Baseline

Methodological guidelines – KPI Vehicle Safety

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Any comments or feedback regarding these guidelines, should be sent to baseline@vias.be.

Version history

Version	Date	Changes
0.0	12-04-2021	Draft made by Vias for input by Euro NCAP
1.0	21-04-2021	Adapted version, integrating feedback and input by Euro NCAP
2.0	05-05-2021	Version incorporating feedback KPI Expert Group Vehicle Safety
2.1	29-06-2021	Additional feedback by experts and reference to Euro NCAP documents
2.2	07-07-2021	Added message on approval by the Technical Committee
2.3	20-10-2021	Correction of some typos and clarification of linkage with EuroNCAP

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Contents

1 Introduction and aims

1.1 Context

The Communication of the European Commission "Europe on the Move – Sustainable Mobility for Europe: safe, connected and clean" of the 13th of 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 aim of the BASELINE project, funded partially by the European Commission, is 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. The outcomes of this project will be used to set future European targets and goals based on the KPIs.

1.2 Main indicator and alternative indicators

The purpose of this document is to describe the minimal methodological requirements to qualify for the BASELINE KPI for vehicle safety. This KPI is defined as follows (see the Commission document EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero" Commission Staff Working Document SWD (2019) 283):

(1) Percentage of new passenger cars with a Euro NCAP safety rating equal or above a predefined threshold

The Commission does not prescribe the threshold. Euro NCAP uses a star rating system (0 to 5 stars, with increasing levels of safety). The Commission suggests to use 4 stars as the threshold. The Euro NCAP coverage area includes all 27 EU countries as well as the UK.

If for certain Member States the Euro NCAP rating is not available for (almost) all vehicles and/or it is not possible to assign a Euro NCAP rating to each vehicle, the Commission accepts two alternative KPIs:

(2) Average age of the total fleet of car passengers

(3) Percentage of the passenger cars that are roadworthy

The roadworthiness criteria to be used have not yet been defined; a number of possibilities will be given in Section 2.2).

It should be noted that although cars with better active and passive safety systems help in avoiding road crashes and protect their occupants better, it is not self-evident that the same relationship holds for national KPIs and the overall improvement of safety at national level. It is yet to be shown that a higher national score on the main and alternative indicators on vehicle safety listed in these guidelines is associated with national road safety performance. Whether, and to what extent this is the case will be analyzed at the end of the Baseline project, based on the KPI data available.

In this context, within the Baseline project there will be a discussion involving the Member States interested, on whether alternative KPIs for vehicle safety can be considered (see Section 0).

1.3 Coverage

For the standard KPI (1) the indicator should cover the whole fleet of newly registered passenger cars in a Member State. For the alternative indicators (2) and (3) the whole fleet of passenger cars needs to be considered. If there are exceptions, these should be precisely defined and communicated.

1.4 Terminology

According to Eurostat (https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Passenger_car), a ***passenger car*** is a road motor vehicle, other than a moped or a motorcycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver). Excluded are light goods road vehicles, as well as motor coaches and buses and mini-buses/mini-coaches.

New passenger cars refers to new cars ***registered*** for the first time in the year for which the KPI is determined.

Make refers to the brand/manufacture of the brand (e.g., Renault, BMW, Volkswagen, Fiat, Volvo, Seat, Skoda, etc.)

Model refers to the specific model of the Make (e. Renault *Clio*, Volkswagen *Tiguan*, Volvo *V40*, etc.). It is important to define the year associated with the model.

Euro NCAP ratings are the vehicle safety ratings assigned by Euro NCAP to new car models appearing on the European market, which are valid for six full years after the year of test. The overall rating is based on a 5 star scale, with 5 stars being the highest safety rating. There are also some additional safety ratings (see Section 3.1).

2 Calculation of the KPI

2.1 Standard KPI: percentages of new passenger cars meeting or exceeding the threshold

For the standard indicator, the following data is required (for each year for which the KPI is calculated):

- the total number of new passenger cars registered
- the distribution of new passenger cars registered by Make/Model, i.e. how many new passenger cars have been registered for each Make/Model
- the most recent valid Euro NCAP star rating for each of the car passenger models (where applicable)
- the numbers of stars to be used as a threshold.

The total number of new ***passenger cars registered*** can be obtained from international sources such as ACEA (e.g. ACEA Pocket Guide 2020-2021 - https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2020-2021.pdf) and Eurostat.

The ***distribution of new passenger car models registered by Make/Model*** needs to be obtained from national sources, typically the public authority or agency that registers new cars. These figures may also be obtained from other sources such as international organisations, car related national associations and federations.

The ***Euro NCAP star ratings*** for each of the car passenger models sold is available on the Euro NCAP website but are included in a database prepared for the Baseline partners by Euro NCAP.

As to the ***safety threshold***, it is suggested to use in a first stage, two thresholds:

- a 'minimum' threshold, corresponding with a 4-star rating
- a 'strong' threshold corresponding with a 5-star rating.

After collecting all this data, the first step in the calculation of the KPI consists is linking the Make/Model items with the vehicle model categorization used in the national database. It should be noted that the categorization of vehicle models into 'Makes' and 'Models', as used by Euro NCAP, is a simplification of a more complex reality. From a formal point of view, vehicles are defined by 'Make', 'Type', 'Variant', 'Version' and 'Commercial Description', as specified in the Council Directive[1] 1999/37/EC of 29 April 1999. So sometimes it may not be straightforward to link the 'Model' with the 'Type', 'Variant', 'Version' and 'Commercial Description').

It may therefore be necessary to first create a conversion table between the variables used in the national database and the model names used in the Euro NCAP dataset. The table below is an example of a part of a conversion table made in the Netherlands, used to link the commercial name of the vehicle with the Euro NCAP Model name.

[1] See References and the following link: https://eur-lex.europa.eu/eli/dir/1999/37/oj/eng)

Make	Commercial name	Model in Euro NCAP database
AUDI	A1 SPORTBACK	A1
BMW	420I	4-Series
BMW	X1 SDRIVE20I	X1
CITROEN	C1	C1
FORD	FIESTA	FIESTA
FORD	FIESTA	FIESTA
HYUNDAI	IX20	IX20
HYUNDAI	KONA	KONA
KIA	CEED	CEED
MERCEDES-BENZ	A 160	A-CLASS
NISSAN	NISSAN QASHQAI	QASHQAI
NISSAN	NISSAN LEAF 30KWH	LEAF
NISSAN	NISSAN QASHQAI	QASHQAI
OPEL	KARL ROCKS / VIVA ROCKS	KARL
PEUGEOT	208	208
RENAULT	CLIO	CLIO
RENAULT	KADJAR	KADJAR
RENAULT	ZOE	ZOE
SEAT	ARONA	ARONA
SEAT	ATECA	ATECA

The conversion table can then be used to group the number of newly registered cars by Make+Model, and then link it to the Euro NCAP star score. The result could then look like in the table below

Make	Model	Count	Star Rating	Year of Test
		46425		
Alfa Romeo	Giulia	522	5	2016
Alfa Romeo	Giulietta	408	3	2017
Alfa Romeo	Stelvio	288	5	2017
Audi	A3	4022	5	2012
Audi	A4	2669	5	2015
Audi	A5	1411	5	2015
Audi	A6	1272	5	2011
Audi	A6	229	5	2018
Audi	Q2	1729	5	2016
Audi	Q3	552	5	2011
Audi	Q3	6	5	2018
Audi	Q5	496	5	2017
Audi	Q7	54	5	2015
Audi	TT	32	4	2015
BMW	i3	1631	4	2013
BMW	X1	2306	5	2015
BMW	X2	694	5	2015
BMW	X3	1279	5	2017
BMW	X4	111	5	2018
BMW	X5	38	5	2018
Citroen	Berlingo	113	3	2014
Citroen	Berlingo	7	4	2018
Citroen	C1	4174	3	2012
Citroen	C3	4520	4	2017
Citroen	C3 Aircross	2206	5	2017
Citroen	C4 CACTUS	1806	4	2014
Total		**471806**		

If the EU Type Approval number is available in the national databases of new cars registered, this variable can also be used to make the link with the Euro NCAP database. This Type Approval Number is, however, not available in the database for all the cars tested by Euro NCAP.

In a few cases, the database file with Euro NCAP star ratings contains two ratings for the same model.

- One possibility is for instance the Honda Jazz for which ratings are available for 2015 and 2020. For cars registered in 2019, the rating of 2015 should be used; for cars registered in 2020, the rating of 2020 should be used.
- Another possibility is that ratings are available for 2019 or 2020 but that production of that model only started in that year, but that safety ratings are available for a previous year. For example, for the KIA Sorrento, ratings are available for 2014 and for 2020, but production of the new model only started in July 2020. This means that, strictly speaking, for many of such cars the rating of 2014 should be used. It may be difficult to know exactly which share or newly registered cars should get the old rating and which share the new one. It is proposed that in such cases, 50% of these registrations get the old rating and 50% the new rating.

In the final step one needs to calculate the total number of all new passenger cars that meet the threshold (i.e. 4+5 or 5) and divide this number by the total number of new passenger cars registered. If a Member State prefers to use only one threshold, it is recommended to use the threshold '5-star'.

The data file in which the data has to be reported foresees two versions of the KPIs. The first version ignores the vehicles for which no Euro NCAP star rating is available. If for, e.g. 50 of 1000 new vehicles registered, no Euro NCAP star rating is available, the KPI is calculated for 950 vehicles. In the second version, the vehicles for which no Euro NCAP star rating is available are included in the calculation (which is equivalent to have them a star rating lower than 4). By definition, this second version of the KPI will have a slightly lower value than the second one.

The KPI should be calculated for each year separately. It is proposed to make the calculation at least for 2019 and 2020, but Member States can calculate the indicators for more years if they wish to do so.

2.2 Calculation of the alternative indicators

The ***average age of the vehicle fleet*** can be obtained from ACEA (https://www.acea.be/statistics/article/average-vehicle-age). The Baseline project coordinator of Baseline will collect these data and put them in the Baseline database. National Baseline project partners can react on these figures in case they consider these not to be correct.

For the percentage of passenger cars that are ***roadworthy***, at present the roadworthiness criteria and thresholds to be used have not yet been defined. Possibilities include:

(a) the average distance driven (in km) by vehicles undergoing technical inspection, based on odometer reading
(b) the average time between the theoretical date of inspection and the actual one
(c) % of vehicles inspected with any major or dangerous deficiency in technical inspections
(d) % of vehicles inspected with any major or dangerous deficiency in roadside inspections
(e) % of vehicles not showing up to the periodical inspection.

These KPIs are proposed because they are based on data recording which is mandatory according to European Directives (Directive 2014/45/EU and Directive 2014/47/EU 2015 – see references at the end of these guidelines). For instance, the definition of deficiencies is in Directive 2014/45/EU, art 7, and the consequences in art 9. Moreover, certain data on vehicle inspection has to be communicated to national authorities and the European Commission.

It is suggested that Member States considering to use such indicators should explore with the KPI Expert Group on Vehicle Safety which common roadworthiness criteria to consider. If roadworthiness data is based on vehicle inspection, Baseline project partners should make sure to

- specify which roadworthiness criteria have been used
- indicate which part of the vehicle fleet is not covered by the figures (e.g. cars which are not yet required to undergo vehicle inspection)
- only report data that are related to passenger cars.

3 Sources of data

3.1 Data on the distribution of new passenger car models registered

The distribution of new passenger car models registered needs to be obtained from national sources, typically the public authority or agency that registers new cars. These figures may also be obtained from other sources such as car related national associations and federations. From certain sources this data is not free of charge and needs to be purchased. International commercial sources that can be consulted for obtaining such car sales data are JATO (www.jato.com) and Carsalesbase (carsalesbase.com).

There could be small discrepancies between the figures of different sources, depending on the classification and counting method used.

3.2 Vehicle safety data

A database (in Excel format) with Euro NCAP data has been developed and is available to the Baseline project partners. It includes, for every passenger model the following data:

- Make
- Model
- Make + Model
- Type Approval Number
- Year in which the technical safety assessment has been conducted
- Year in which the production of the model started
- Euro NCAP car category
- Overall safety rating *(number of stars)*
- AOP (Adult Occupant Protection) score *(%)*
- COP (Child Occupant Protection) score *(%)*
- VRU (Vulnerable Road User) protection score *(%)*
- SA (Safety Assist) score *(%)*
- AEB (Automatic Emergency Break) Car-to-Car *(Standard / Optional / Not available)*
- AEB (Automatic Emergency Break) Pedestrian *(Standard / Optional / Not available)*
- AEB (Automatic Emergency Break) Cyclist *(Standard / Optional / Not available)*
- LA (Lane Assist) System *(Standard / Optional / Not available)*
- SA (Speed Assist) System *(Standard / Optional / Not available)*
- ESC (Electronic Stability Control) *(Standard / Optional meeting fitment / Not available)*

The database only includes variables for car models that have been tested since 2013, since Euro NCAP ratings have only a validity of six years.

3.3 Data on the age of the passenger car fleet

The average age of the vehicle fleet can be obtained from ACEA (https://www.acea.be/statistics/article/average-vehicle-age). The Baseline project coordination team will collect these data and put them in the Baseline database. National Baseline project partners can react on these figures in case they consider these not to be correct.

3.4 Data on roadworthiness of passenger cars

This data needs to be obtained from the authorities supervising the technical vehicle inspection. The whole country should be covered. In case this is not possible, it should clearly be indicated which part of the country or of the car passenger fleet that is not covered, and whether this may create a bias on the percentage provided.

The Baseline project coordination team, in cooperation with CITA, will explore with the European Commission which data on roadworthiness could be obtained from European data sources, which can be given to interested Baseline partners in view of calculating one or more alternative KPIs based on roadworthiness.

4 Data to be provided

4.1 Minimal requirements for the standard indicator

- Number of new registered passenger cars per make and model:
  - for 2019
  - for 2020
- KPI percentages for 2019:
  - using a threshold of 4 stars (ignoring the cars for which no star rating is available)
  - using a threshold of 5 stars (ignoring the cars for which no star rating is available)
  - using a threshold of 4 stars (including the cars for which no star rating is available)
  - using a threshold of 5 stars (including the cars for which no star rating is available)
- KPI percentage for 2020:
  - using a threshold of 4 stars (ignoring the cars for which no star rating is available)
  - using a threshold of 5 stars (ignoring the cars for which no star rating is available)
  - using a threshold of 4 stars (including the cars for which no star rating is available)
  - using a threshold of 5 stars (including the cars for which no star rating is available)
- Metadata:
  - source(s) of the number of new vehicles registered
  - which models and types of cars are missing (because the database on newly registered vehicles is incomplete or because no EuroNCAP ratings are available)
  - which percentage of the new vehicles registered is missing (because the database on newly registered vehicles is incomplete or because no EuroNCAP ratings are available)
  - issues encountered during the linking process
  - the percentage of new vehicles per year in relation to the entire vehicle fleet.

Baseline project participants will be provided with a data file template in Excel in which the data can be entered.

4.2 Minimal requirements when using one or more roadworthiness indicators

- KPI averages (KPI indicators type (a) or (b)) or percentages (KPI indicators type (c), (d) or (e)) for 2019
- KPI averages (KPI indicators type (a) or (b)) or percentages (KPI indicators type (c), (d) or (e)) for 2019
- Metadata:
  - source(s) of the data on roadworthiness
  - roadworthiness criteria used
  - whether only passenger cars are included or not
  - which part of the fleet is excluded from the data and why (e.g. no need for vehicle inspection)
  - issues encountered during the calculation process

5 Possible future developments

5.1 Historical adjustment

For some make/models the most recent assessment score may be already several years old. Since then, Euro NCAP criteria have become stricter. Ideally therefore, old ratings should be adjusted to reflect the stricter criteria that are used now.

Euro NCAP and the KPI Expert Group (KEG) on Vehicle Safety will examine to what extent it is feasible to adjust the older scores. If this appears to be the case, the central Baseline project team will assist Member States in a recalculation of the KPI based on the adjusted scores.

5.2 Safety rating for the full fleet

Another development envisaged is estimating the average safety rate of the ***complete fleet*** of passenger cars (not just the newly registered cars). The Baseline project coordination team, together with the members of the KEG on Vehicle Safety, will examine whether, based on data of the composition of the whole fleet, it is possible to develop an estimation of the KPI for the whole fleet. This will need to be accomplished with an historical adjustment to cover changing Euro NCAP protocols.

The estimation models will then be applied for all countries where sufficient data is available.

5.3 KPIs based on the additional safety ratings

Other possible (non-compulsory) indicators could start from the scores of the additional Euro NCAP ratings (Safety Assist score, VRU score, Child occupant score, …). Since percentages for different years of test have different meanings, it is not meaningful at present to compare the values. Maybe a historical correction can be applied; in that case, guidelines will be defined on how the scores can be used for the construction of a KPI.

5.4 KPI on the advanced safety systems of cars

A final optional additional indicator for vehicle safety could be the percentage of new cars equipped with advanced safety systems like AEB, LSS, SAS…. This could furthermore be weighted with the Safety Assist score. An example of how such a KPI could be constructed will be developed at a later stage.

Possibly this could even be extended to cover the whole fleet (not just the newly registered cars), like is done for instance in Norway, which uses indicators on the percentage of motor vehicle traffic involving cars with AEB (autonomous emergency braking), LDW (lane departure warning) and pedestrian AEB.

The KPI expert group will make a recommendation at a later stage on which of KPIs on the advanced safety systems of cars might be most appropriate for the future.

References

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