Understanding speeding through Key Performance Indicators

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Abstract

Within Trendline, a project co-funded by the EU, a series of basic Key Performance Indicators (KPIs) are calculated including one on speed defined as the percentage of vehicles travelling within the speed limit.

In order to supplement this basic KPI and provide a good further insight into overspeeding, Alternative Speeding Indicators (ASI) were suggested taking into account national facts on speed limits, distribution of vehicle types and road types. These included:
a) the percentage of vehicles travelling 10km/h, 20km/h or 30km/h faster than the speed limit,
b) the speed variation expressed by the difference between the lowest and highest 10% of speeds per road type or area type or speed limit or vehicle type.

Pilot implementation of these ASI showed that the same data are needed for the development of KPI Speed and ASI but they must be differently analysed. Generally, the percentage of vehicles overspeeding decreases at higher overspeeding levels showing a restrained inclination to speeding. In most cases the higher the speed limit is, the higher the speed variation gets showing different behaviours towards speeding in different contexts.

Meaningful overspeeding intervals differ among Member States implying different levels of tolerance against speeding reflected in the respective enforcement practices and sanctions.

Keywords: speeding, speed variation, KPI, Trendline, pilot

Introduction

Excessive and inappropriate speed is accountable for about **one third of fatal collisions** and is an aggregative factor in most collisions (ETSC, 2019).

Speed differences (**variation**) result in more encounters with other road users and in more lane-changing and overtaking manoeuvres; this increases the risk of crashes.

On **freeways**, crash rates increase as the within lane speed variations rise, especially at higher traffic volumes. Higher speeds coupled with greater volume and high between-lanes speed variation also increase crash likelihood. On **urban arterials**, it has been found that an increase of 1% in mean speed is associated with a 0,7% increase in total crashes, and larger speed variation is also associated with increased crash frequency.

EU co-funded project Trendline (**www.trendlineproject.eu**) brought together 25 EU Member States (and 4 observers) for data collection, data analysis, delivery of road safety KPIs and for using these within road safety policies.

The work on the selection of Alternative Speeding Indicators (ASI), the development of the respective methodological guidelines and the pilot testing of this KPI was undertaken by a **group of experts from Member States** with different levels of road safety performance and different national road infrastructure, policies and safety culture characteristics, thus allowing for the contribution of several different opinions and experiences on the examined subject.

The objective of this paper is to present the **selection and pilot testing of ASI that can serve as complimentary indicators to the basic KPI Speed** and provide a more thorough understanding of the major road safety problem of speeding.

Methodology

The minimum requirement for ASI was to calculate:
the percentage of vehicles travelling 10km/h or 20km/h or 30km/h faster than the speed limit.

Each Member State could additionally calculate the KPI using the intervals that are more meaningful to them taking into account national law provisions.

Besides this indicator, it was suggested to also measure:
speed variation expressed by the difference between the lowest and highest 10% of speeds per road type or area type or speed limit or vehicle type

This indicator is calculated as the difference of the 90th percentile speed and the 10th percentile speed for each road type or area type or speed limit or vehicle type. The 10th percentile speed represents the speed below which 10% of the speeds fall, and the 90th percentile speed represents the speed below which 90% of the speeds fall.

Minimum requirements for KPI ASI

Table 1 Overview of minimum requirements for KPI Alternative Speeding Indicators

	MINIMUM REQUIREMENT	OPTIONAL
KPI	• Percentage of vehicles travelling 10km/h or 20km/h or 30km/h faster than the speed limit • Speed variation i.e. difference between the lowest and highest 10% of speeds / road type or area type or speed limit or vehicle type • Free flow traffic	• Non-free flow traffic data • Calculation of the percentage of vehicles overspeeding using the speed intervals over the speed limit that are more meaningful to each Member State taking into account national law provisions.
Location	• Random selection • Representative of entire national road network • Covering the whole country • Measurements should not take place near speed cameras, either fixed or mobile • A minimum traffic flow of at least 10 vehicles passing/hour • Locations where the speed limit was changed up to 6 months before the measurements or in between measurements -> data excluded	Stratification by Regions
Road type	• Motorway • Expressway including urban express roads • Rural road • Urban road (or road inside urban areas) • Public road inside urban boundary signs	• Differentiate between single and dual carriageway roads for rural and urban roads • Differentiate between speed limits within rural and urban roads
Vehicle type	Passenger cars	Motorcycles Vans and light trucks Heavy trucks Buses
Time period	Weekdays Daylight hours Spring/autumn	Weekend Night-time hours
Weather	Good conditions	-
Sample size	• Minimum of 2000 observations • Minimum of 500 observations / road type • Minimum of 10 locations / road type • The proportion of observations for each of the three road types should be at a minimum 20%	-

Pilots on Alternative Speeding Indicators

Four Member States (Finland, Italy, Poland, Portugal) run a **pilot** implementation of ASI according to the respective Trendline methodological guidelines and adjusted to the particular needs and interests in each pilot country, to the extent that this was allowed (e.g. overspeeding using other speed intervals).

Table 2 Overview of pilot calculations of KPI Alternative Speeding Indicators

KPI	FINLAND	ITALY	POLAND	PORTUGAL
% of vehicles travelling 10km/h, 20km/h or 30km/h over the speed limit	• passenger car on weekday-daytime/ road type • weekday/daytime/ road type and vehicle type (passenger car, truck/HGV) • passenger car/ time period and road type • free flow	• passenger car on weekday-daytime/ road type • weekday/daytime/ road type and vehicle type (passenger car, vans-buses-trucks) • vehicle type / time period and road type • free flow	• passenger car on weekday-daytime/ road type • weekday/daytime/ road type and vehicle type (passenger car, vans, buses, trucks, motorcycles) • vehicle type / time period and road type • free flow • non-free flow	• passenger car on weekday-daytime/ road type • weekday/daytime/ road type and vehicle type (passenger car) • vehicle type/ time period and road type • free flow
difference between the lowest and highest 10% of speeds (variation) per road type or area type or speed limit or vehicle type	as above	as above	as above	as above
% of vehicles overspeeding using other speed intervals	Yes (≥ 31 km/h)	Yes (≤ 5, 11-39, 40-59, ≥ 60 km/h)	No	Yes (≥ 40, ≥ 60 km/h)

Results

A summary of the results for the minimum requirements and per Member State are presented in Tables 3-6.

Table 3 Summary of ASI pilot results in Finland

KPI	MOTORWAY (120 km/h)	EXPRESSWAY (100 km/h)	RURAL ROAD (80 km/h)	URBAN ROAD (60 km/h)
% of vehicles travelling 10km/h, 20km/h or 30km/h over the limit	32,6% 7,4% 0,9%	43,3% 10,5% 2,0%	50,3% 11,7% 2,6%	55,8% 10,8% 1,1%
difference between the lowest and highest 10% of speeds (variation) per road type	28,9	21,0	17,2	14,8
% of vehicles overspeeding using other speed intervals (≥ 31 km/h)	0,2%	0,5%	0,6%	0,2%

Table 4 Summary of ASI pilot results in Italy

KPI	MOTORWAY (130 km/h)	EXPRESSWAY (110 km/h)	RURAL ROAD (90 km/h)	URBAN ROAD (30 km/h)	URBAN ROAD (50 km/h)
% of vehicles travelling 10km/h, 20km/h or 30km/h over the limit	4,7% 5,7% 5,8%	8,5% 11,9% 13,0%	10,8% 15,8% 18,0%	30,3% 46,7% 53,2%	18,4% 26,6% 29,2%
difference between the lowest and highest 10% of speeds (variation) per road type	46,0	51,0	44,0	34,0	39,0
% of vehicles overspeeding using other speed intervals (≤5, 11-39, 40-59, ≥60 km/h)	3,2% 1,1% 0,0% 0,0%	5,0% 4,8% 0,1% 0,0%	6,4% 8,0% 0,3% 0,0%	15,6% 24,2% 0,4% 0,0%	10,4% 11,5% 0,3% 0,0%

Results

Table 4 Summary of ASI pilot results in Poland

KPI	MOTORWAY (140 km/h)	EXPRESSWAY (120 km/h)	RURAL ROAD (90 km/h)	URBAN ROAD (50 km/h)
% of vehicles travelling 10km/h, 20km/h or 30km/h over the limit	21,4% 9,8% 4,3%	42,6% 23,0% 12,3%	23,8% 11,5% 5,2%	41,4% 15,7% 4,9%
difference between the lowest and highest 10% of speeds (variation) per road type	50,0	49,0	43,0	30,0
% of vehicles overspeeding using other speed intervals	-	-	-	-

Table 5 Summary of ASI pilot results in Portugal

KPI	MOTORWAY (120 km/h)	RURAL ROAD (90 km/h)	URBAN ROAD (50 km/h)
% of vehicles travelling 10km/h, 20km/h or 30km/h over the limit	17,0% 1,3% 0,0%	27,0% 4,4% 0,0%	7, 6% 2,4% 0,1%
difference between the lowest and highest 10% of speeds (variation) per road type	38,4	38,7	20,7
% of vehicles overspeeding using other speed intervals (40+, 60+ km/h)	0,0% 0,0%	0,0% 0,0%	0,0% 0,0%

Discussion

The developed methodological guidelines include the **minimum requirements** to deliver the ASI and **recommendations** for optional additional speeding measurements.

Member States can decide to extend or not their methodology, depending on **available means** and their own **research questions**. Data needed for the development of KPI ASI are the same data as for KPI Speed but analysed in a different way.

Generally, the percentage of vehicles overspeeding decreases at higher overspeeding levels (i.e. 10, 20, 30 km/h over the speed limit) showing a **restrained inclination to speeding**.

In most cases the **higher the speed limit** is, the **higher the speed variation** (difference between the lowest and highest 10% of speeds) gets, showing different behaviours towards speeding in different contexts. This result in combination with findings of previous studies on the association of high speed variation with increased crash likelihood and increased crash frequency suggests that **speed variation** is **more critical** on **high-speed roads**.

Meaningful overspeeding intervals differ among Member States implying **different levels of tolerance** against speeding reflected in the respective enforcement practices and sanctions. Overall, the suggested ASI provides a good further insight into overspeeding taking into account national facts on speed limits, distribution of vehicle types and road types.

Based on the pilot calculation of ASI it is suggested that in cases **where different speed limits** exist for the same road type (e.g. rural roads with 70km/h, 80km/h or 90km/h speed limit), the **prevailing speed limit** is considered.

Given the **transition phase of urban speed limits** from 50 to 30km/h, it is suggested that two different categories are considered for urban roads based on speed limit and are compared to each other.

The examined ASI are **not the most common** or expected KPI regarding speed. However, they **allow** for a more **profound understanding** of the actual situation on the road in terms of speed. Thus, it may help to better understand existing problems and select the most appropriate measures.

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