of the behaviour of road users and to the subsequent significant reduction of road crashes (NTUA, 2022).

- Speeding can be effectively addressed with a combination of mobile roadside police checks together with automated enforcement, including mobile and fixed cameras (ETSC, 2022). Implementation of camera enforcement results in a 7% speed reduction, a 57% decrease in the share of speed offenders, a 19% decrease in the number of crashes, an 18% decrease in the number of road injuries and a 21% decrease in the number of serious and fatal crashes (SWOV, 2019). A meta-analysis (Høye, 2014) showed that speed cameras reduce total crash numbers by about 20%. The effect declines with increasing distance from the camera location. Fatal crashes were found to be reduced by 51%, this result may however be affected by regression to the mean (RTM). Section control was found to have a greater crash reducing effect than speed cameras (-30% for total crash numbers and -56% for KSI crashes).
- The implementation of red-light cameras is associated with a 61% reduction of red-light negations, 20% fewer road injuries, 24% fewer side impacts and 29% fewer side impacts involving injuries, but also with 19% more rear-end collisions. These figures concern effect estimates for intersections monitored by cameras. The latest safety effect estimates of red-light cameras, based on 2013-2017 studies, confirm this picture: 24% fewer road injuries and 29% fewer side impacts involving injuries, but also 14% more rear-end collisions (SWOV, 2019).

- Wearing a seatbelt reduces the risk of a fatality among front seat passengers by 40-50% and among rear-seat passengers by 25-75%. (WHO, 2018). The European Commission (2008) suggests that action targeting the use of seat belts could save up to 7.300 lives a year in the EU.
- The presence of enforcement (camera or police personnel) increases the correct use of helmets, especially in principal roads (Guzman et al, 2020).
- Drink-driving enforcement leads to a 14% decrease in crashes (SWOV, 2019).
- Enforcement can help spot drivers who are more in danger of a crash. The estimated probability of involvement in a fatal or severe crash is 65% higher for drivers who received one ticket per year compared to those who received no tickets, and more than eleven times higher for drivers with six tickets per year compared to drivers who received one ticket (Factor, 2014).
- According to evidenced in previous research (Lee, 2015), tickets lead to fewer crashes. Further, tickets help to reduce nonfatal injuries stemming from motor vehicle crashes. Overall, Lee (2015) found that as unpopular as traffic tickets are among drivers, motorist behavior does respond to tickets.

Based on the above, several KPIs related to the enforcement of traffic regulations can be defined to enhance understanding of implemented actions and of their effectiveness. Based on international literature, **indicative indicators indirectly linked to the level of road safety** are:
• the number of offenses for not using seat belts and helmets, as estimated by relevant surveys categorized by type of road network,
• the number of offenses for driving under the influence of alcohol or other substances, assessed by relevant surveys and differentiated by type of road network,
• the number of offences related to mobile phone usage offences

1.3 Purpose and basis of this document

The specific document concerns the collection of KPIs related to the enforcement of traffic regulations. Enforcement needs to be systematic and targeted in space and time, with particular emphasis on the key dangerous behaviours of road users. KPIs may concern any of the steps of the penal procedure that constitutes enforcement of traffic regulations.

However, **methods and procedures** for the enforcement of traffic regulations **vary widely** among the Member States. Subsequently available data on relevant procedures and results may be substantially different in different countries. Furthermore, it is essential to consider the key road safety problems in each country and to focus on KPIs that are related to specific road safety offences, road user groups, or road types associated with these key problems. Therefore, it is suggested that each Member State chooses to calculate the most appropriate and useful KPI on enforcement of traffic rules based on applicability and availability of data as well as on the particular needs in the respective country.

Based on the above, no single definition for the KPI enforcement of traffic regulations is provided. Instead, this document describes the minimum methodological requirements to qualify for a KPI enforcement of traffic regulations that can be selected from the following alternative options which have been identified in the relevant international literature and relate to different aspects of enforcement:

Option 1: Number of police controls per infringement (speeding, seat-belt use, helmet use, distraction, drink-driving, red light driving) and per population

Option 2: Number of tickets per infringement (speeding, seat-belt use, helmet use, distraction, drink-driving, red light driving) and per population

Option 3: Number of red-light cameras on the urban network per population

Option 4: Number of fixed speed enforcement cameras or section control stretches per population

It is noted that in Option 1 and Option 2 police controls and tickets refer to enforcement activities taken up by Police officers in certain periods and locations. Continuous enforcement using fixed cameras is not taken into account for this KPI.

Option 1 provides a good measurement of the **effort** dedicated to enforcement in a country and of the importance given to specific infringements. In combination with an analysis of key road safety problems in a country, this indicator can be very useful for the identification of enforcement gaps.

Option 2 reflects the **effectiveness** of enforcement activities in terms of identifying violators. Additionally, Indicator 2 in combination with Indicator 1 may provide useful insight as for the effectiveness of enforcement as a preventive measure.

Option 3 is a measure of the **level of enforcement** at sites where traffic violations might be frequent and indicates potential gaps.

Option 4 is related to **speeding** which has been highlighted as one of the key road safety issues worldwide. Therefore, the importance of this indicator is undoubtable.

Options 1 and 2 require a **well organised enforcement system** in which all information about all stages of enforcement is properly recorded and followed and relevant data is accessible.

Options 3 and 4 may be developed using information from various sources to fill in possible gaps in official information. Thus, they are perhaps **easier** to develop. Still, trustworthiness of non-official information sources must be checked.

The minimum requirement for the KPI enforcement of traffic regulations is to estimate **at least one** of the options listed above. In case Option 1 (Number of police controls per infringement (speeding, seat-belt use, helmet use, distraction, drink-driving, red light driving) and per population) or Option 2 (Number of tickets per infringement (speeding, seat-belt, helmet, distraction, drink-driving, red lights)

and per population) is selected, as many infringements as possibly should be taken into account, preferably at least three.

It is noted that for each of the Options 1-4, Member States may also choose **additional measurement units** e.g. per km of network OR per population OR per population/km2 OR per traffic volume based on the available data and particular interests. Still, for comparison reasons, it is required to also calculate the chosen Option(s) in the form described in the text box.

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

Member States can decide whether to follow the minimum requirements only (i.e. calculate one KPI enforcement of traffic regulations) or to extend (part of) their methodology, depending on **available means** and their own **research questions**.

2 Requirements

Since on-site data collection is not necessary for this KPI, this section does not stipulate any requirements regarding free or non-free flow traffic conditions, or observation equipment. However, it does include specifications for sampling, given that existing databases may not encompass the entirety of a Member State, or only portions of relevant databases might be utilized, necessitating the selection of a representative sample.

In the exceptional case of a country being willing to run on-site data collection for this KPI, other Trendline methodological guidelines on KPI Speed, KPI safety belts and child restraint systems, KPI Helmet use among Cyclists and Powered two-wheelers (PTWs), KPI Driving under the influence of alcohol and KPI Distraction may be advised with regards to requirements on measurement locations and equipment.

2.1 Selection of KPI

As previously emphasized, it is crucial to address the unique road safety issues faced by each Member State. This entails concentrating on KPIs that are specifically connected to particular road safety offenses, distinct groups of road users, or types of roads that are most relevant to these problems. Each of the proposed KPIs relates to a different road safety problem or is differently associated to crash risk.

Option 1 provides a good measurement of the **effort** dedicated to enforcement in a country and of the importance given to specific infringements. In combination with an analysis of key road safety problems in a country, this indicator can be very useful for the identification of enforcement gaps.

Option 2 reflects the **effectiveness** of enforcement activities in terms of identifying violators. Additionally, Indicator 2 in combination with Indicator 1 may provide useful insight as for the effectiveness of enforcement as a preventive measure.

Option 3 is a measure of the **level of enforcement** at sites where traffic violations might be frequent and indicates potential gaps.

Option 4 is related to **speeding** which has been highlighted as one of the key road safety issues worldwide. Therefore, the importance of this indicator is undoubtable.

Options 1 and 2 require a **well organised enforcement system** in which all information about all stages of enforcement is properly recorded and followed and relevant data is accessible.

Options 3 and 4 may be developed using information from various sources to fill in possible gaps in official information. Thus, they are perhaps **easier** to develop. Still, trustworthiness of non-official information sources must be checked.

Therefore, each Member State should choose which KPI(s) to calculate based on the most crucial road safety problems that are faced and the targets set in the relevant national policies.

2.2 Data sources

Methods and procedures for the enforcement of traffic regulations as well as traffic regulations themselves vary widely among the Member States. Consequently, the data on relevant procedures and outcomes may vary significantly across different countries.

In contrast to all other KPIs calculated in the framework of the Trendline project, KPI on enforcement of traffic regulations will be calculated using already existing databases instead of conducting new surveys for acquiring the necessary data. This applies to all suggested options for this KPI and may be an additional criterion for selecting KPI(s) to be calculated. Still, if a Member State has the necessary resources to run complete or complementary enforcement activities it is of course possible to do so.

In general, data availability per option is as following:

- **Option 1** (Number of police/authorities controls per infringement and per population):
  This KPI is widely used though not equally for all road infringements. Data on police controls for speeding, seat belt and helmet use as well as drink-driving are available in many countries worldwide. On the other hand, police controls for distracted driving are focussed on driving while using a mobile phone and all other distraction factors are less examined. Data on red light running controls are also limited.
- **Option 2** (Number of tickets per infringement and per population):
  Similarly to Option 1, in most countries, the number of tickets is available for specific infringements. In this case too, data are limited concerning distraction factors other than driving while using a mobile phone and red light running. ETSC PIN Flash Report 42 (2022) presents the most current available such data from European countries.
- **Option 3** (Number of red-light cameras on urban network per population):
  This KPI is widely used. In fact, apart from official sources, data on red light cameras are also available in open databases which are regularly updated by anonymous users.
- **Option 4** (Number of fixed speed cameras per population)
  Similarly to Option 3, data on the number of speed cameras are available from both official and non-official sources, covering both mobile speed cameras used by the police and the fixed speed cameras throughout the road infrastructure.

Data needed for the proposed KPIs could be available through Traffic Police in each Member State. In many Member States data on traffic regulations enforcement activities and the respective results are published and are freely available. This is done either by the Traffic Police directly or through other public authorities such as the competent Ministry or the national statistical body. In case the needed data are not freely available, they should be requested by the competent Authority using a comprehensive questionnaire to cover all aspects of the selected KPI.

Especially, for Option 3 and Option 4, data from official sources should be looked for. Data from non-official sources should be considered only in case of total lack of an official response to the relevant request and should be treated as approximate or indicative information.

2.3 Sampling

Depending on the chosen KPI option and based on the nature of the required data (i.e. number of controls, tickets or automated enforcement equipment) it makes sense that the sample covers the whole area of jurisdiction of each Member State. However, as mentioned before, specific characteristics and needs in each Member State (i.e. target groups of road users, types of roads and road safety problems) should be taken into consideration.

In case a national database for traffic regulation enforcement and results does not exist, but instead data are scarcely available (e.g. at regional or local level), sampling should be used.

Member States can define their own sampling methodology. It is important that the locations with available data are representative for the national road network and cover the entire geographical area of the country. In general, sampling should be based on well-established statistical techniques aimed at achieving a properly representative result.

Selection of locations should be as random as possible, with a minimum requirement of covering the whole geographical area of the country. There are different options for random location selections: e.g. simple random, stratified random (e.g. random sampling in different regions). The basic process consists of three steps:

1. First the required number of locations is determined for the entire country or per region.
2. Next, these locations are randomly selected on a map using the entire area under consideration (e.g. country or region), taking a sufficient geographical spread into account. The specific requirements for each location (e.g. road type or speed limit) do not have to be taken into account at this point. This step is just to ensure a reasonable geographical spread of the randomly selected locations.
3. Finally, the exact locations from where data will be used are manually chosen in the area surrounding the locations randomly selected in the previous step. At this point, the final selection must be based on the location requirements (different road types) and practical considerations. This final selection can be done using Google Street View for instance to search for observation locations near the randomly selected locations from step one that meet all the necessary criteria. The selected locations can then also be visited for a final check if needed. Care should be taken to ensure that the different road types are also sufficiently geographically spread.

A convenient way of selecting locations randomly (step 2) is to use a GIS system (e.g. cartographic software like ARCView/ARCGIS) as such software can automatically randomly select location points within pre-defined areas. If Member States have no GIS software, step 2 can also be done manually using a national geographic map, e.g. Google Maps/Google Earth.

Distribution per area type or road type would be useful especially for Option 3 and Option 4. When stratification is used, results should be weighted according to traffic volumes by region. The method used and rationale for choosing the locations of the measurements should be described in the method section of the study.

2.4 Stratifications and subpopulations

Depending on the chosen KPI option and the specific needs and interests in each Member State, the examination of subpopulations may be meaningful. Although no minimum requirements can be drawn, it is suggested that different **road types** (at a minimum urban, rural and motorways), **type of vehicle, time of day, day of the week** are taken into account depending on relevance to the chosen KPI option. In particular, the following stratifications and subpopulations are only relevant to Option 1 and Option 2. It is possible that available databases include aggregate data instead of detailed data per control or infringement. In that case, the presentation of stratified results or per subpopulations is not possible. However, depending on the level of detail provided in each database it is recommended that results are presented in the most detailed way.
In the sections below strata categories and subpopulations are discussed in more detail.

Road types

Stratification per road type is meaningful for all suggested Options for KPI enforcement of traffic regulations.
Road types considered inTrendline are those listed in section "Terms and definitions" of this document.

Concerning motorways, all Member States that collect data on motorways and on expressways are requested to report results **separately for motorways and expressways**.

In reality, road characteristics will vary between different road typesTherefore, relevant KPI(s) should be presented separately for these different road types.

Road users

Depending on the selected Option for this KPI and the national legislation in each Member State, it might be needed to present results per category of road user. For example, if Option 1 or Option 2 and particularly infringements of not wearing a seat belt are selected, it is significant to provide results per driver and passenger on the front seat. Similarly, if not wearing a helmet is considered, results per driver or passenger are more useful.

Vehicle types

Similarly to road users, the distribution of results per vehicle type is meaningful for Options 1 and 2. Vehicle types that need to be considered for the calculation of the KPI Enforcement are those listed in section "Terms and definitions" of this document.

Results should clearly define vehicle types included and should be presented separately for different vehicle types. Small vans might be hard to distinguish from person cars, and therefore, a certain percentage of the sample might contain small vans as well. This is hard to avoid and is acceptable, since in any event, small vans are not that different from person cars in size and driving characteristics.

Time periods (time of day, day of the week, month)

In the case of Options 1 and 2, the time of controls or infringements is also crucial. Comparisons between day and night are recommended due to the difference in traffic conditions and in the composition of the population of drivers between the two periods. The results should be shown separately for day and night and weekdays and weekend days. It is understood that this information

depends strongly on the level of detail of the relevant databases that will be used. Still, if possible, it is recommended to present this information.

In order to harmonize definitions of week vs weekend and daytime vs night-time, the definitions adopted in the ERSO project (European Commission, 2022), also listed in section "Terms and definitions" of this document should be used.

If available data (controls and/or infringements or activated cameras) concern specific days or periods, such as public holidays, this should be indicated, if possible.

Region

The indicator should be representative of the whole Member State territory. To obtain enforcement indicators at regional level, a stratified random sample of locations according to region (e.g. NUTS1 regions) can be considered. If there are exceptions (e.g. for islands), they should be precisely defined and communicated.

When stratification by region is used, results should be weighted according to population by region in order to compute the KPI at national level.

2.5 Data analysis

Post stratification weights and statistical analysis

For each level of stratification, results on Options for which this is meaningful, should be weighted according to population by level of stratification.

Expected results, data delivery and metadata

The **minimum required KPI on enforcement of traffic regulations is one of the four options** (at national level). Especially, for Option 1 and Option 2 it is required to cover at least three different infringements based on the particular needs and interests of each Member State.

If possible, results should also include the number of locations and the number of drivers considered for this KPI before applying weights according to population by level of stratification.

Depending on relevance and availability of data, national indicator(s) on enforcement of traffic regulations should be reported separately according to the following parameters:

- Road type
- Road user
- Vehicle type
- Time period

Together with the above estimates, a report should be submitted that describes the methodology of the field work and the statistical techniques used to weight and analyze the results. Member States are free to determine the statistical analysis techniques and tools.

In addition to this, all Member States are expected to provide **metadata** on the applied regulations and procedures related to this KPI (e.g. legislation on examined road safety issues).

For the **data delivery** to the Trendline consortium (inclusion in the Trendline database), three possible levels of aggregation are possible:

1) Minimum level requirement: overall estimates for the chosen Option/ infringements)
2) Medium level: crossed-level matrix of all considered levels of disaggregation (crossed point estimates) + confidence intervals.
3) Ideal level: also, delivery of the raw cleaned data (not pure raw data). Data cleaning is the process of preparing data for analysis by removing or modifying data that is incorrect, incomplete (only if the minimally required data is missing), irrelevant, duplicated, or improperly formatted. This data is usually not necessary or helpful when it comes to analyzing data because it may hinder the process or provide inaccurate results.

3 Summary of requirements

	Minimum requirement	Optional
KPI	• One of the four suggested Options Option 1: Number of police controls per infringement (speeding, seatbelt, helmet, distraction, drink-driving, red lights) and per population Option 2: Number of tickets per infringement (speeding, seatbelt, helmet, distraction, drink-driving, red lights) and per population Option 3: Number of red-light cameras on the urban network (per population) Option 4: Number of fixed speed cameras (per population) • For Options 1 and 2: at least three different infringements are considered	• Additional Options on KPI • Additional infringements • Additional versions of Options 1-4 using different measurement units e.g. per km of network OR per population OR per population/km² OR per traffic volume based on available data and particular interests of Member States.
Road type (if relevant)		• Motorway • Expressway including urban express roads • Rural road • Urban road (or road inside urban areas)
Vehicle type (if relevant)		• Passenger cars / taxis • Motorcycles • Light goods vehicle • Heavy goods vehicle • Buses / coaches
Time period (if relevant)		• Weekdays / Weekend • Daylight / Night-time hours • Special days
Sample size	• Representative at national level	

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