Baseline

Baseline report on the KPI Distraction

January 2023

Baseline

Belgium | Austria | Bulgaria | Cyprus | Czech Republic | Finland | Germany | Greece | Ireland | Latvia | Lithuania | Luxembourg | Malta | Netherlands | Poland | Portugal | Spain | Sweden

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Any comments or feedback regarding this report should be sent to Baseline@vias.be.

Version history

Version	Date	Changes
1.0	April 25, 2022	First draft version using data collected in 2021.
1.1	June 27, 2022	New data and corrected former data from MS added
1.2	September 16, 2022	Update status: data from 11 MS
1.3	October 3, 2022	Update for MS review
1.4	November 25, 2022	Draft update (incomplete) for the coordination team including additional MS data and after the first review by the MS and KEG (Spain and Netherlands not yet included)
1.5	December 22, 2022	Final draft including Spain and reference to the Dutch report. Spanish weekday data still to be included. For review to all MS and KEG.
Final	January 2023	Final including all reviews

Contents

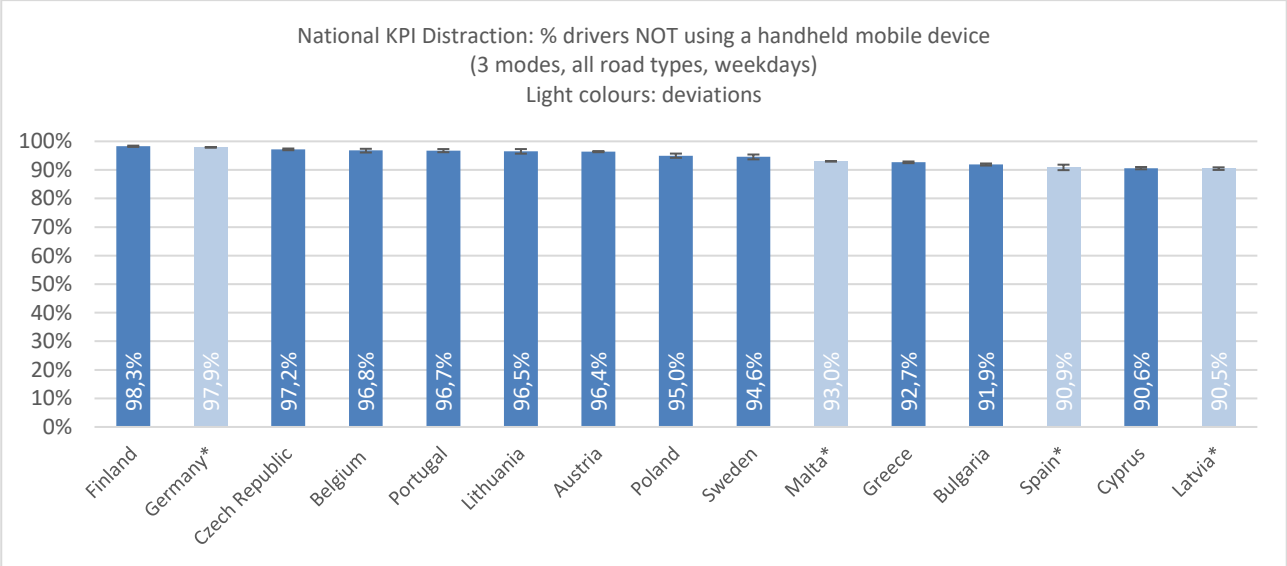
Executive summary

The aim of the BASELINE project is to assist participating Member States' authorities in the collection and harmonized reporting of Key Performance Indicators (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. This document is the report providing information on the KPI Distraction, which is defined as the percentage of drivers not using a handheld mobile device. Driver distraction is considered as a collision factor of growing importance due to the increased use of mobile devices (mainly smartphones) during the past years, and the widespread use of texting applications has aggravated the existing problem of phone calls. The use of a handheld mobile device while driving is proposed as a proxy to assess the driver distraction problem (SWD, 2019).

Of the 18 participating MS, 15 collected KPI distraction data, based on fieldwork between 2019 and 2022: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Finland, Germany, Greece, Latvia, Lithuania, Malta, Poland, Portugal, Spain and Sweden. Thirteen MS used observers along the road, and two used camera images.

One of the Baseline aims was a check of feasibility and limitations of collecting comparable KPIs across EU. With regard to the KPI distraction this proves to be possible to a certain extent but not completely due to national differences in sampling and weighting. Overall though the minimum requirements set in Baseline for this KPI were feasible for most MS. The Baseline experience furthermore indicates that the use of cameras could be considered, taking some challenges into account.

The figure underneath shows the national aggregate KPIs for three vehicle types together (passenger cars, light goods vehicles and busses/coaches), on 3 road types together (urban roads, rural roads, motorways), on weekdays (Monday-Friday), which is the minimum required national KPI set by Baseline. This result indicates that overall more than 90% of the drivers in the participating MS do not use a handheld mobile device while driving; the actual percentages range between 90,6% in Cyprus and 98,3% in Finland.



*Malta, Latvia: no motorways in road network. *Latvia: week + weekend days. *Germany: only passenger cars. * Spain: broader KPI: % having in the hand or operating with the hand a mobile phone or other electronic devices, whether mobile or on-board. * Spain: 4 road types with expressways. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Finland, Lithuania: analysis of camera images; other MS: roadside observations by trained observers.

The report gives an overview of the national meta-data (methodology and legislation) and main KPI results. Besides the KPIs for minimum required stratifications, many MS also provided additional (optional and recommended) KPIs, which are also included in the report. An interesting general pattern among MS was found with regard to the optional KPIs for separate vehicle types, namely that light goods vehicles clearly more often use a handheld mobile device than car and bus drivers. Another general pattern relates to the age categories, although only available for 3 MS , with clearly less device use in 65-plus drivers compared to younger drivers. With regard to road types and time periods, different patterns are found in the MS. Different recommendations are formulated, related to the defined KPI (which could be extended), observation methodology, methodological requirements and stratifications (e.g. indicators per vehicle type, inclusion of trucks/heavy goods vehicle, operational definition of road types, and more common weighting sources and procedures).

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 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 better 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 list of the KPIs is given in Table 1. The minimum requirements for these KPIs are described in the *Commission Staff Working Document SWD (2019) 283*, further referred to as 'SWD'.

Table 1. List of European KPIs for road safety

KPI area	KPI 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 PTWs 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 passenger cars with a Euro NCAP safety rating equal or above a threshold
Infrastructure	Percentage of distance driven over roads with a rating above an agreed threshold
Post-crash care	Time elapsed between the emergency call following a collision resulting in personal injury and the arrival at the scene of the collision of the emergency services

Funding has been made available by the European Commission to support Member States in the data collection and analysis for these KPIs. Eighteen Member States participate in a common project, called "Baseline". 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 Participation in Baseline

The following EU Member States participated in the Baseline project: Austria; Belgium; Bulgaria; Cyprus; Czech Republic; Finland; Germany; Greece; Ireland; Latvia; Lithuania; Luxembourg; Malta; The Netherlands; Poland; Portugal; Spain; Sweden. Some data regarding KPIs of EU Member States that were not participating in Baseline are also included in the deliverables.

1.3 Final deliverables of the Baseline project

The final public outcomes and deliverables of the Baseline project are:

- Eight specific reports, each on one KPI
- A website on which all public information is accessible
- A final report including the key results of the project and recommendations for next steps.

This document is the report providing information on the ***KPI Distraction***. This KPI has been defined as:

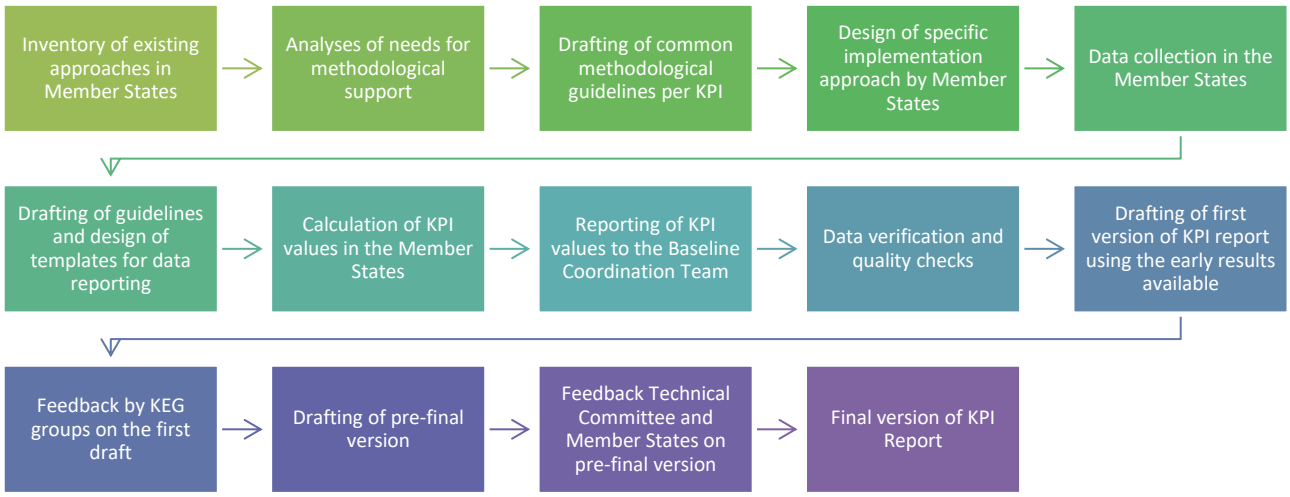
"Percentage of drivers not using a handheld mobile device"

2. Methodology

2.1 Overall process

The process followed for arriving at this report is summarized in the following scheme:

Figure 1. Process leading to this report



For each KPI, a "KPI Expert Group" (KEG) was established, which was responsible for the design of the methodological guidelines and for the review of a draft version of this report. The KEG for the distraction indicator consisted of the following persons:

- Sofie Boets, Vias institute (Belgium)
- Markus Schumacher, BASt (Germany)
- Agnieszka Stelling, SWOV (Netherlands)
- Dagmara Jankowska -Karpa, ITS - Motor Transport Institute (Poland)
- Dimos Pavlou, NTUA (Greece)

The overall process was overseen by the Technical Committee, which focused in particular on issues that were important for several KPIs (e.g. structure and content of methodological guidelines, minimum samples, number of observations and locations, weighting of data, data reporting, etc.). The Technical Committee consisted of:

- Peter Silverans, Vias institute (Belgium) - Coordinator
- Wouter Van den Berghe, Vias institute (Belgium)
- Frits Bijleveld, SWOV (Netherlands)
- Sheila Ferrer López, DGT (Spain)
- Peter Larsson, Trafikverket (Sweden)
- Markus Schumacher, BASt (Germany)
- Veronika Valentova, CDV (Czech Republic)
- George Yannis, NTUA (Greece)

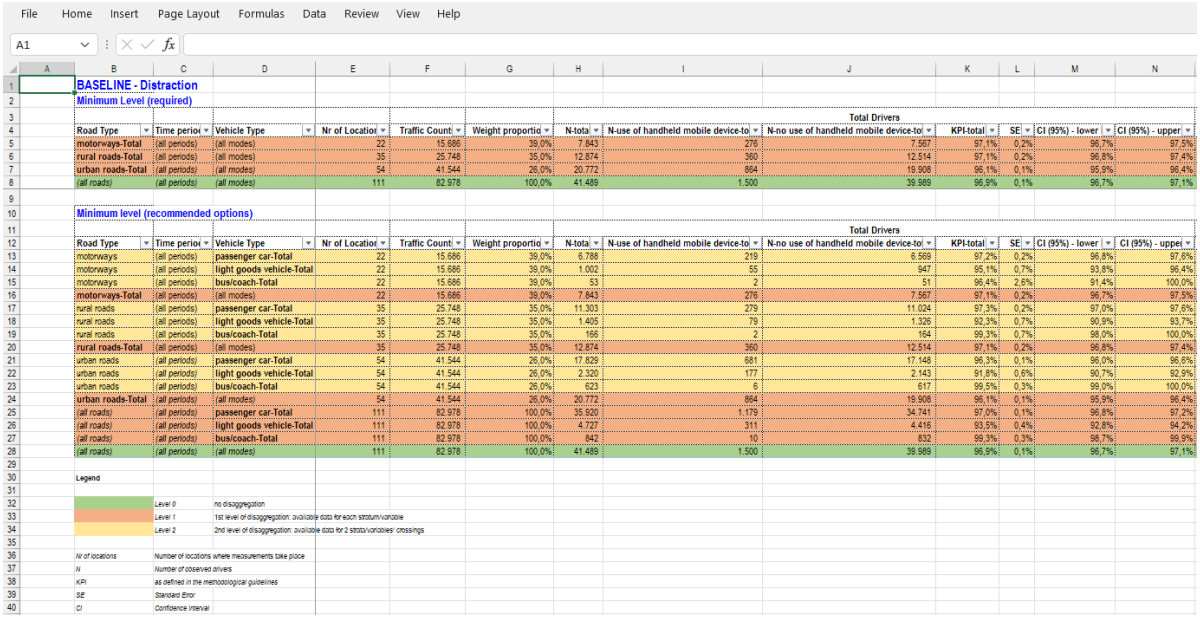
2.2 Support tools developed

For every KPI, methodological guidelines were developed, covering topics such as:

- definition of the KPI concerned, and possibly complementary or alternative KPIs
- methods to be used for data collection
- breakdowns requested of the KPI values (road category, vehicle type, day of week, …)
- minimum sample of observations/cases and observation locations
- methods for weighting and analysing the data
- nature and format of data to be reported

The methodological guidelines of the KPI Distraction can be accessed from the Baseline website via this link: https://www.baseline.vias.be/storage/minisites/methodological-guidelines-kpi-distraction.pdf. Many elements of the Methodological Guidelines have been integrated in this report, either within the main body of the text, or as part of the Annex.

In order to streamline and harmonize the data flow, data reporting guidelines and data reporting templates were developed. The data reporting templates (in Excel) were used by the Member States for reporting their KPI values to the Baseline Coordination Team.



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BASELINE - Distraction

Minimum Level (required)

									Total Drivers					
Road Type	Time perio	Vehicle Type	Nr of Locatior	Traffic Count	Weight proportio	N-total	N-use of handheld mobile device-to	N-no use of handheld mobile device-to	KPI-total	SE	CI (95%) - lower	CI (95%) - upper
motorways-Total	(all periods)	(all modes)	22	15.686	39,0%	7.843	276	7.567	97,1%	0,2%	96,7%	97,5%
rural roads-Total	(all periods)	(all modes)	35	25.748	35,0%	12.874	360	12.514	97,1%	0,2%	96,8%	97,4%
urban roads-Total	(all periods)	(all modes)	54	41.544	26,0%	20.772	864	19.908	96,1%	0,1%	95,9%	96,4%
(all roads)	(all periods)	(all modes)	111	82.978	100,0%	41.489	1.500	39.989	96,9%	0,1%	96,7%	97,1%

Minimum level (recommended options)

									Total Drivers					
Road Type	Time perio	Vehicle Type	Nr of Locatior	Traffic Count	Weight proportio	N-total	N-use of handheld mobile device-to	N-no use of handheld mobile device-to	KPI-total	SE	CI (95%) - lower	CI (95%) - upper
motorways	(all periods)	passenger car-Total	22	15.686	39,0%	6.788	219	6.569	97,2%	0,2%	96,8%	97,6%
motorways	(all periods)	light goods vehicle-Total	22	15.686	39,0%	1.002	55	947	95,1%	0,7%	93,8%	96,4%
motorways	(all periods)	bus/coach-Total	22	15.686	39,0%	53	2	51	96,4%	2,6%	91,4%	100,0%
motorways-Total	(all periods)	(all modes)	22	15.686	39,0%	7.843	276	7.567	97,1%	0,2%	96,7%	97,5%
rural roads	(all periods)	passenger car-Total	35	25.748	35,0%	11.303	279	11.024	97,3%	0,2%	97,0%	97,6%
rural roads	(all periods)	light goods vehicle-Total	35	25.748	35,0%	1.405	79	1.326	92,3%	0,7%	90,9%	93,7%
rural roads	(all periods)	bus/coach-Total	35	25.748	35,0%	166	2	164	99,3%	0,7%	98,0%	100,0%
rural roads-Total	(all periods)	(all modes)	35	25.748	35,0%	12.874	360	12.514	97,1%	0,2%	96,8%	97,4%
urban roads	(all periods)	passenger car-Total	54	41.544	26,0%	17.829	681	17.148	96,3%	0,1%	96,0%	96,6%
urban roads	(all periods)	light goods vehicle-Total	54	41.544	26,0%	2.320	177	2.143	91,8%	0,6%	90,7%	92,9%
urban roads	(all periods)	bus/coach-Total	54	41.544	26,0%	623	6	617	99,5%	0,3%	99,0%	100,0%
urban roads-Total	(all periods)	(all modes)	54	41.544	26,0%	20.772	864	19.908	96,1%	0,1%	95,9%	96,4%
(all roads)	(all periods)	passenger car-Total	111	82.978	100,0%	35.920	1.179	34.741	97,0%	0,1%	96,8%	97,2%
(all roads)	(all periods)	light goods vehicle-Total	111	82.978	100,0%	4.727	311	4.416	93,5%	0,4%	92,8%	94,2%
(all roads)	(all periods)	bus/coach-Total	111	82.978	100,0%	842	10	832	99,3%	0,3%	98,7%	99,9%
(all roads)	(all periods)	(all modes)	111	82.978	100,0%	41.489	1.500	39.989	96,9%	0,1%	96,7%	97,1%

Legend

Level 0	no disaggregation
Level 1	1st level of disaggregation: available data for each stratum/variable
Level 2	2nd level of disaggregation: available data for 2 strata/variables' crossings

Nr of locations	Number of locations where measurements take place
N	Number of observed drivers
KPI	as defined in the methodological guidelines
SE	Standard Error
CI	Confidence Interval

2.3 Definition of distraction

Driver distraction is considered as a collision factor of growing importance due to the increased use of mobile devices, mainly smartphones - during the past years, the widespread use of texting applications has aggravated the existing problem of phone calls. This is why the use of a handheld mobile device while driving is proposed as a proxy to assess the driver distraction problem.

The KPI Distraction refers to a handheld mobile device. The use of 'device' instead of 'phone' makes this KPI futureproof. A mobile device can be defined as "a computer small enough to hold and operate in the hand" (e.g. https://en.wikipedia.org/wiki/Mobile_device), such as: mobile phones (e.g. smartphones), mobile computers (e.g. tablets), personal navigation devices, digital cameras.

Most Member States have a ban on mobile phone use while driving, while in some States this has meanwhile been extended to mobile electronic 'devices'. Participating Member States provide metadata on the applied regulations and procedures related to this.

As an absolute minimum, two clearly visible distraction categories, excluding each other, had to be recorded in each observation:

- Having a mobile device in the hand (driver is holding a mobile device in the hand, which can be held at the ear, at the steering wheel or anywhere else)
- Not having a mobile device in the hand (rest category)

Although the KPI Distraction refers to 'use of a handheld mobile device', this categorization is based on what is visibly detectable during an on-road observation study. This allows a clear and uniform observation procedure, even though handheld mobile device use will be underestimated because drivers often hide their mobile device under the dashboard or on their laps.

2.4 Minimum and optional requirements for the KPI Distraction within Baseline

The minimum requirements for the KPI Distraction are given in Table 2. The table also includes optional supplementary approaches. Baseline partner countries had the option of either just meet the minimum requirements or to extend (part of) their methodology and include other elements.

The KPI is presented as the percentage of drivers not using a handheld mobile device while driving over the national territory. Optionally, when data is available on the total of all kilometres driven over the national territory (per vehicle type and road type), the KPI can also be presented as the total number of kilometres driven without using a handheld mobile device. For instance, the percentage of drivers not using a handheld mobile device while driving then reflects the percentage of kilometres driven without using a handheld mobile device.

Table 2. Minimum requirements and optional additions for the KPI Distraction

	Minimum requirements	Optional additions
KPI definition	• Percentage of drivers not using a handheld mobile device	• Differentiation between private and professional drivers
Conditions	• Direct observation on the road • Daylight • Sufficiently good weather conditions (no heavy rain, no storm, no snow) • Good visibility (no darkness, no fog) • Good road conditions (no ice) • Flowing traffic (no accident or construction site): observation of vehicles in movement, not of stationary vehicles • Not during holidays or heavy winter period	• Trained observers or video/camera images
Sample size	• Min 2.000 observations for the three minimum vehicle types together • Min 500 observations / road type • Min 10 locations / road type • Min. 30 minutes per session	
Locations	• Random selection	• Stratification by Regions

	• Representative of entire national road network • Flowing traffic (e.g. not near intersections, traffic lights) • Good view, safe, inconspicuous	• Optional exclusion of locations with less than 10 relevant vehicles passing per hour
Vehicle types	• Passenger cars, light goods vehicles, buses/coaches (combined for the minimum KPI)	• Minimum vehicle types separately • Any other optional vehicle type (e.g. trucks, motorcycles)
Road types	• Motorways • Rural roads (defined as roads outside built-up areas, but no motorways) • Urban roads (defined as roads inside built-up areas)	
Time periods	• Daylight hours • Weekday with a mix of daytime hours in the fieldwork: on and off peak on week days, balanced over road types	Stratification by additional Time periods: • Weekend day • Weekday peak • Weekday off peak • Week + weekend day *(min. 10 locations per time period; min. 2 locations per time period x road type; min. 500 observations/time period)*

3. Meta-data results

In this section an overview of the national regulations regarding handheld mobile phone/device use while driving is provided as well as a detailed overview of the methodologies and sampling designs used to deliver the KPIs for distraction. The MS that provided Baseline datafiles including meta-data are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Finland, Germany, Greece, Latvia, Lithuania, Malta, Poland, Portugal, Spain and Sweden. Data from the Netherlands is available from a study report on a national measurement that was done before Baseline, with a method deviating from the Baseline definitions and requirements (Mak, 2020). Reference will be made in Section 3.2 to their method and main results.

3.1 National legislation

As shown in Table 3 all participating MS had legislation prohibiting handheld mobile phone use while driving at the time of their data collection. In some MS the regulation was already updated and broadened to 'mobile device'. It is possible that MS with legislation on handheld 'mobile phone' use only – so not (yet) on the (broader) handheld 'mobile electronic device' use – only delivered KPIs for 'mobile phone use' (see section 3.2).

Table 3. National legislation

	KPI distraction related legislation
Austria	Ban of use of hand-held mobile **phones** while driving.
Belgium	Ban of handheld mobile **phone** use while driving, also while standing still in front of a red light or in a jam (updated regulation after the study, in 2022: "Except when the vehicle stands still or is parked, the driver may not use, hold or manipulate a mobile electronic device, except in a holder attached to the vehicle").
Bulgaria	Using a handheld mobile **device** while driving a motor vehicle is prohibited.
Cyprus	Drivers are not allowed to use their mobile **phone** without a hand-free set.
Czech Republic	The driver must not hold a mobile **phone or** recording **device** in his hands or in any other way while driving the car.
Finland	Drivers of motorised vehicles are not allowed to hold communications **devices** for use while the vehicle is in motion.
Germany	Drivers may use an electronic communication **device** such as a cell phone while driving in particular only if they neither pick up the device nor hold it in their hands and if they only glance briefly at the device to operate and use it.
Greece	Mobile **phone** use while driving is only permitted when it is placed on a special position for hands-free listening/talking or when used with a wireless communication headset.
Latvia	The driver of a vehicle is prohibited from the following: 1) using a **telephone** if the vehicle is in motion, except for cases where a telephone is used in a hands-free mode. 2) using notebook computers, tablet PCs, and smart **devices** if the vehicle is in motion.
Lithuania	Drivers of motor vehicles, tractors and self-propelled machinery are prohibited from using mobile **devices** if they are using their hands, except when the engine of the stationary vehicle is switched off.
Malta	No person shall drive a motor vehicle on a road if that person is holding and, or using a hand-held mobile **telephone** or any other similar hand-held **device**, other than a hand-free device or a two-way radio, while the motor vehicle is in motion.
Netherlands	Holding a mobile **phone** (or other electronic **devices** that can be used for communication and information processing) while the vehicle is in motion is prohibited. Nor may telephones be clasped between ear and shoulder. However, operating a phone in a holder is allowed. This regulation applies to all vehicle drivers and riders, including cyclists, (light) moped-riders, motorcyclists, etc.

Poland	The vehicle driver is forbidden to use a **telephone** while driving that requires a handset or microphone to be held in the hand. This applies to all vehicle drivers, also including motorbikes, mopeds, bicycles, horse-drawn vehicles, etc.
Portugal	It is forbidden for drivers to use or handle, while driving, any type of equipment or **device** that may impair driving, such as headphones and radiotelephone devices. The use of a single headset or microphone with a loudspeaker system is allowed.
Spain	The use of mobile **phones** or any other communication **device** while driving is prohibited, except when communication takes place without using hands nor using headphones or similar.
Sweden	Law prohibiting the use of a mobile **phone** or other communication **device** which are held by hand while driving a motor vehicle.

3.2 Data collection methodology and characteristics

Baseline KPI datafiles were provided by 15 MS. The Netherlands did not provide a Baseline datafile, but they referred to a report of a study which was conducted before Baseline (Mak, 2020). They used a location sampling design which is not compatible with the Baseline definitions and minimum requirements (deviations on location sample sizes, road typology, distraction categories: no differentiation between screen manipulation with the phone in the hand or in a fixed holder)[1]. The Dutch indicators will thus not be presented together with the other national indicators (see main Dutch results in the footnote).

For the 15 MS that provided Baseline datafiles, the data collection specifications can be summarised as follows (see also Table 4):

- All MS indicated in their meta-data to have provided the Baseline KPI Distraction. This KPI is defined as '*the % drivers not using a handheld mobile device*'. Generally no further specification or definition of the indicator was provided, so it is assumed that these MS collected data on handheld mobile device use. At a later stage Spain indicated to have used a wider distraction definition namely '*% drivers having (in the hand) or operating with the hand a mobile phone or other electronic device (GPS, tablets, monitors, etc.), whether mobile or on-board*'. Because of the broader distraction behaviour measured, it can be expected that Spain generally has lower KPI percentages. The Spanish KPIs are thus not fully comparable with the other national KPIs and will therefor not be presented in the figures with the other countries. They will be included in the tables with the proper explanation. Furthermore, as some national regulations (see section 3.1) only ban handheld mobile 'phone' use (not 'device') an additional check was done if these MS' KPIs refer to mobile phone use only or to mobile device use. Austria, Greece and Cyprus indicated that their KPI refers to mobile phone use. In Belgium the legislation at the time of the fieldwork referred to handheld mobile phone use only but the delivered KPI refers to handheld mobile device use, thus including also other mobile electronic devices (with a screen). The same counts for Poland. The legislation of the other MS refers to both phones and other devices.
- Most MS used direct observation by trained observers along the road (13). For motorways, some MS used observations from a riding vehicle, but others considered this complex and used observers along the motorways and from bridges. More detailed fieldwork information is not systematically collected in the meta-data so it's only available for some MS. Two MS used camera images (Finland – see Annex 6 – and Lithuania).
- The fieldwork periods ranges from May 2019 to May 2022. The majority of the studies took place in 2021 and 2022.

[1] The Netherlands: Method: Study on use of equipment (no use vs. handheld calling (at ear), handheld calling (in hand/on steering wheel), handsfree calling (with ears/headphone), screen manipulation (in hand/holder) together with seatbelt and child restraint use. Observations of driving vehicles (car, bus, truck; no LGV) were made from 7 fixed positions along the side of the road (maximum allowed speed 70 km/h) and on 8 motorway sections (riding along with the traffic). In total, the use of equipment has been registered for more than 9.000 drivers. At the measuring screen use, no distinction was made between phone in hand or in holder. Results**:** 'no use' 2020: Total: 91%; 50km/h roads: 92%, 60-70km/h roads: 85%, Motorways: 90%; Car: 92%, Bus: 86%, Truck: 84% (Mak, 2020).

- The vast majority of MS indicated to have used a stratified random sample of locations (by road type, sometimes combined with region). Germany uses a historical representative set of locations (3 road types) with good and safe observability and sufficient traffic in a representative set of regions (8) for the country. Some MS indicated 'simple random' sampling (Bulgaria, Sweden) but with the same number of locations per road type, generally a disproportionally stratified sample (according to the road type strata). No further details on the actual sampling procedure were requested in the meta-data. Only Malta provided more details on how GIS was used for location sampling.
- All studies were conducted as required during daylight hours, in flowing traffic and sufficiently good weather conditions.
- The number of sessions per MS varies greatly (from 30 to 520) and session duration varies from 20-30 minutes to 3:22h (observers), and up to more than 5 hours in Finland using cameras.
- All MS provided KPIs for the 3 minimum required vehicle types *together* (passenger cars, light goods vehicles and busses/coaches), except for Germany (only passenger cars).
    - Five MS only provided KPIs for the 3 vehicle types together, which is the minimum requirement.
    - Nine MS provided KPIs for the 3 vehicle types together as well as per vehicle type (3) which was optional.
    - The bus/coach sample is generally too small for any further subgroup analysis. This report will not include indicators for this mode only.
    - Some MS also collected data on trucks or HGV (with bigger samples than for busses/coaches), but this mode is not part of the Baseline data collection, and thus not included in this report.
- All MS provided KPIs for the 3 minimum required road types, except for Latvia and Malta because these MS do not have motorways in their national road network. Their national KPI thus only includes 2 road types. Spain delivered separate indicators for motorways and expressways, while Poland combined observation data from motorways (140km/h) and expressways (120km/h) in the motorway KPI. Other MS did not mention 'expressways' in their meta-data.
- Some MS provided very detailed descriptions of the road types while others only briefly referred to that. It seems that the operational definition of urban (inside built-up area) and rural (outside built-up area) is not as easy to take into account in the location sampling (not available in GIS searches) as well as for data weighting (no national data available on length in road network nor traffic volume data) as compared to, for instance, speed regimes or other common road categorisations. Main characteristics mentioned for motorways are: public dual carriageways with at least two lanes each way, central barrier or median, no crossing, signposted exists/entrances, only for heavier motor vehicles (no quadricycles, mopeds), 120-140 km/h speed limit. Poland and Spain refer also to expressways (in the motorway category for Poland; separate category for Spain). For rural roads main characteristics mentioned are: 1st and 2nd class roads outside built-up area, 70-90km/h speed limit. For urban roads main characteristics mentioned are: inside built-up area, 30-50km/h.
- Fourteen MS provided the minimum 'weekday only' KPIs, and 8 of these also provided weekend day indicators as well as indicators for 'all periods' (week- + weekend days). Seven MS also provided weekday peak vs. off-peak indicators. Almost all MS did include peak and off-peak hours in the fieldwork set-up (cfr. the minimum Baseline requirement to measure during a mix of daytime hours, on and off-peak, balanced over road types/locations).
- Five MS provided KPIs by gender; 3 by age category.
- Seven MS provided indicators for several 3- to 5-level crossed stratifications (AT, BE, CY, CZ, GR, PO, ES). Three MS additionally provided separate indicators for 'private' vs. 'professional' drivers. This report focusses on the main stratifications and 2-level crossings for 'total' drivers.

Table 4. Meta-data on KPI distraction

	Method	Data collection period	Stratifications considered	Delivered datasets
Austria	Roadside **observation** by trained observers Stratified random sample 216 sessions (several per location, 86 peak/off peak, 44 weekend)	01/05/2021 - 30/07/2021	• Vehicle type (3) • Road type (3) • Time period (3: week peak (7-8:59; 15-18:59), off-peak (rest), weekend: 6-22) • Age categories (3) • Gender (2)	Aggregate (for weekday only and for week- + weekend day) semi-aggregate (up to level road x

	(1 session = 50 observations, ca. 20-30 min)			time x mode x gender x age) (total, private, professional drivers)
Belgium	Roadside **observations** by trained observers Stratified random sample 161 sessions (1 per location, 48 peak, 62 off-peak, 51 weekend) (average 1h)	08/10/2020 - 04/12/2020	• Vehicle type (3) (+ trucks – excluded for KPI) • Road type (3) • Time period (3: week peak 7:30-9 and 16-18; off peak 10-12 and 14-16; weekend: 9-17) • Age categories (3) • Gender (2)	Aggregate (for weekday only and for week- + weekend day) semi-aggregate (up to level road x time x mode x gender x age)
Bulgaria	Roadside **observations** by trained observers Stratified random sample 120 sessions (4 per location, 60 week/weekend) (average 2h)	02/10/2021 - 07/11/2021 and 14/03/2022 - 31/05/2022	• Thee vehicle types together • Road type (3) • * Time period (2: week (hours cover peak and off-peak) and weekend day 9-12:30 and 13-17:30): considered in fieldwork set-up (no KPIs)	Aggregate (for weekday only and for week- + weekend day) (all modes only)
Cyprus	Roadside **observations** by trained observers Stratified random sample 120 sessions (108 weekday, 12 weekend day) (average 3h)	01/09/2022-13/10/2022	• Vehicle type (3) • Road type (3) • Time period (2: week (hours cover peak and off-peak), weekend: 9-12; 13-16)	Aggregate (for weekday only and for week- + weekend day) semi-aggregate (up to level road x time x mode)
Czech Republic	Roadside **observations** by trained observers Stratified random sample 72 sessions (2 x per location, 36 week/weekend) (average 42 min)	09/06/2021-30/06/2021 03/09/2021-20/10/2021	• Vehicle type (3) • Road type (3) • Time period (2: week (hours cover peak and off-peak) and weekend day: 7-18) • Gender (2)	Aggregate (for weekday only and for week- + weekend day) semi-aggregate (up to level road x time x mode; gender)
Finland	Analysis of **camera images** (1 of license plate and 1 of driver) Stratified random sample (*near automatic traffic measurement stations*) 30 sessions (1 per location) (median 1h20; 54 min to 5:27h)	10/09/2022 - 07/10/2022	• Vehicle type (3) (+ trucks – excluded for KPI) • Road type (3) • Time period (1: only week day: 8:49-18:59 but most between 11-16)	Aggregate (weekday only)
Germany (Kathmann et al., 2019)	Roadside **observations** by trained observers Stratified representative sample (selection of locations (3 road types) in 8 German regions, representative for DE) 79 sessions (23 per road type, 69 week, 10 weekend) (average 3h)	06/05/2019 - 06/09/2019	• Vehicle type (1: only cars) • Road type (3) • * Time period (3: week peak 7-10am; off peak 10:30-13:30; weekend (only 10 sessions): 9:30-12:30 and 13-16): considered in fieldwork set-up (no KPIs). KPI refers to weekday only.	Aggregate (weekday only) (only cars)
Greece	Roadside **observations** by trained observers	28/03/2022-09/07/2022	• Vehicle type (3) • Road type (3)	Aggregate (for weekday only

	Stratified random sample 130 sessions (1 per location, 102 week, 28 weekend) (average 3:22h)		• Time period (2: week (hours cover peak and off-peak), weekend: 8-18)	and for week- + weekend day) semi-aggregate (up to level road x time x mode)
Latvia	Roadside **observations** by trained observers Stratified random sample 108 sessions (in total 136 hours)	09/09/2021 - 27/11/2021	• Vehicle type (3) • Road type (2: no motorways) • * Time period (2: week (hours cover peak and off-peak) and weekend day: 07:30-19:30): considered in fieldwork set-up (no KPIs)	Aggregate (for week- + weekend day only, no separate weekday)
Lithuania	Analysis of **video images** Stratified random sample 30 sessions (1 per location) (average 45 min)	02/06/2021 - 17/06/2021	• Three vehicle types together • Road type (3) • Time period (1: only week day: 8-16)	Aggregate (weekday only) (all modes only) (total, private, professional drivers)
Malta	Roadside **observations** by trained observers Stratified random sample (*To determine the urban areas, the CORINE GIS layer was joined with a layer showing urban areas from the Planning Authority in Malta. Random points were generated using GIS software, and these points were adjusted manually to find a location where the officers could safely position themselves.)* 60 sessions (2 per location, 30 peak/off-peak) (average 30 min)	28/02/2022 - 03/05/2022	• Three vehicle types together • Road type (2: no motorways in Malta) • Time period (2: week peak 7-11 and off-peak 11-16:30)	Aggregate (weekday only) (all modes only) semi-aggregate (only time period: peak, off peak)
Poland	Roadside **observations** by trained observers Stratified random sample 84 sessions (25 urban, 32 rural, 27 motorway; 52 week, 32 weekend) (average 1-2h)	21/09/2021 - 06/11/2021	• Vehicle type (3) • Road type (3) • Time period (2: week (hours cover peak and off-peak), weekend: 6/7/7-19/17:30/16) • Age categories (3) • Gender (2)	Aggregate (for weekday only and for week- + weekend day) semi-aggregate (up to level road x time x mode x gender x age)
Portugal	Roadside **observations** by trained observers Stratified random sample 38 sessions (1 per location) (average 70 min)	12/10/2021 – 16/12/2021	• Three vehicle types together (+ trucks – excluded for KPI) • Road type (3) • Time period (1: weekday sunrise -30min up to sunset +30min (hours cover peak and off-peak))	Aggregate (weekday only) (all modes only)
Spain	Roadside **observations** by trained observers Stratified random sample 520 sessions (4 per location) (average 30 min)	19/10/2021 – 23/11/2021	• Vehicle type (3) • Road type (3 + 1 extra road type: expressway, i.e. pubic road that does not meet all the requirements of motorways) • * Time period (2: week and weekend day: 8-13:30 and	Aggregate (for weekday only and for week- + weekend day) Semi-aggregate (up to gender x road x mode)

			14-16 covering peak and off-peak: considered in fieldwork set-up (no KPIs) • Gender (2)	(total, private, professional drivers)
Sweden	Roadside **observations** by trained observers Stratified random sample (*random selection of safe observation spots; rural roads and motorways: on bridges for pedestrians and cyclists*) 33 sessions (1 per location) (30 min)	28/04/2022 - 18/05/2022	• Three vehicle types together • Road type (3) • Time period (1: week day 8-19)	Aggregate (weekday only) (all modes only)

*Some MS also collected data on trucks but these are not included in the Baseline analyses. *Minimum required time period: weekday (covering peak and off peak). Optional: KPIs for weekday peak, weekday off-peak, weekend day, week + weekend day. Some MS considered different time periods in the fieldwork set-up without delivering separate indicators.

3.3 Sampling design

In this section the sampling framework of the KPI distraction studies is presented in different tables, including the location and driver samples in total, per road type and per vehicle type on weekdays, and if available on different time periods (e.g. weekday peak, weekday off-peak, weekday, weekend day) as well as the samples for further crossed strata. This gives an overview on the validity (in terms of sample size) of the indicators for the different stratifications. Deviations from the sample requirements are marked differently: in case of a minor deviation the KPI is included in normal colour in the figure and marked orange in the table; in case of a bigger deviation the KPI is included in a lighter colour in the figure and marked red in the table.

In Malta and Latvia the road network does not include motorways. Germany only provided KPIs for passenger car drivers. Latvia provided KPIs (and sample sizes) for the combination of week- and weekend days, and not for weekdays only.

Table 5 gives an overview of the total sample size for the 3 vehicle types together on weekdays and if available on week- + weekend days, and per road type. The number of locations per road type ranges between 8 and 78. Germany (8) deviates slightly from the requirement to include 10 locations per road type. The overall driver sample for the 3 vehicle types 'together' ranges from 3.834 to 33.974 on weekdays (16.526 to 41.489 on week- + weekend days) .

All MS meet the minimum required total driver sample of 2.000. The minimum driver sample per road type is 500, which is also reached by all MS.

Table 5. Location and driver sample: total and per road type on weekdays and for week + weekend

	Total driver sample (3 types together; min. 2.000)	**Location sample per road type** (min. 10)			**Driver sample per road type** (3 types together; min. 500)		
		Urban	**Rural**	**Motor-way**	**Urban**	**Rural**	**Motor-way**
Austria *Week*	33.974	50	31	22	16.968	9.976	7.030
Week + Weekend	41.489	54	35	22	20.772	12.874	7.843
Belgium *Week*	12.269	53	33	24	5.400	5.560	1.309
Week + Weekend	16.845	78	48	35	7.404	7.583	1.858
Bulgaria *Week*	21.994	10	10	10	7.332	7.890	6.772
Week + Weekend	39.464	10	10	10	12.261	13.367	13.836
Cyprus *Week*	20.229	14	13	13	8.709	4.839	6.681
Week + Weekend	22.166	14	13	13	9.286	5.471	7.409
Czech Republic *Week*	11.918	13	13	10	3.578	3.363	4.977

Week + Weekend	18.632	13	13	10	5.199	5.230	8.203
Finland *Week*	12.695	10	10	10	3.887	4.125	4.771
Germany* *Week*	(145.040: only cars)	8	8	8	-	-	-
Greece *Week*	38.020	49	49	32	15.123	12.471	10.426
Week + Weekend	36.858	45	43	32	14.526	11.906	10.426
Latvia* *Week + Weekend*	16.526	32	11	-	10.425	6.101	-
Lithuania *Week*	8.053	10	10	10	3.589	1.720	2.744
Malta* *Week*	5.878	15	15	-	3.331	2.547	-
Poland *Week*	23.568	14	21	17	7.144	7.915	8.509
Week + Weekend	38.499	24	19	23	12.367	11.524	14.608
Portugal *Week*	3.834	15	12	11	1.178	1.504	1.152
Spain *Week*	14.015	65	25	*10 motorway* ---------- *30 express-way*	6.811	2.144	1.506 ---------- 3.554
Week + Weekend	24.216	65	25	*10 motorway* ---------- *30 express-way*	11.336	3.966	2.597 ---------- 6.317
Sweden *Week*	7.384	11	11	11	2.166	1.795	3.423

*Minimum required samples for weekdays. If KPIs are available for week + weekend days these total sample sizes are also included. *Latvia, Malta: no motorways. *Germany: only passenger cars; minor deviation in location sample size per road type.

Table 6 gives an overview of the driver sample per vehicle type and per vehicle type x road type (both optional), for either weekday only and for week- and weekend day together. Minor deviations from the proposed minimum sample size requirement (between 400 and 500 drivers) are marked orange; big deviations are marked red in the table.

Nine MS provide separate KPIs per vehicle type (8 MS for weekdays; 8 for week- + weekend days). The vast majority to collected driver data is for car drivers. Nine MS have sufficient car driver sample to deliver a KPI; the sample size on weekdays ranges from 10.041 (Belgium) to 145.040 (Germany). For light goods vehicles (LGV) 8 MS have sufficient sample to deliver a KPI for weekdays (range: 1.545 Finland - 6.819 Greece). The sample of bus/coach drivers is generally very small (weekdays: 67 Finland up to 819 Greece) and mostly too small for any further analysis (6 MS have a sufficient sample for a bus KPI of which 3 with a minor deviation from the minimum sample size).

Breakdowns of passenger cars per road type are provided with sufficient sample by 9 MS. For breakdowns of LGV per road type, the sample sizes for all crossed strata are sufficient for 4 MS. For busses/coaches the sample is generally too small for this crossed stratification.

Table 6. Driver samples: per vehicle type and vehicle x road type (optional)

	Driver sample per vehicle type (min. 500)			Driver sample per vehicle type x road type (min. 500)								
	Car	LGV	Bus	Car			LGV			Bus		
				urban	rural	motor-way	urban	rural	motor-way	urban	rural	motor-way
Austria week	28.952	4.249	773	14.289	8.620	6.043	2.104	1.207	938	575	149	49

Week + Weekend	35.920	4.727	842	17.829	11.303	6.788	2.320	1.405	1.002	623	166	53
Belgium week	10.041	2.029	199	4.571	4.464	1.006	707	1.025	297	122	71	6
Week + Weekend	14.104	2.511	230	6.349	6.264	1.491	918	1.234	359	137	85	8
Bulgaria* week	17.657	4.074	263	-	-	-	-	-	-	-	-	-
Week + Weekend	33.322	5.649	493	-	-	-	-	-	-	-	-	-
Cyprus week	18078	1.724	427	7.980	4.411	5.687	498	365	861	231	63	133
Week + Weekend	19.897	1.812	457	.8536	5.009	6.352	514	389	909	236	73	148
Czech Republic week	18.078	1724	427	7.980	4.411	5.687	498	365	861	231	63	133
Week + Weekend	16.373	2.148	111	4.823	4.736	6.814	330	470	1.348	46	24	41
Finland week	11.064	1.545	67	3.374	3.577	4.113	384	532	629	22	16	29
Germany* week	145.040 (108.857 weighted)	-	-	46.503	41.120	57.417	-	-	-	-	-	-
Greece week	22.519	6.819	819	9.204	7.434	5.881	1.982	1.726	3.111	420	191	208
Week + Weekend	29.054	7.992	974	12.199	9.990	6.865	2.414	2.235	3.343	510	246	218
Latvia *(Week + Weekend)*	14.714	1.498	314	9.376	5.338	-	812	686	-	237	77	-
Lithuania	-	-	-	-	-	-	-	-	-	-	-	-
Malta	-	-	-	-	-	-	-	-	-	-	-	-
Poland week	20.140	3.043	385	6.339	6.781	7.020	607	1.024	1.412	198	110	77
Week + Weekend	33.871	4.031	597	11.104	10.157	12.610	935	1.238	1.858	328	129	140
Portugal week	-	-	-	-	-	-	-	-	-	-	-	-
Spain week	12.030	1.761	224	6.001	1.798	1.298 motor-way --- 2.933 express-way	665	320	201 --- 575	145	26	7 --- 46
Week + Weekend	21.210	2.618	388	10.098	3.479	2.288 --- 5.345	999	444	288 --- 887	239	43	21 --- 85
Sweden	-	-	-	-	-	-	-	-	-	-	-	-

*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Bulgaria: sample size per vehicle type was provided but no indicators per vehicle type (only for all modes together). *Germany: only passenger car drivers.

Table 7 gives an overview of the driver sample per optionally considered time period and for the crossing vehicle type x time period. Minor deviations from the proposed minimum sample size requirement in the Baseline guidelines (between 400 and 500 drivers) are marked orange; bigger deviations are marked red.

Eight MS delivered KPIs for the 3 minimum vehicle types *together* with sufficient sample for different time periods. The considered periods differ: Austria, Belgium, Cyprus, Czech Republic, Greece, Poland and Spain differentiated between weekday (W) and weekend day (WE); Austria and Belgium additionally differentiated weekdays into peak (Wp) and off-peak (Wo) hours, and Malta only differentiated between week peak and off-peak hours.

Six MS also provided time period indicators for the separate vehicle types, with sufficient sample for cars and LGV (with minor deviations in Austria and Belgium). The sample of bus drivers is generally too small for separate time period indicators.

Table 7. Location and driver samples: per time period and vehicle type x time period (optional)

	Location sample per time period (min. 10)		Driver sample per time period (min. 500)		Driver sample per vehicle type x time period (min. 500)					
	W	WE	W	WE	Car		LGV		Bus	
					W	WE	W	WE	W	WE
Austria	103 Wp: 86 Wo: 86	44	33.974 Wp: 17.389 Wo: 16.585	7.515	28.952 Wp: 14.970 Wo: 13.982	6.968	4.249 Wp: 2.033 Wo: 2.216	478	773 Wp: 386 Wo: 387	69
Belgium	110 Wp: 48 Wo: 62	51	12.269 Wp: 7.010 Wo: 5.259	4.576	10.041 Wp: 5.835 Wo: 4.206	4.063	2.029 Wp: 1.037 Wo: 992	482	199 Wp: 138 Wo: 61	31
Bulgaria	-	-	-	-	-	-	-	-	-	-
Cyprus	40	10	20.229	1.937	18.078	1.819	1.724	88	427	30
Czech Republic	36	36	11.918	6.714	10.194	6.179	1.644	504	80	31
Finland	-	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	-	-	-	-	-	-
Greece	102	28	30.157	7.863	22.519	6.535	6.819	1.173	819	155
Latvia	-	-	-	-	-	-	-	-	-	-
Lithuania	-	-	-	-	-	-	-	-	-	-
Malta	60 Wp: 30 Wo: 30	-	5.878 Wp: 2.893 Wo: 2.985	-	-	-	-	-	-	-
Poland	52	32	23.568	14.931	20.140	13.731	3.043	988	385	212
Portugal	-	-	-	-	-	-	-	-	-	-
Spain	130	130	14.015	10.201	12.030	9.180	1.761	857	224	164
Sweden	-	-	-	-	-	-	-	-	-	-

***** W: weekday; WE: weekend day; Wp: weekday peak hours; Wo: weekday off peak hours *****Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement.

Table 8 gives an overview of the location and driver sample per optionally considered combination of the road type and time period, for all modes together. The minimum sample requirements per crossed stratum are 2 locations and 500 drivers. Minor deviations are marked orange (between 400 and 500 drivers), bigger deviations are marked red (<400 drivers).

Six MS delivered KPIs for the 3 minimum vehicle types *together* with sufficient sample for the different combined strata, except for Belgian motorways x peak hours.

Table 8. Location and driver samples per road type x time period for all modes (optional)

	Road type	Time period	Location sample (min. 2)	Driver sample - all modes (min. 500)
Austria	motorways	weekday/daytime peak	19	2.865
		weekday/daytime off-peak	22	4.165
		weekday	22	7.030
		weekend/daytime	8	813
	rural roads	weekday/daytime peak	27	6.779
		weekday/daytime off-peak	20	3.197
		weekday	31	9.976
		weekend/daytime	15	2.898
	urban roads	weekday/daytime peak	40	7.745
		weekday/daytime off-peak	44	9.223
		weekday	50	16.968
		weekend/daytime	21	3.804
Belgium	motorways	weekday/daytime peak	4	343
		weekday/daytime off-peak	20	966
		weekday	24	1.309
		weekend/daytime	11	549
	rural roads	weekday/daytime peak	17	3.121
		weekday/daytime off-peak	16	2.439
		weekday	33	5.560
		weekend/daytime	15	2.023
	urban roads	weekday/daytime peak	27	3.546
		weekday/daytime off-peak	26	1.854
		weekday	53	5.400
		weekend/daytime	25	2.004
Cyprus	motorways	weekday/daytime	13	6.681
		weekend/daytime	4	728
	rural roads	weekday/daytime	13	4.839
		weekend/daytime	3	632
	urban roads	weekday/daytime	14	8.709
		weekend/daytime	3	577
Czech Republic	motorways	weekday/daytime	10	4.977
		weekend/daytime	10	3.226
	rural roads	weekday/daytime	13	3.363
		weekend/daytime	13	1.867
	urban roads	weekday/daytime	13	3.578
		weekend/daytime	13	1.621
Greece	motorways	weekday/daytime	27	9.200
		weekend/daytime	5	1.226
	rural roads	weekday/daytime	36	9.351
		weekend/daytime	13	3.120
	urban roads	weekday/daytime	39	11.606
		weekend/daytime	10	3.517
Malta	rural roads	weekday/daytime peak	15	1.280
		weekday/daytime off-peak	15	1.267
	urban roads	weekday/daytime peak	15	1.613
		weekday/daytime off-peak	15	1.718
Poland	motorways	weekday/daytime	17	8.509
		weekend/daytime	10	6.099
	rural roads	weekday/daytime	21	7.915
		weekend/daytime	10	3.609
	urban roads	weekday/daytime	14	7.144
		weekend/daytime	10	5.223
Spain	Motorways --- Expressway	weekday/daytime	10 --- 30	1.506 --- 3.554
		weekend/daytime	10	1.091

			---------- 30	---------- 2.763
	rural roads	weekday/daytime	25	2.144
		weekend/daytime	25	1.822
	urban roads	weekday/daytime	65	6.811
		weekend/daytime	65	4.525

*Marked red: deviation from the minimum sample requirement.

3.4 Post-stratification weighting

In this section, the methodologies used by the Member States for the post-stratification weighting of the collected data and the calculation of the national KPI and the respective Confidence Intervals (CI) are presented. Weight guidelines were developed within Baseline (Silverans & Boets, 2020).

As can be seen in Table 9, all MS applied weighting but in very different levels. Most MS applied the minimum Baseline weight formula, including stratum sampling weight (sample correction for the actual share of a road type on the road network and/or correction for the actual duration of a time period in a week) and session sampling weight (correction for the selection probability during a session based on traffic counts). Most MS worked with sessions within different time periods (optional) – mostly with an amount of sessions that is disproportionate to actual time period shares (based on duration in a week or on traffic volume data) – while usually no specific weighting for 'time period share', neither based on % time period in a week (except for 4/15), nor based on % traffic volume per time period (except for Germany). Differences in traffic volume between different time periods can be partly weighted for by the use of the session weights (traffic counts). Session weights are usually included (12/15) but sometimes only for the 3 modes together (4/15) instead of per mode, so in that case the sampling (and possible over/under-sampling) of a vehicle type may not correspond to the actual frequency of that vehicle type in the traffic stream. Some MS did not consider session sampling weight, thus did not correct for differences in traffic density during sessions. Some MS used their own standard weighting procedures and other types of sources for weighting. Six MS used national traffic volume data (estimates) (AT, BE, FI, DE, PL, SE). The other MS mostly indicated that no official national traffic volume data are available in their country. This can be considered as relevant data to be collected in future. The MS not using traffic volume mostly were able to use the minimum weight formula to correct the stratified location sampling according to actual proportions of road types in the national road network, and to correct the driver sampling based on traffic counts during the sessions, as minimum required.
The differences in weighting are an issue for the comparability of the KPIs between MS. Some KPIs are representative for national traffic volumes while other KPIs are a close or distant proxy to that. In the absence of traffic volume data it remains unclear to what extent KPIs are representative. Even when traffic volume data is available, it is not always clear if this is also available for different week periods and for different vehicle types. Ideally traffic volume data is available for all crossings of road x time x mode. Some MS considered different time periods in their fieldwork, but it is not always clear if the sessions were proportionate to reality (e.g. 5/7 week, 2/7 weekend) for each road type and, if not, if any disproportionate sampling was correctly weighted for.

Table 9. Post-stratification weighting methodology

	Post-stratification weighting
Austria	National traffic volume data only • **Traffic volume** weight based on estimates in millions of km per **road type** and **vehicle type**: motorway 39%; rural 35%; urban 26% (*Traffic volumes in Mio. km per road and vehicle type are estimated by the ministry of environment: "Ergebnisse der österreichischen Luftschadstoffinventur")* *Weighting: by road type. Analysis was done by counting for fulfilling KPI divided by number of observations, including the weight, ignoring the locations. Confidence Intervals are calculated for N > 30.*
Belgium	Adapted Baseline recommended formula: • Stratum sampling weight: **share of time period** (week peak, off peak, weekend) • Session sampling weight: **traffic count per mode** • **Traffic volume** weight based on estimates in million vehicle km per **vehicle type x road type** x region (Federal Public Service 2017) *[Share of week period (3) in a week / number of sessions in the respective week period (3)] * [session counts per minute per vehicle type / observations per minute per vehicle type * session duration]* *Then the share of these weighted frequencies per region x road type is calculated = X.*

	Then TVS (region x road type based on FPS data) is divided by X (% weighted share of sample per region x road type)
Bulgaria	Baseline minimum formula: • Stratum sampling weight: **road type length** estimates: motorway: 0,005 (832 km), rural: 0,235 (37.791 km), Urban: 0,760 (122.000 km) • Session sampling weight: **traffic count per mode** *National traffic volume data: no*
Cyprus	Baseline minimum required formula: • Stratum sampling weight for road type length: total **road network length** of 8552 km: 3,2% motorways, 44,0% rural roads; 52,8% urban roads, and **time period share** (week, weekend) • Session sampling weight: **traffic counts per mode** National traffic volume data: no
Czech Republic	Baseline minimum formula + extra national data (number of registered vehicles per mode, total male/female population): • Stratum sampling weight: **road type length** estimates: motorways 1,4%, rural 21%, urban 78%, **share of time period** (week – no peak – , weekend) • Session sampling weight: **traffic count per mode** (*On rural and urban roads the measuring of traffic counts during calibration of automatic traffic counter of KPI speed. On motorways the total number of driver = traffic volume. The KPI-distraction on rural and urban roads was observed during the KPI-speed measurements. All passing vehicles were detected. We did the observation of KPI-speed with using of vehicle-speed devices – radars, so the measuring of KPI-distraction was in progress usually during a calibration of these radars. So, the traffic count duration is the same as the observation time of the KPI distraction.)* *We used the methodological guidelines created by the expert group for calculation of weighting and statistical analysis (confidence interval, standard error…). Weight proportion is based on ratio combination of national road network (km of motorways, rural and urban roads), total number of vehicles in the Czech Republic (passenger cars, light goods vehicles, buses/coaches), time period (weekdays/daytime, weekend/daytime) and total population in the Czech Republic (male/female). For calculation of weight proportion we used the formula: [M/m] * [N/(n*t)]. The confidence intervals calculated as described in the methodological guidelines.* National traffic volume data: no
Finland	National traffic volume data + session sampling weight: • **Traffic volume** weight based on estimates in millions of km per **road type:** motorway 20%; rural 73%; urban 7% • Session sampling weight: automatic **traffic volume count (all modes and cars)**. *The measured sample is not exactly the same as the number of all automatically counted passed-by vehicles. The camera was triggered by an algorithm that detected the vehicle's licence plate and did not always work perfectly (i.e. did not take pictures of all passing vehicles). Therefore, the sample is smaller than the total traffic count (from the nearby loop detector). The extrapolation was done because it was included in the instructions. The total count includes all vehicle types. Buses and trucks were tagged in the data, but their number was low, and we cannot be fully certain that this classification matches the classification from the loop detectors. Therefore, we consider the results unreliable, especially since the number of mobile phone users in those groups amounts to only a few drivers.* *Two sets of weights were calculated: a session based weighting (according to guidelines) and a road type based weighting from the national traffic volume estimates. These were combined to a total sampling weight and applied to each session to produce an appropriately weighted mean reflecting both the sample characteristics within each session and the road type volume. Road network lengths were not used since they would result in a highly biased estimate for Finland (shown by national statistics above). The traffic volume weight indicates the proportion of annual traffic on each of the road types. If the KPI is supposed to represent a percentage of traffic volume (or drivers) not using a handheld phone, to weight the road type strata according to traffic volume is far better than using road length, which we assume that would be a proxy for traffic volume. In Finland, there are only 936 km of motorways (1.2% of public road network) which account for 20% of the traffic volume.*
Germany	National traffic volume data + extra national data: • **Traffic volume** weight based on mobility survey data for **road type** and **time period** (field set-up: week peak, off peak, weekend) *Weighting is done in two steps. Weighting by road type according to "German Vehicle Mileage Survey", Weighting by additional factors according to "Mobility in Germany": Days of the week, Time of day, age of driver, gender of driver, presence of passengers.*

Greece	Baseline minimum required formula: • Stratum sampling weight for **road type length**: total road network length of 125.230 km: 3,1% motorways, 69,5% rural roads; 27,5% urban roads, and **time period share** (week, weekend) • Session sampling weight: **traffic counts per mode** National traffic volume data: no
Latvia	National traffic volume estimate only: • Estimate traffic volume: total mileage (odometers) and traffic intensity counts *The weighting factors for rural roads and urban roads have been calculated from the total mileage of the whole vehicle fleet obtained from odometer readings at regular technical inspections, having assumption that the mileage of Latvian vehicles abroad may be close to the mileage of the foreign vehicles on Latvian roads and from traffic intensity counts on Latvian rural roads. The obtained values are 75% traffic on rural roads and 25% on urban roads.*
Lithuania	Baseline minimum required formula: • Stratum sampling weight: estimated share of **road type length**: urban roads 7,9% (6.681km), rural roads 91,6% (77.688km), motorways 0,5% (400km) • Session sampling weight: **traffic count for the 3 modes together** *"Calculating KPIs first of all normalized weights (calculated as a proportion of 1) were introduced for each road type (motorways, rural roads and urban roads) by estimating the traffic flows at the measuring points N / n (the ratio of traffic volume to observed number of drivers). Because the number of measurement sessions is the same for all road types, it was not used to calculate weights. As the duration of all the measurement sessions was the same, it was also not taken into account when entering the weights.* *After entering the weights, the KPIs, SE and CI for each road type were calculated and the results were then combined into a single KPI using weights representing the proportion of the road type in the total road network (0.005 for motorways, 0.916 for rural roads and 0.079 for urban roads).* *The calculation of KPIs for each road type for both private drivers and professional drivers uses the same weights entered (taking into account the flows at the measuring points), but they are normalized for each observation group separately (so that the sum of weights is 1 for both private drivers and professional drivers). Then using the weights reflecting the proportion of road type in the overall road network (0.005 for motorways, 0.916 for rural roads and 0.079 for urban roads) KPIs from separate road types are combined into a common national KPI for private drivers. By analogy, a common KPI is obtained for professional drivers."* National traffic volume data: no
Malta	Baseline minimum required formula: • Stratum sampling weight: **road type length** proportion calculated at 52% rural and 48% urban (total national network: 2.700km) • Session sampling weight: **traffic count for the 3 modes together** National traffic volume data: no
Poland	National traffic volume data + session sampling weight: • **Traffic volume** weight based on data in mln vehicle/km per **road type**: urban: 65.835km, 31,0%; non-urban: 130.335km, 61,4%; motor/expressways: 15.998km, 7,5% (National Statistical Office GUS) • Session sampling weight: **traffic count per mode** *Weights are calculated as product of weights based on traffic volume on each road type (road_type_weight) and weight based on density of traffic and number of measured vehicles during the session (session_weight). Weights are based on data on traffic volume in Poland and sample data. The weights are the quotient of the number of vehicles surveyed and the traffic volume for specific road types. This method of calculation corresponds to that proposed in the guidelines; the use of such constructed weights causes that the distribution of vehicles in the sample after rescaling corresponds to the traffic density on specific types of roads in Poland. Session weights were calculated according to formula given in Table 1 of Considerations for sampling weights in Baseline (Version 1.3, December 6th, 2021) (Silverans & Boets, 2021). The analysis was performed for all subsets of data determined by vehicle type and road type. Confidence intervals for 85% quantile (weighted whenever it was applicable) were computed using bootstrap method with 200 resamples. Confidence intervals for proportion of vehicles moving below permissible limit was calculated using formula p±1.959964 ·SE Where SE= √(p·(1-p)·∑_(i=1)^n▒ 〖(w_i/W)〗 ^2), where: p – (weighted) proportion of vehicle moving within speed limit; wi – weight; W – sum of weights; 1.959964 – respective quantile of normal distribution; total weight was calculated as road_type_weight * session_weight*
Portugal	Baseline minimum required formula: • Stratum sampling weight: estimated **road type length**: motorway 4,15%, rural 70,67%, urban: 25,18%

	• Session sampling weight: **traffic count for the 3 modes together** National traffic volume data: no
Spain	The document "Considerations for sampling weights in Baseline" was thoroughly followed. Sampling weights were calculated according to section 2.2.2. "KPIs with several time period strata". Baseline minimum required formula: • Stratum sampling weight: estimated **road type length**: urban roads: 128.181, rural roads: 149857, motorways:2.997 , expressways: 13.007 and **time period share** (week, weekend) • Session sampling weight: **traffic count per mode** National traffic volume data: no
Sweden	National traffic volume data + session sampling weight: • **Traffic volume** weight based on national vehicle kilometre data: motorway 26%, rural 50%, urban 24% (in total 74600 *10^6) (*All vehicle types are included. It is calculated through a model based on changes in the traffic on the national road network from the Swedish Transport Administration measurements and data on mileage for Swedish registered vehicles (odometer data at annual vehicle inspections). Information regarding distances are adjusted for foreign traffic by Swedish vehicle and traffic on Swedish roads by foreign vehicles.)* • Session sampling weight: **traffic count per mode** *The estimation formulas are based on the assumption of equal sampling probability within each stratum. The proportion of mobile phone use is estimated separately for each stratum. The total estimate is then calculated by weighting the proportions using national traffic volume data. We have three strata (road type). The estimation formulas are based on ratio estimation in sampling theory (and previously described in VTI report 599 from 2007, equations 2.1–2.4. (Forsman et al., 2007).*

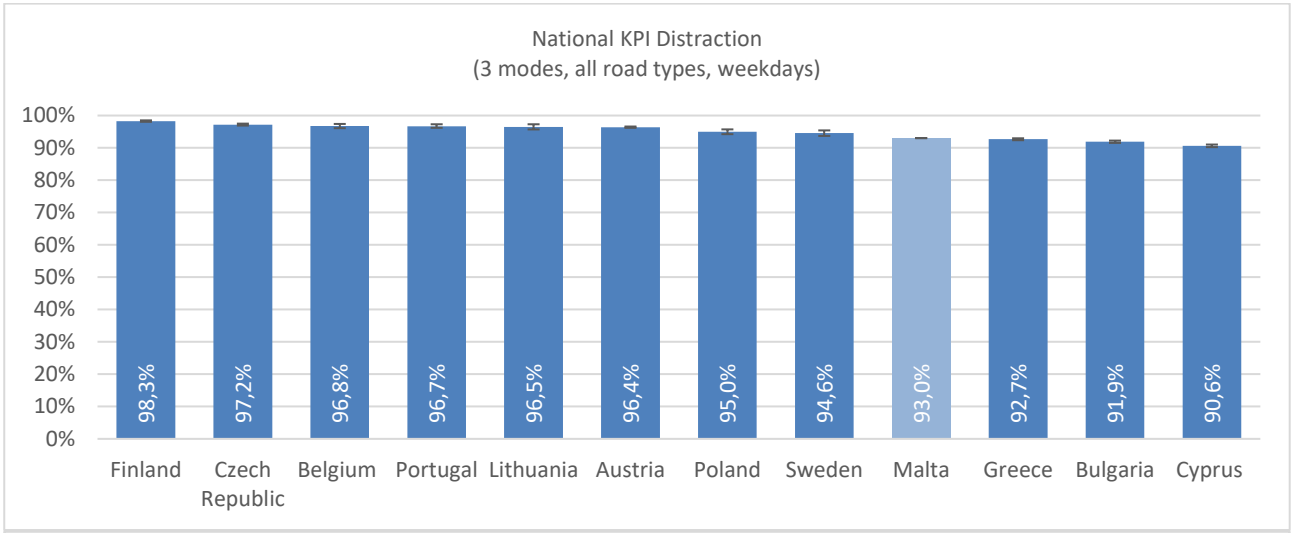
4. KPI results

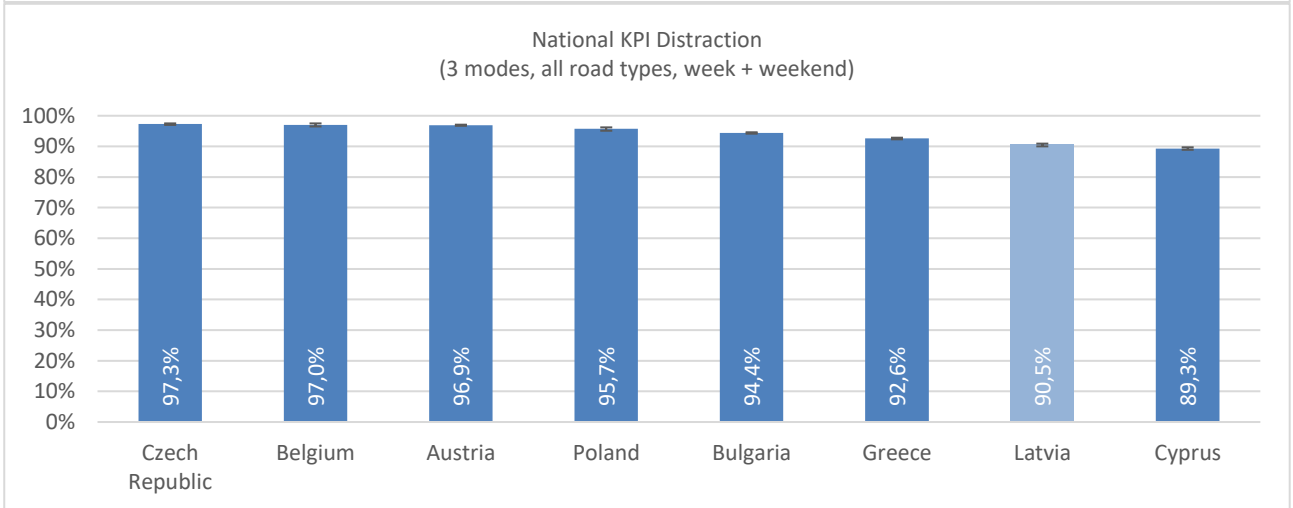
In this chapter the main KPI outcomes per MS are presented. Underneath each figure and table the main specifications and deviations are indicated. Minor stratum sample size deviations (between 400 and 500) are included in the figures without a mark and are marked orange in the tables; bigger deviations (<400) are light coloured in the figures and marked red in the tables. MS with also other deviations in the methodology are shown with light colours in the figures. The KPI results are ordered from high to low in the figures/tables.

4.1 National aggregate KPIs

In this section, the national distraction KPI's (with 95% CI) are presented for three vehicle types *together* (cars, LGV, busses/coaches), on all road types together, on weekdays (minimum required) and on week- + weekend days (recommended). All overall national KPIs meet the minimum location and driver sample size requirements, but as mentioned before, differences in sampling (e.g. sample size, representativity of the different vehicle type samples) and weighting complicate comparability in general, thus all national comparisons are indicative and should be interpreted in the scope of the methodological information (meta-data). As can be seen in Figure 2 and Table 10, the KPIs are generally quite high. On weekdays (12MS) the KPI is highest in Finland (98,3%) and lowest in Cyprus (90,6%). Taking both week- and weekend days together (8MS) the KPIs range from 89,3% (Cyprus) to 97,3% (Czech Republic). Spain also provided a national KPI for weekdays and for week- and weekend days, but these are only included the table because their KPI is broader defined than in the other MS (see section 3.2) and therefor is not fully comparable with the other national KPIs.

Figure 2. National KPI Distraction





*Malta and Latvia: no motorways. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Finland, Lithuania: analysis of camera images; other MS: roadside observations by trained observers.

Table 10. National KPI Distraction (95% CI)

	Weekday			Week- and weekend day		
	All roads	95% CI		**All roads**	95% CI	
Finland	**98,3%**	98,1%	98,5%			
Czech Republic	**97,2%**	96,9%	97,5%	**97,3%**	97,0%	97,5%
Belgium	**96,8%**	96,1%	97,4%	**97,0%**	96,5%	97,5%
Portugal	**96,7%**	96,2%	97,3%			
Lithuania	**96,5%**	95,7%	97,3%			
Austria	**96,4%**	96,2%	96,6%	**96,9%**	96,7%	97,1%
Poland	**95,0%**	94,2%	95,7%	**95,7%**	95,1%	96,2%
Sweden	**94,6%**	93,7%	95,4%			
Malta*	**93,0%**	93,0%	93,0%			
Greece	**92,7%**	92,4%	93,0%	**92,6%**	92,3%	92,8%
Bulgaria	**91,9%**	91,5%	92,3%	**94,4%**	94,1%	94,6%
Latvia*				**90,5%**	90,2%	91,1%
Spain*	**90,9%**	89,9%	91,8%	**90,1%**	89,3%	90,9%
Cyprus	**90,6%**	90,2%	91,0%	**89,3%**	88,9%	89,7%

***Malta and Latvia: no motorways. ***Austria, Greece, Cyprus: % not using a handheld mobile phone. ***Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic device (GPS, tablets, monitors, etc.), whether mobile or on-board."* ***Finland, Lithuania: analysis of camera images; other MS: roadside observations by trained observers.

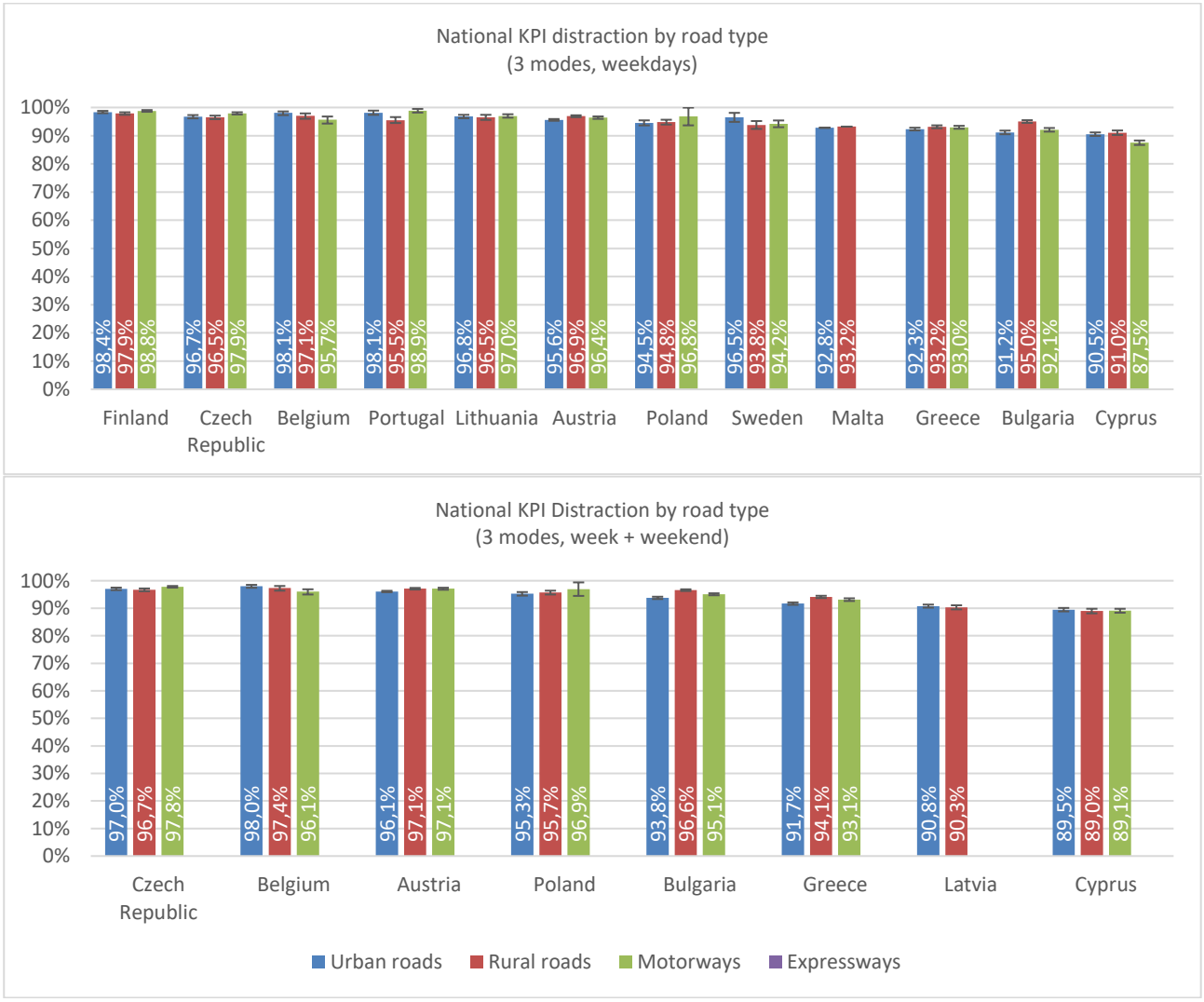
4.2 Breakdown by road type

In this section, the KPI Distraction by road type for all vehicle types together are presented, for weekdays only (*minimum required*) (12MS) and for week- and weekend days together (8MS) (recommended). Data for motorways is not available for Malta and Latvia, as referred above. Spain is only included in the tables due to the broader KPI definition.

Overall the KPI on urban roads ranges between 90,5% (Cyprus) and 98,4% (Finland) based on weekday data; for week and weekend data this ranges between 89,5% (Cyprus) and 98,0% (Belgium). On rural roads the lowest KPI is 91,0% (Cyprus) and the highest 97,9% (Finland) (weekday) and 89,0% (Cyprus) vs. 97,4% (Belgium) for week and weekend data. On motorways the KPI ranges between 87,5% (Cyprus) and 98,9% (Portugal) for weekdays, and from 89,1% (Cyprus) to 97,8% (Czech Republic) for week and weekend day data.

In some MS there is a clear difference between road types, e.g. in Belgium the KPI is significantly lower (more device use) on motorways than on the other road types. Also in Cyprus this is the case, but the opposite (highest KPI for motorways) is more often the case (in 6 of 12 MS based on week data). In some of these MS the difference between motorways and another road type goes beyond the borders of the confidence intervals, e.g. in Finland, Czech Republic, Portugal. In other MS the KPI is highest on urban roads (e.g. Sweden), or on rural roads (e.g. Bulgaria). There is thus no common pattern among the Member States.

Figure 3. KPIs distraction by road type



*Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 11. KPI distraction by road type

Weekday												
	Urban roads	95% CI		**Rural roads**	95% CI		**Motor-ways**	95% CI		**Express-ways**	95% CI	
Finland	**98,4%**	98,0%	98,8%	**97,9%**	97,4%	98,3%	**98,8%**	98,5%	99,1%			
Czech Republic	**96,7%**	96,1%	97,3%	**96,5%**	95,9%	97,1%	**97,9%**	97,5%	98,3%			
Belgium	**98,1%**	97,3%	98,6%	**97,1%**	96,0%	97,9%	**95,7%**	94,3%	96,8%			
Portugal	**98,1%**	97,4%	98,9%	**95,5%**	94,5%	96,6%	**98,9%**	98,2%	99,5%			
Lithuania	**96,8%**	96,2%	97,4%	**96,5%**	95,6%	97,4%	**97,0%**	96,4%	97,6%			
Austria	**95,6%**	95,3%	95,9%	**96,9%**	96,6%	97,2%	**96,4%**	96,0%	96,8%			
Poland	**94,5%**	93,7%	95,4%	**94,8%**	93,9%	95,7%	**96,8%**	93,7%	100,0%			
Sweden	**96,5%**	94,9%	98,1%	**93,8%**	92,4%	95,2%	**94,2%**	93,0%	95,4%			
Malta	**92,8%**	92,8%	92,8%	**93,2%**	93,2%	93,2%						
Greece	**92,3%**	91,9%	92,8%	**93,2%**	92,6%	93,7%	**93,0%**	92,5%	93,5%			
Bulgaria	**91,2%**	90,5%	91,8%	**95,0%**	94,5%	95,5%	**92,1%**	91,4%	92,7%			
Spain*	**89,3%**	87,6%	90,9%	**92,4%**	91,1%	93,8%	**94,5%**	93,0%	96,1%	**90,6%**	88,5%	92,8%
Cyprus	**90,5%**	89,9%	91,1%	**91,0%**	90,2%	91,9%	**87,5%**	86,7%	88,3%			

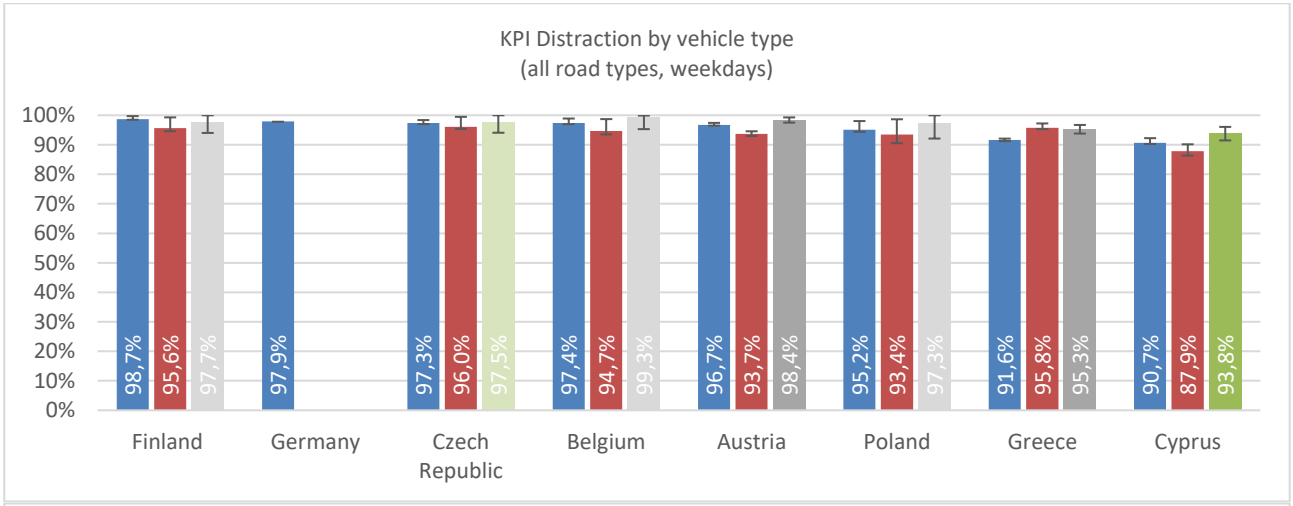
Week- and weekend day												
	Urban roads	95% CI		Rural roads	95% CI		Motor-ways	95% CI		Express-ways	95% CI	
Czech Republic	**97,0%**	96,6%	97,5%	**96,7%**	96,2%	97,2%	**97,8%**	97,5%	98,1%			
Belgium	**98,0%**	97,4%	98,5%	**97,4%**	96,4%	98,1%	**96,1%**	95,0%	96,9%			
Austria	**96,1%**	95,9%	96,4%	**97,1%**	96,8%	97,4%	**97,1%**	96,7%	97,5%			
Poland	**95,3%**	94,6%	95,9%	**95,7%**	95,0%	96,4%	**96,9%**	94,5%	99,4%			
Bulgaria	**93,8%**	93,3%	94,2%	**96,6%**	96,3%	96,9%	**95,1%**	94,7%	95,4%			
Greece	**91,7%**	91,3%	92,1%	**94,1%**	93,7%	94,5%	**93,1%**	92,7%	93,6%			
Latvia	**90,8%**	90,2%	91,3%	**90,3%**	89,6%	91,1%						
Spain*	**88,1%**	86,8%	89,4%	**91,8%**	90,7%	93,0%	**94,5%**	93,4%	95,6%	**90,3%**	88,7%	91,8%
Cyprus	**89,5%**	88,9%	90,1%	**89,0%**	88,2%	89,8%	**89,1%**	88,4%	89,8%			

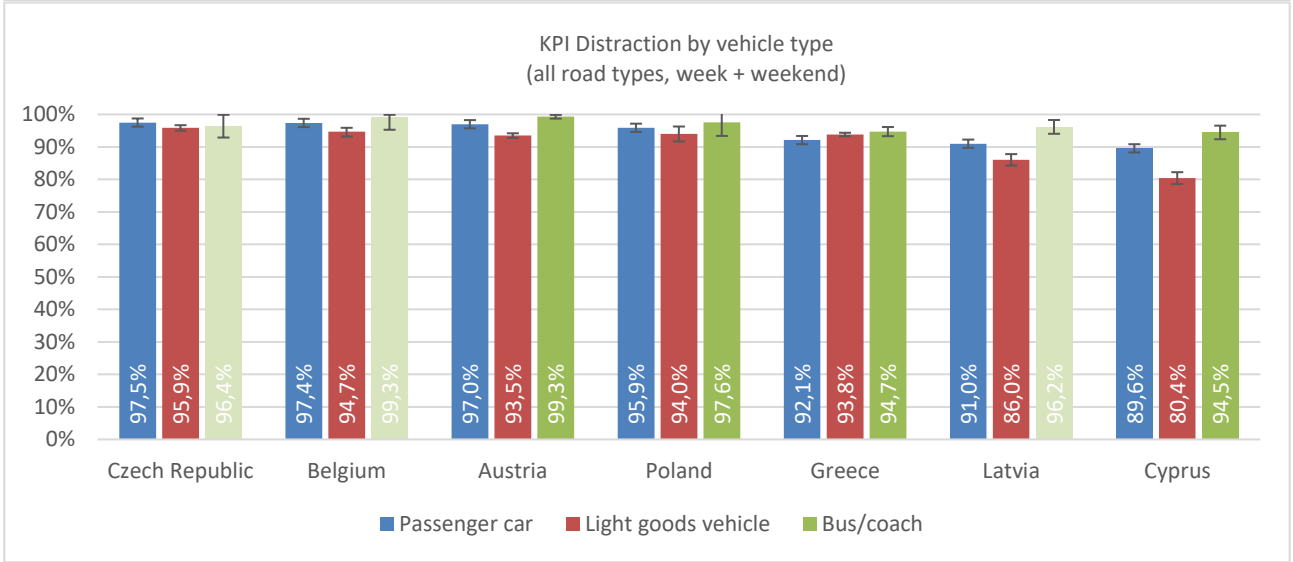
*Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

4.3 Breakdown by vehicle type

Figure 4 shows the distraction KPIs by vehicle type (recommended KPIs). The bus sample is generally too small (light coloured), except for in a few MS. Data for separate vehicle types is available in 9 MS (Spain only in the tables due to the broader KPI definition).

Figure 4. KPI distraction by vehicle type





*Latvia= no motorways. *Germany: only passenger cars. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Light coloured: deviating method (sample size).
In most MS the KPI for LGV is lower than for cars, and if available also for busses. If available, the KPI is highest (least device use) for bus drivers. The difference between LGV and cars (and busses) goes in many MS beyond the borders of the confidence intervals. For car drivers the KPI ranges from 90,7% (Cyprus) to 98,7% (Finland) on weekdays, and from 89,6% (Cyprus) to 97,5% (Czech Republic) on week and weekend days. For LGV the KPI ranges from 87,9% (Cyprus) to 96,0%M (Czech Republic) (week), and 80,4% (Cyprus) to 95,9% (Czech Republic) (week and weekend). For busses the KPIs are generally higher.

Table 12. KPI distraction per vehicle type

Weekday									
	Passenger car	95% CI		**Light goods vehicle**	95% CI		**Bus/coach**	95% CI	
Finland	**98,7%**	98,5%	98,9%	**95,6%**	94,6%	96,6%	**97,7%**	97,5%	99,3%
Germany	**97,9%**	97,8%	98,0%						
Czech Republic	**97,3%**	97,0%	97,6%	**96,0%**	95,0%	96,7%	**97,5%**	94,1%	100,0 %
Belgium	**97,4%**	96,8%	97,8%	**94,7%**	93,2%	95,9%	**99,3%**	95,3%	99,9%
Austria	**96,7%**	96,5%	96,9%	**93,7%**	93,0%	94,4%	**98,4%**	97,5%	99,3%
Poland	**95,2%**	94,4%	95,9%	**93,4%**	90,5%	96,3%	**97,3%**	92,1%	100,0 %
Greece	**91,6%**	91,3%	92,0%	**95,8%**	95,3%	96,3%	**95,3%**	93,8%	96,7%
Spain*	**91,1%**	90,0%	92,1%	**88,4%**	85,7%	91,1%	**97,9%**	95,6%	100,1%
Cyprus	**90,7%**	90,3%	91,1%	**87,9%**	86,3%	89,4%	**93,8%**	91,5%	96,1%
Week- and weekend day									
	Passenger car	95% CI		**Light Goods Vehicle**	95% CI		**Bus/coach**	95% CI	
Czech Republic	**97,5%**	97,2%	97,7%	**95,9%**	95,0%	96,7%	**96,4%**	92,9%	99,9%
Belgium	**97,4%**	96,8%	97,8%	**94,7%**	93,2%	95,9%	**99,3%**	95,3%	99,9%
Austria	**97,0%**	96,8%	97,2%	**93,5%**	92,8%	94,2%	**99,3%**	98,7%	99,9%
Poland	**95,9%**	95,3%	96,4%	**94,0%**	91,7%	96,3%	**97,6%**	93,4%	100,0 %
Greece	**92,1%**	91,8%	92,4%	**93,8%**	93,3%	94,4%	**94,7%**	93,3%	96,1%
Latvia*	**91,0%**	90,5%	91,4%	**86,0%**	84,3%	87,8%	**96,2%**	94,1%	98,3%
Spain*	**90,2%**	89,4%	91,1%	**87,9%**	85,3%	90,5%	**96,8%**	94,2%	99,4%
Cyprus	**89,6%**	89,2%	90,0%	**80,4%**	78,6%	82,2%	**94,5%**	92,4%	96,6%

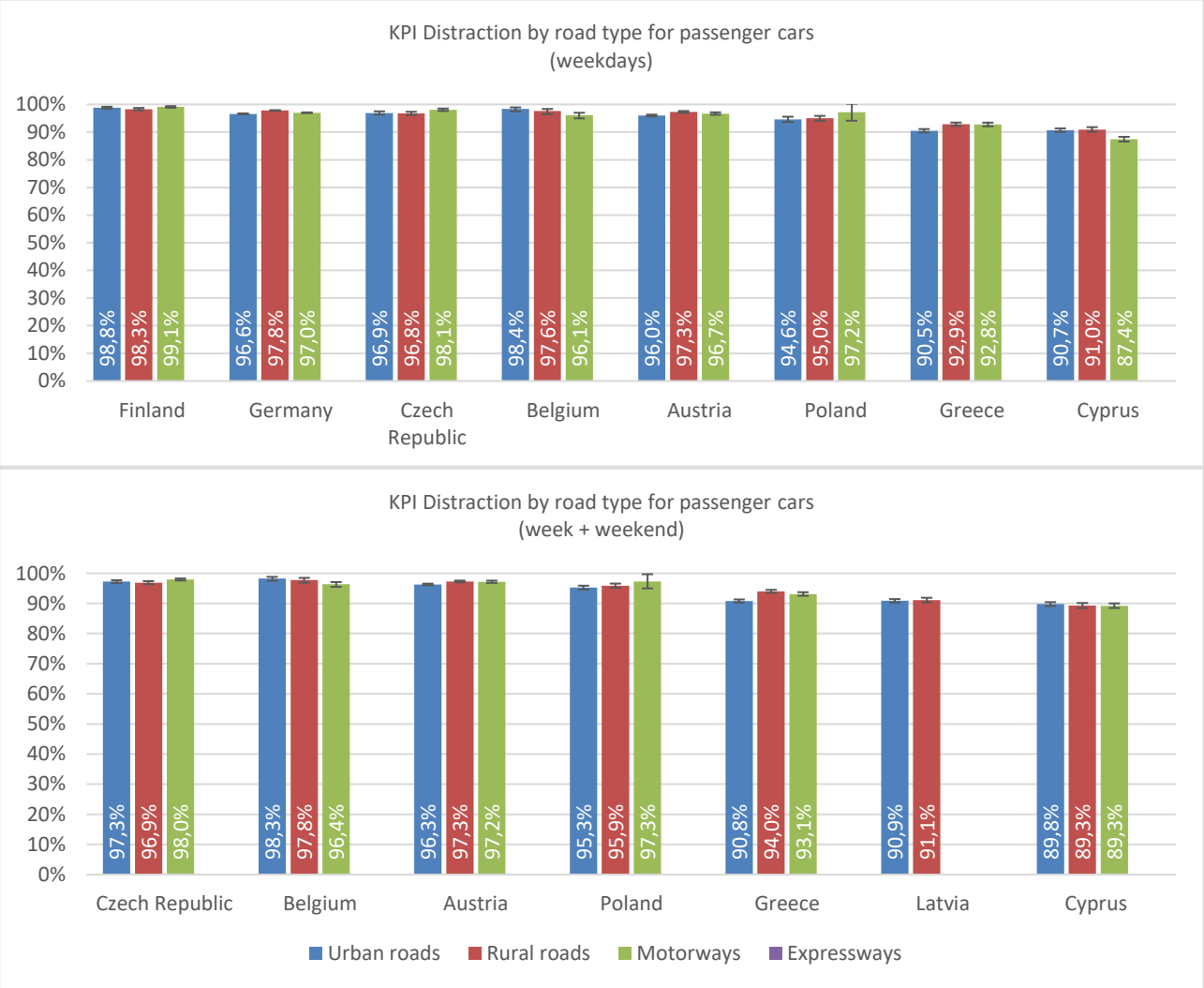
*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: "% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."

4.4 Breakdown by vehicle type x road type

Data by road type per vehicle type are available for 9 MS (+Spain only in the tables due to the broader KPI definition), with differences according to the time period considered (e.g. Finland and Germany only for weekdays; Latvia only for week + weekend days). All MS achieve the minimum driver sample for cars crossed with road type and for bus drivers the sample is overall too small. The minimum sample of LGV drivers is not achieved for all combinations of strata in about half of the MS, thus, caution is needed when interpreting the results.

Like for the overall road type analysis, there is no common pattern among the MS, not for cars and neither for LGV (see Figures 5-6).

Figure 5. KPI distraction by road type for passenger cars



*Austria, Greece, Cyprus: % not using a handheld mobile phone.

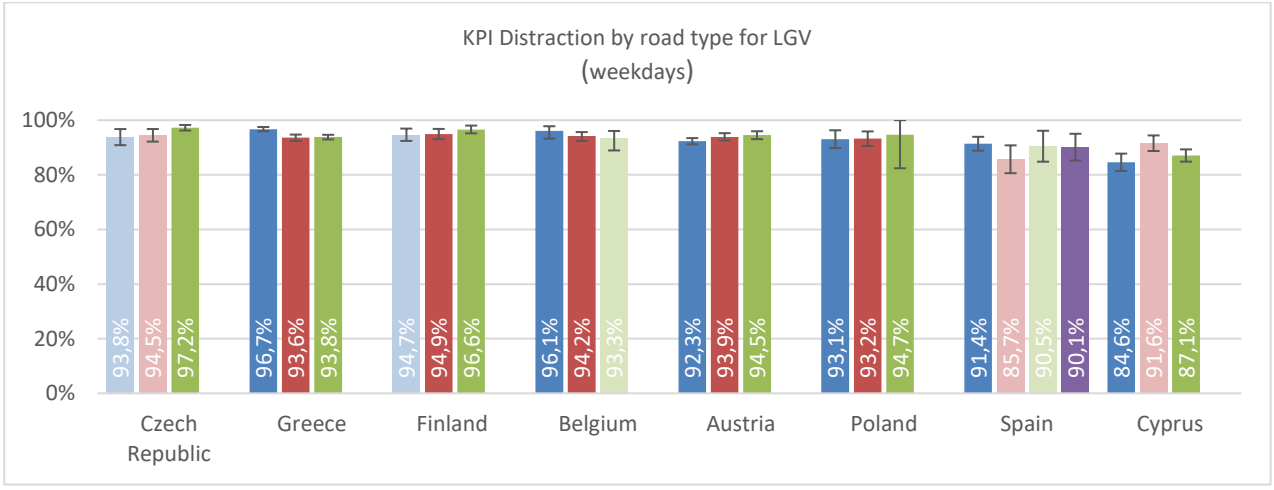
Table 13. KPI distraction by road type for passenger cars

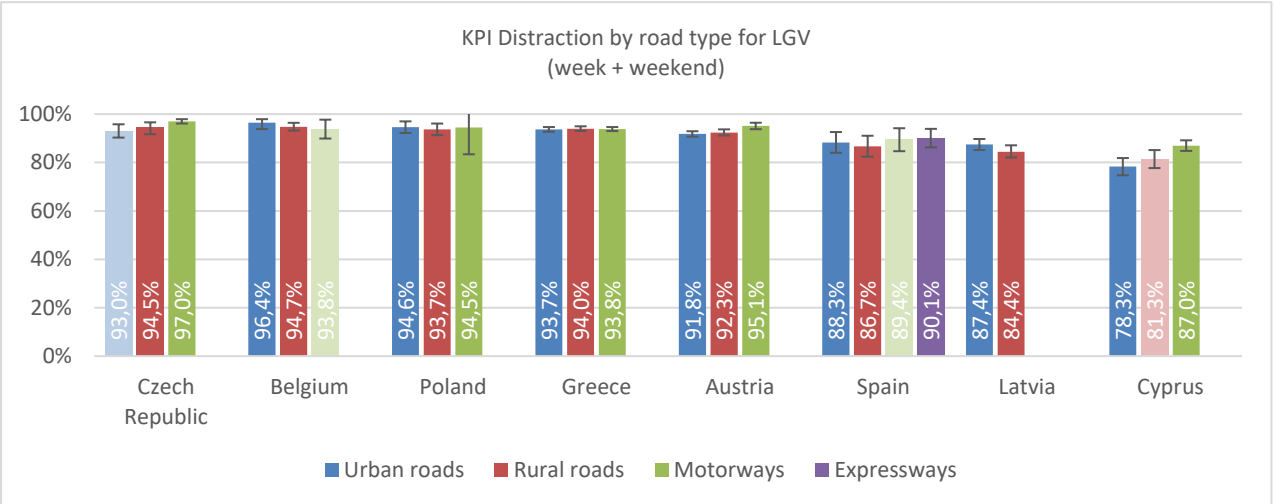
Weekday									
	Urban roads	95% CI		**Rural roads**	95% CI		**Motor-ways**	95% CI	
Finland	**98,8%**	98,4%	99,2%	**98,3%**	97,9%	98,7%	**99,1%**	98,8%	99,4%
Germany	**96,6%**	96,4%	96,8%	**97,8%**	97,7%	97,9%	**97,0%**	96,9%	97,1%
Czech Republic	**96,9%**	96,3%	97,5%	**96,8%**	96,1%	97,4%	**98,1%**	97,7%	98,5%
Belgium	**98,4%**	97,5%	98,9%	**97,6%**	96,5%	98,4%	**96,1%**	95,0%	97,0%
Austria	**96,0%**	95,7%	96,3%	**97,3%**	97,0%	97,6%	**96,7%**	96,3%	97,2%
Poland	**94,6%**	93,7%	95,6%	**95,0%**	94,1%	95,9%	**97,2%**	94,1%	100,3%
Greece	**90,5%**	89,9%	91,1%	**92,9%**	92,3%	93,5%	**92,8%**	92,1%	93,4%
Spain* ---------- **Expressways**	**88,8%**	87,0%	90,7%	**93,4%**	92,0%	94,8%	**95,2%** ---------- **90,6%**	93,7% --------- 88,2%	96,7% ---------- 93,0%
Cyprus	**90,7%**	90,1%	91,4%	**91,0%**	90,1%	91,8%	**87,4%**	86,6%	88,3%

Week- and weekend day									
	Urban roads	95% CI		**Rural roads**	95% CI		**Motor-ways**	95% CI	
Czech Republic	**97,3%**	96,8%	97,7%	**96,9%**	96,4%	97,4%	**98,0%**	97,6%	97,7%
Belgium	**98,3%**	97,5%	98,8%	**97,8%**	96,9%	98,5%	**96,4%**	95,5%	97,1%
Austria	**96,3%**	96,0%	96,6%	**97,3%**	97,0%	97,6%	**97,2%**	96,8%	96,8%
Poland	**95,3%**	94,6%	95,9%	**95,9%**	95,2%	96,6%	**97,3%**	95,0%	94,9%
Greece	**90,8%**	90,3%	91,3%	**94,0%**	93,6%	94,5%	**93,1%**	92,5%	93,7%
Latvia	**90,9%**	90,3%	91,5%	**91,1%**	90,4%	91,9%		0,0%	0,0%
Spain* ---------- **Expressways**	**87,8%**	86,4%	89,2%	**92,4%**	91,2%	93,6%	**95,1%** ---------- **90,2%**	94,1% ---------- 88,4%	96,2% ---------- 91,9%
Cyprus	**89,8%**	89,2%	90,4%	**89,3%**	88,4%	90,1%	**89,3%**	88,5%	88,5%

*Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

Figure 6. KPI distraction by road type for light goods vehicles





*Light coloured: deviating method (sample size). *Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 14. KPI distraction by road type for light goods vehicles

Weekday												
	Urban roads	95% CI		Rural roads	95% CI		Motor-ways	95% CI		Express-ways	95% CI	
Czech Republic	93,8%	90,9%	96,7%	94,5%	92,2%	96,8%	97,2%	96,2%	98,2%			
Greece	96,7%	95,9%	97,5%	93,6%	92,4%	94,7%	93,8%	92,9%	94,6%			
Finland	94,7%	92,4%	96,9%	94,9%	93,1%	96,8%	96,6%	95,2%	98,0%			
Belgium	96,1%	93,2%	97,8%	94,2%	92,4%	95,6%	93,3%	88,9%	96,1%			
Austria	92,3%	91,2%	93,4%	93,9%	92,6%	95,3%	94,5%	93,1%	96,0%			
Poland	93,1%	89,8%	96,3%	93,2%	90,5%	95,9%	94,7%	82,4%	107,0%			
Spain*	91,4%	88,8%	93,9%	85,7%	80,6%	90,8%	90,5%	84,8%	96,1%	90,1%	85,2%	95,0%
Cyprus	84,6%	81,4%	87,8%	91,6%	88,7%	94,4%	87,1%	84,8%	89,3%			

Week- and weekend day												
	Urban roads	95% CI		Rural roads	95% CI		Motor-ways	95% CI		Express-ways	95% CI	
Czech Republic	93,0%	90,3%	95,8%	94,5%	92,4%	96,5%	97,0%	96,1%	97,9%			
Belgium	96,4%	93,8%	97,9%	94,7%	93,0%	96,0%	93,8%	89,9%	96,3%			
Poland	94,6%	92,2%	97,0%	93,7%	91,3%	96,1%	94,5%	83,4%	100,0%			
Greece	93,8%	92,9%	94,8%	94,0%	93,0%	95,0%	93,7%	92,9%	94,5%			
Austria	91,8%	90,7%	92,9%	92,3%	90,9%	93,7%	95,1%	93,8%	96,4%			
Spain*	88,3%	84,0%	92,6%	86,7%	82,3%	91,1%	89,4%	84,7%	94,2%	90,1%	86,2%	93,9%
Latvia*	87,4%	85,2%	89,7%	84,4%	81,7%	87,1%						
Spain	88,3%	84,0%	92,6%	86,7%	82,3%	91,1%	89,4%	84,7%	94,2%	90,1%	86,2%	93,9%
Cyprus	78,3%	76,1%	80,5%	81,3%	77,4%	85,1%	87,0%	83,4%	90,6%			

*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Austria, Greece, Cyprus: % not using a handheld mobile phone.*Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

4.5 Breakdown by time period

The minimum required KPI is for weekdays, with the requirement to organise the fieldwork balanced over peak and off-peak hours. Provision of separate time period indicators was optional. In this section, distraction KPI's by available optional time periods for all vehicle types *together* and per mode (except busses) are presented.

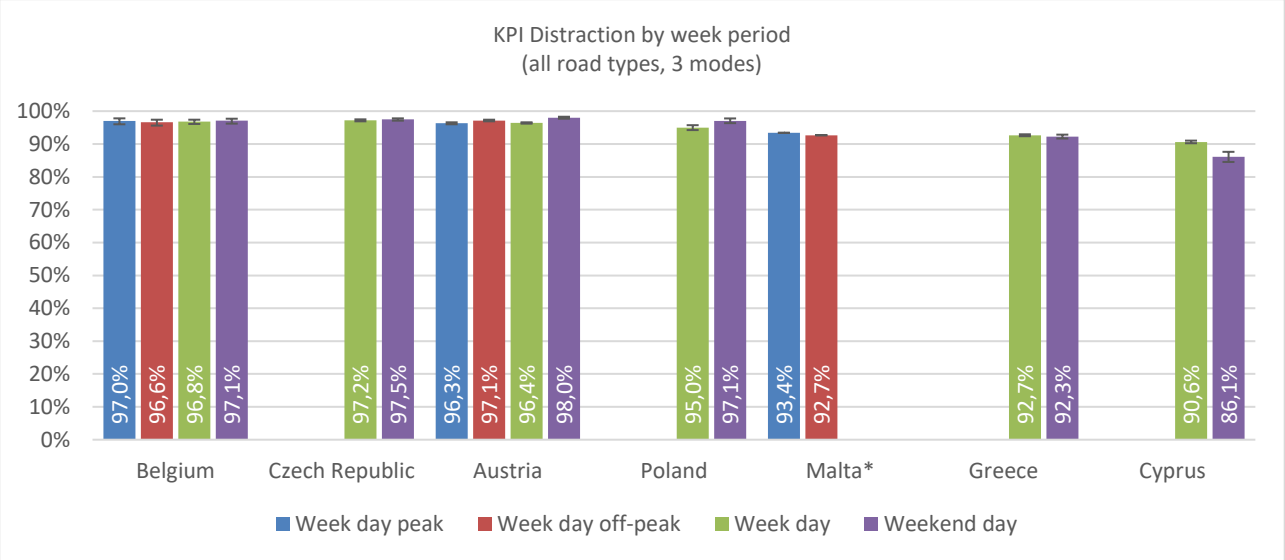
Seven MS delivered KPIs by time period (+ Spain only in the tables due to the broader KPI definition), with sufficient sample size per period. The MS that did not provide different time period indicators did indicate to have considered a combination of peak and off-peak hours in their fieldwork organisation (meta-data).

Different time period categories are used: 6 MS have separate indicators for week- and weekend days (as well as combined for week- and weekend, see section 4.1), of which 2 MS (AT, BE) also have data on week peak and off-peak hours. Malta provided general week, week peak and week off-peak indicators.

In 4 of the 6 MS that provided a weekend indicator, the KPI is higher (less device use) in the weekend than in the week (for Austria and Poland the difference goes beyond the confidence interval borders). In Greece and Cyprus it is the opposite (more device use on weekend days). In Austria the KPI gradually increases between week peak hours, over off-peak hours, to weekend day. In Belgium the KPI is similar in all time periods.

The same patterns are found for the KPIs by time period for car and LGV drivers, except for Greece where the KPI for car drivers is lower (more device use) on weekdays than in the weekend, while the opposite is the case for LGV (in Cyprus the LGV sample is too small).

Figure 7. KPI distraction by time period for all vehicle types



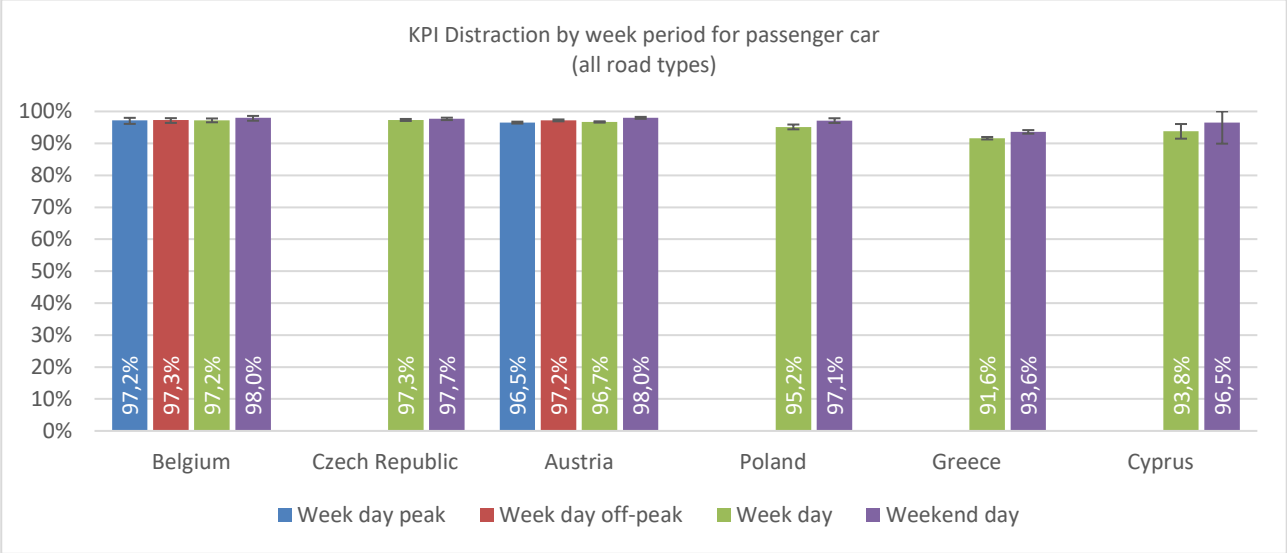
*Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 15. KPI distraction by time period for all vehicle types

	Weekday peak	95% CI		Weekday off-peak	95% CI		Weekday	95% CI		Weekend day	95% CI	
Belgium	**97,0%**	96,0%	97,8%	**96,6%**	95,6%	97,4%	**96,8%**	96,1%	97,4%	**97,1%**	97,1%	98,6%
Czech Republic							**97,2%**	96,9%	97,5%	**97,5%**	97,1%	97,8%
Austria	**96,3%**	96,0%	96,6%	**97,1%**	96,9%	97,4%	**96,4%**	96,2%	96,6%	**98,0%**	97,7%	98,3%
Poland							**95,0%**	94,2%	95,7%	**97,1%**	96,3%	97,8%
Malta	**93,4%**	93,4%	93,4%	**92,7%**	92,7%	92,7%						
Greece							**92,7%**	92,4%	93,0%	**92,3%**	91,7%	92,9%
Spain*							**90,9%**	89,9%	91,8%	**89,1%**	87,8%	90,3%
Cyprus							**90,6%**	90,2%	91,0%	**86,1%**	84,5%	87,6%

*Austria, Greece, Cyprus: % not using a handheld mobile phone. * Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

Figure 8. KPI distraction by time period for passenger cars



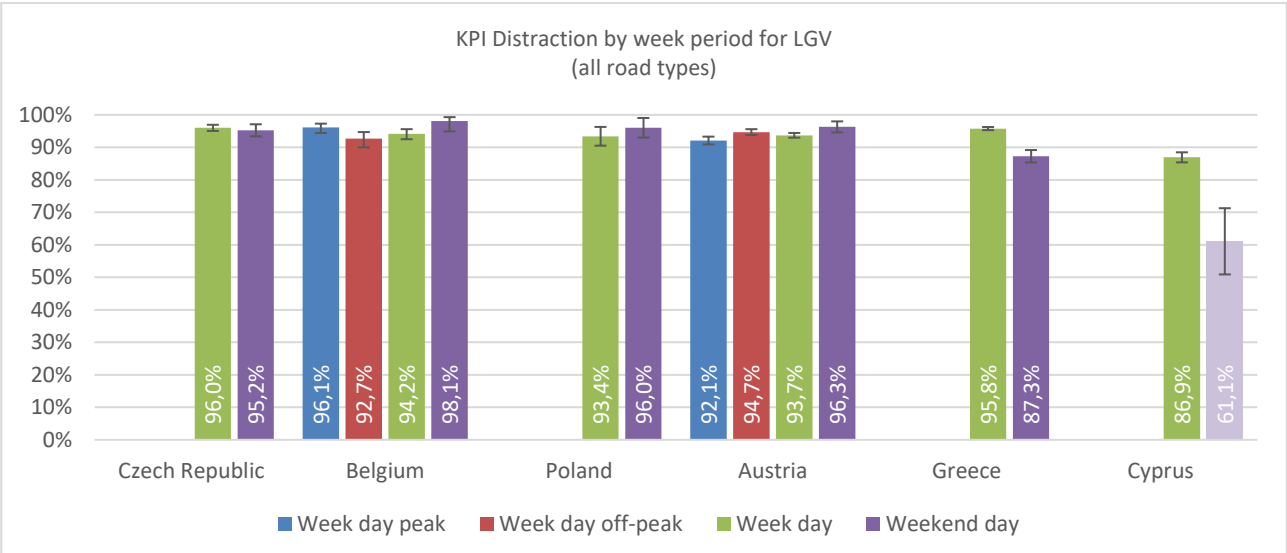
*Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 16. KPI distraction by time period for passenger cars

	Weekday peak	95% CI		Weekday off-peak	95% CI		Weekday	95% CI		Weekend day	95% CI	
Belgium	**97,2%**	96,1%	98,0%	**97,3%**	96,4%	97,9%	**97,2%**	96,6%	97,8%	**98,0%**	97,1%	98,6%
Czech Republic							**97,3%**	97,0%	97,6%	**97,7%**	97,3%	98,0%
Austria	**96,5%**	96,2%	96,8%	**97,2%**	96,9%	97,5%	**96,7%**	96,5%	96,9%	**98,0%**	97,7%	98,3%
Poland							**95,2%**	94,4%	95,9%	**97,1%**	96,4%	97,9%
Greece							**91,6%**	91,3%	92,0%	**93,6%**	93,0%	94,2%
Spain*							**91,1%**	90,0%	92,1%	**89,1%**	87,8%	90,5%
Cyprus							**93,8%**	91,5%	96,1%	**96,5%**	89,9%	100,0%

*Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

Figure 9. KPI distraction by time period for light goods vehicles



*Light coloured: deviating method (sample size). *Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 17. KPI distraction by time period for light goods vehicles

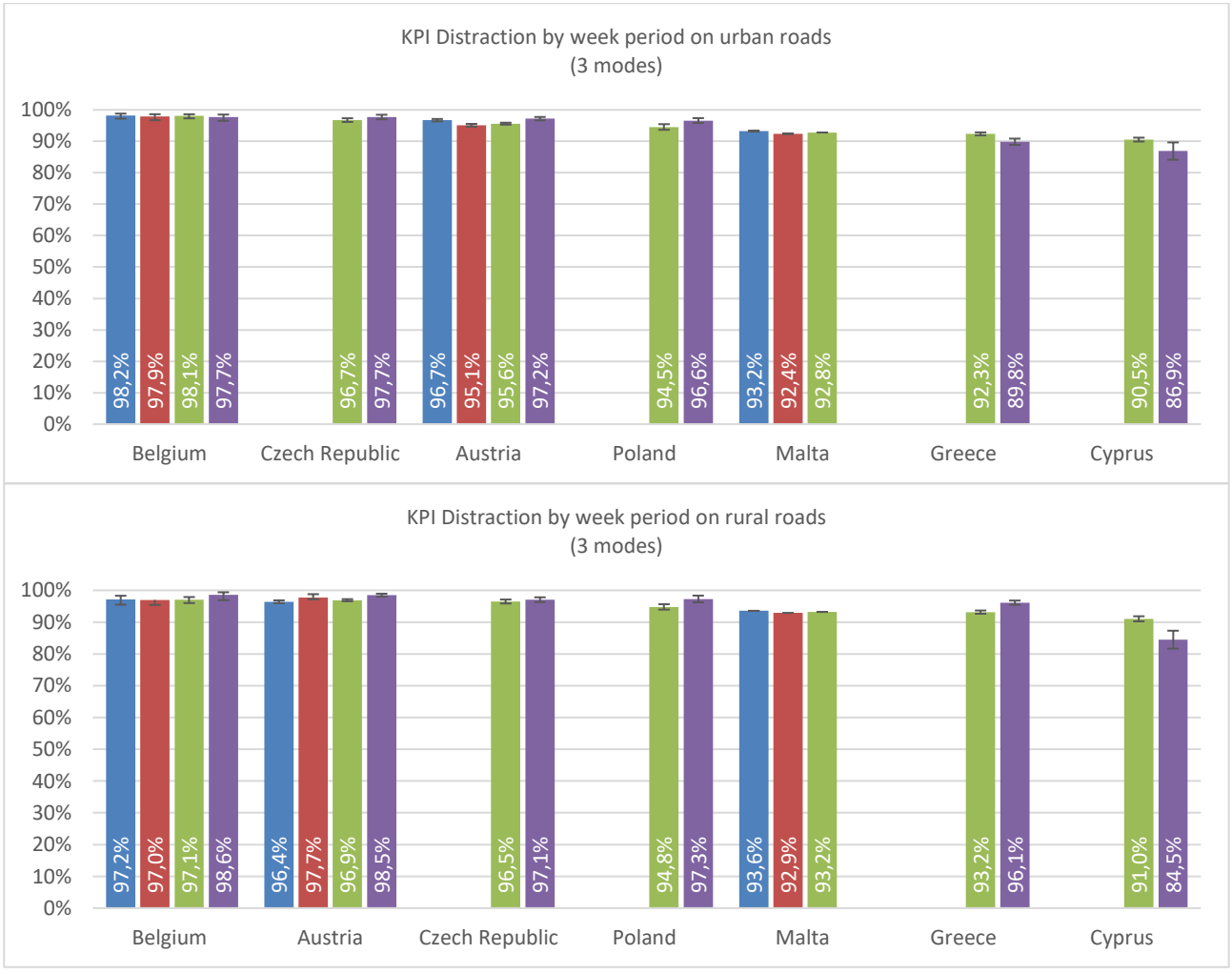
	Weekday peak	95% CI		Weekday off-peak	95% CI		Weekday	95% CI		Weekend day	95% CI	
Czech Republic							**96,0%**	95,1%	97,0%	**95,2%**	93,4%	97,1%
Belgium	**96,1%**	94,4%	97,3%	**92,7%**	90,0%	94,7%	**94,2%**	92,5%	95,6%	98,1%	94,9%	99,3%
Poland							**93,4%**	90,5%	96,3%	**96,0%**	93,0%	99,0%
Austria	**92,1%**	90,9%	93,3%	**94,7%**	93,8%	95,6%	**93,7%**	93,0%	94,4%	96,3%	94,6%	98,0%
Greece							**95,8%**	95,3%	96,3%	**87,3%**	85,4%	89,2%
Spain*							**88,4%**	85,7%	91,1%	**86,7%**	81,0%	92,4%
Cyprus							**86,9%**	85,4%	88,5%	**61,1%**	50,9%	71,3%

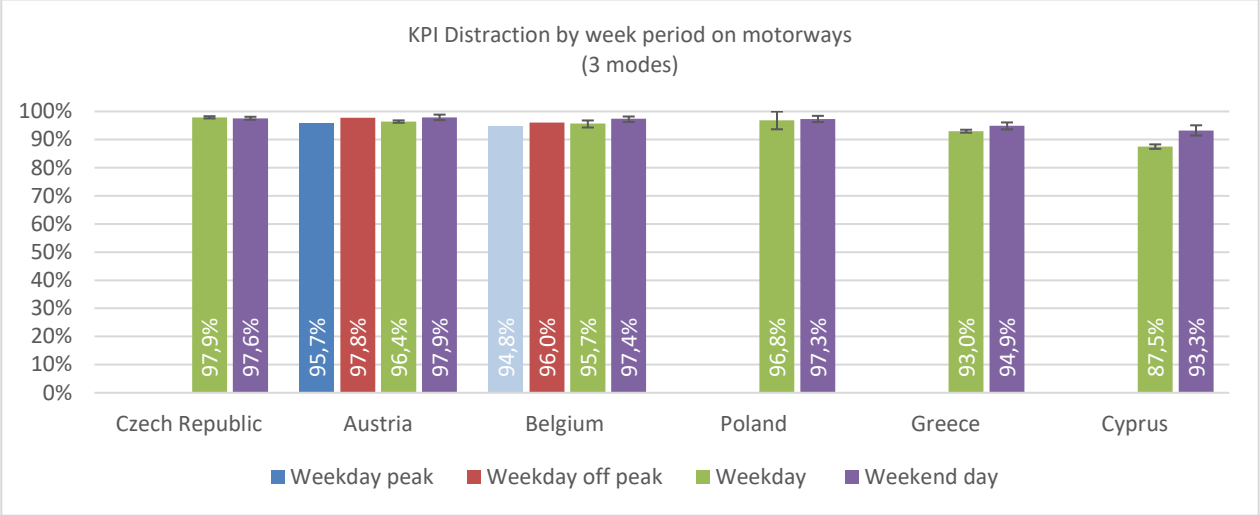
*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

4.6 Breakdown by road type x time period

In this section, distraction KPI's by available combination of road type and time period for all vehicle types *together* and for passenger cars (3-level crossing) are presented. Seven MS provided such data (+ Spain in the tables only due to a broader defined KPI), with sufficient sample sizes, in terms of locations and drivers for all crossed strata (minimum requirement: 2 locations and 500 drivers per combination), except Belgium: too small sample on peak hours on motorways.

Figure 10. KPI distraction for all vehicle types: road type x time period





*Light coloured: deviating method (sample size). *Austria, Greece, Cyprus: % not using a handheld mobile phone.

The KPI (all modes) for urban road x weekday ranges from 90,5% (Cyprus) to 98,1% (Belgium). For urban road x weekend day this ranges from 86,9% (Cyprus) to 97,7% (Belgium, Czech Republic). The KPI for rural road x weekday ranges from 91,0% (Cyprus) to 97,1% (Belgium). For rural road x weekend day this ranges from 84,5% (Cyprus) to 98,6% (Belgium). The KPI for motorway x weekday ranges from 87,5% to 97,9% (CY - CZ). For motorway x weekend day this ranges from 93,3% (Cyprus) to 97,9% (Austria).

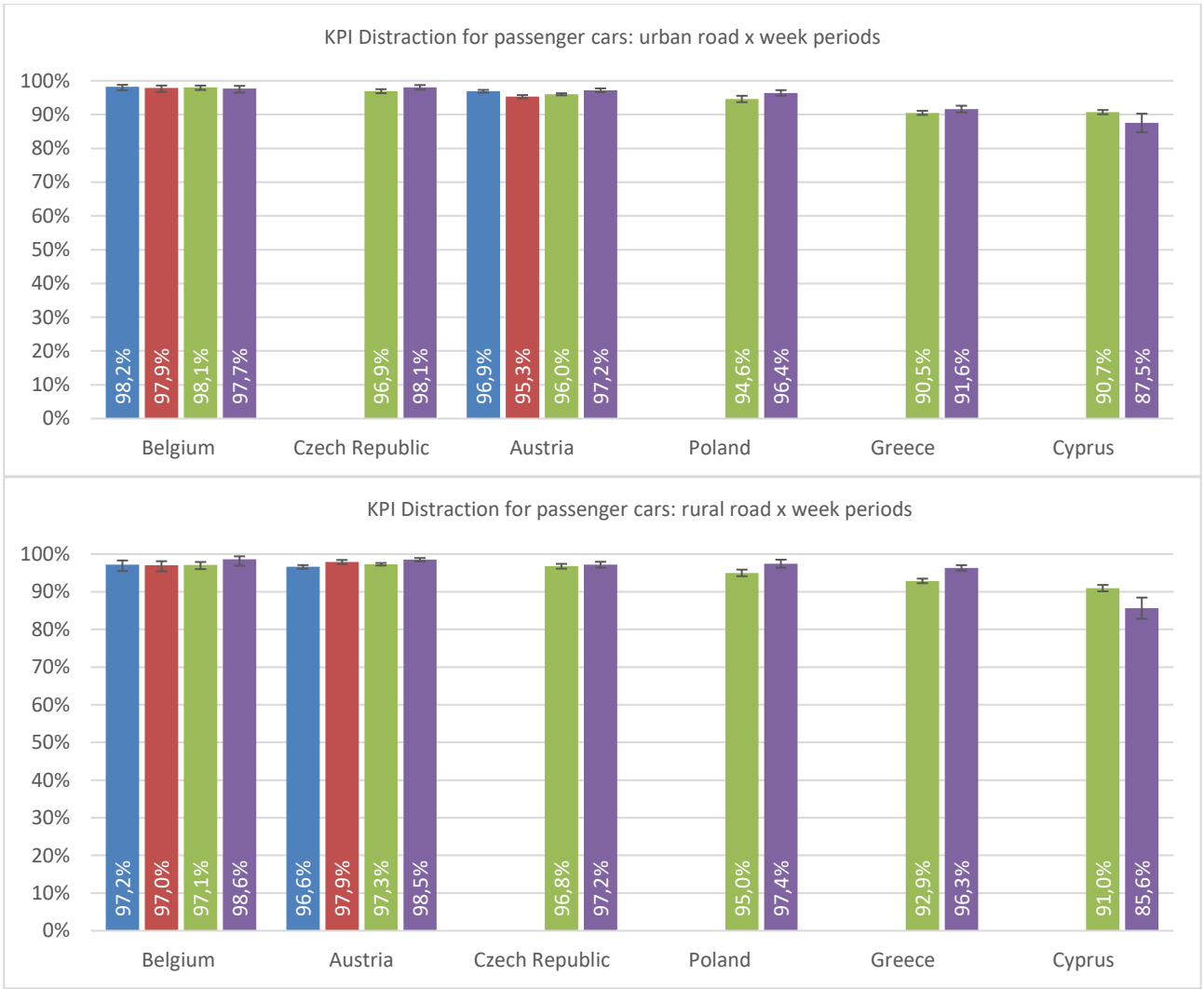
Table 18. KPI distraction: road type x time period (all vehicle types)

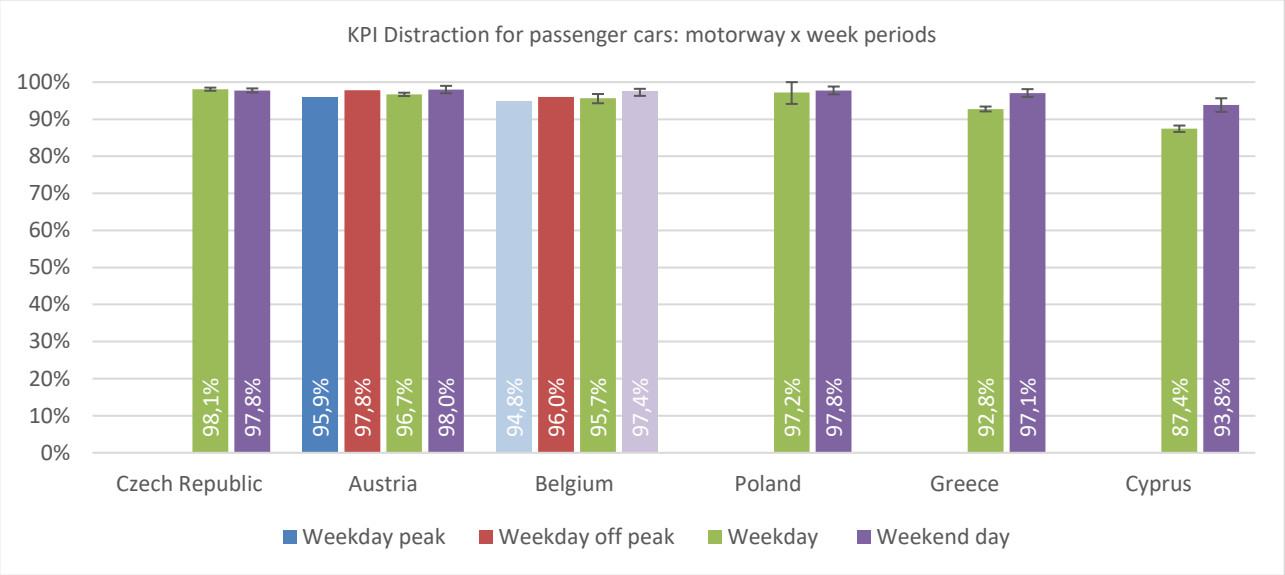
Urban roads												
	Weekday peak	95% CI		**Weekday off peak**	95% CI		**Weekday**	95% CI		**Weekend day**	95% CI	
Belgium	**98,2%**	97,2%	98,8%	**97,9%**	96,7%	98,6%	**98,1%**	97,3%	98,6%	**97,7%**	96,5%	98,5%
Czech Republic							**96,7%**	96,1%	97,3%	**97,7%**	97,0%	98,4%
Austria	**96,7%**	96,3%	97,1%	**95,1%**	94,7%	95,5%	**95,6%**	95,3%	95,9%	**97,2%**	96,7%	97,7%
Poland							**94,5%**	93,7%	95,4%	**96,6%**	95,8%	97,4%
Malta	**93,2%**	93,2%	93,3%	**92,4%**	92,4%	92,4%	**92,8%**	92,8%	92,8%			
Greece							**92,3%**	91,9%	92,8%	**89,8%**	88,8%	90,8%
Spain*							**89,3%**	87,6%	90,9%	**86,4%**	84,3%	88,6%
Cyprus							**90,5%**	89,9%	91,1%	**86,9%**	84,1%	89,6%
Rural roads												
	Weekday peak	95% CI		**Weekday off peak**	95% CI		**Weekday**	95% CI		**Weekend day**	95% CI	
Belgium	**97,2%**	95,5%	98,3%	**97,0%**	95,4%	98,1%	**97,1%**	96,0%	97,9%	**98,6%**	96,9%	99,4%
Austria	**96,4%**	96,0%	96,9%	**97,7%**	97,2%	98,2%	**96,9%**	96,6%	97,2%	**98,5%**	98,1%	99,0%
Czech Republic							**96,5%**	95,9%	97,1%	**97,1%**	96,3%	97,8%
Poland							**94,8%**	93,9%	95,7%	**97,3%**	96,2%	98,4%
Malta	**93,6%**	93,5%	93,6%	**92,9%**	92,9%	92,9%	**93,2%**	93,2%	93,2%			
Greece							**93,2%**	92,6%	93,7%	**96,1%**	95,4%	96,8%
Spain*							**92,4%**	91,1%	93,8%	**91,1%**	89,2%	93,0%
Cyprus							**91,0%**	90,2%	91,9%	**84,5%**	81,7%	87,3%
Motorways												

	Weekday peak	95% CI		Weekday off peak	95% CI		Weekday	95% CI		Weekend day	95% CI	
Czech Republic							**97,9%**	97,5%	98,3%	**97,6%**	97,1%	98,1%
Austria	**95,7%**	95,0%	96,4%	**97,8%**	97,4%	98,3%	**96,4%**	96,0%	96,8%	**97,9%**	96,9%	98,9%
Belgium	**94,8%**	92,5%	96,4%	**96,0%**	94,3%	97,3%	**95,7%**	94,3%	96,8%	**97,4%**	96,3%	98,2%
Poland							**96,8%**	93,7%	100,0%	**97,3%**	96,2%	98,4%
Greece							**93,0%**	92,5%	93,5%	**94,9%**	93,6%	96,1%
Spain* ---------- **Expressways**							**94,5%** ---------- **90,6%**	93,0% ---------- 88,5%	96,1% ---------- 92,8%	**94,4%-** ---------- **89,5%**	92,8% ---------- 87,4%	95,9% ---------- 91,5%
Cyprus							**87,5%**	86,7%	88,3%	**93,3%**	91,4%	95,1%

*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

Figure 11. KPI distraction for passenger cars: road type x time period





*Light coloured: deviating method (sample size). *Austria, Greece, Cyprus: % not using a handheld mobile phone.

Table 19. KPI distraction for passenger cars: road type x time period

Motorways												
	Weekday peak	95% CI		**Weekday off peak**	95% CI		**Weekday**	95% CI		**Weekend day**	95% CI	
Czech Republic							**98,1%**	97,7%	98,5%	**97,8%**	97,2%	98,3%
Austria	**95,9%**	95,1%	96,7%	**97,8%**	97,3%	98,3%	**96,7%**	96,3%	97,2%	**98,0%**	97,0%	99,0%
Belgium	**94,8%**	92,5%	96,4%	**96,0%**	94,3%	97,3%	**95,7%**	94,3%	96,8%	**97,4%**	96,3%	98,2%
Poland							**97,2%**	94,1%	100,0%	**97,8%**	96,7%	98,8%
Greece							**92,8%**	92,1%	93,4%	**97,1%**	96,0%	98,1%
Spain*							**95,2%**	93,7%	96,7%	**95,0%**	93,5%	96,5%
Expressways							**90,6%**	88,2%	93,0%	**89,3%**	87,1%	91,6%
Cyprus							**87,4%**	86,6%	88,3%	**93,8%**	92,0%	95,6%
Rural roads												
	Weekday peak	95% CI		**Weekday off peak**	95% CI		**Weekday**	95% CI		**Weekend day**	95% CI	
Belgium	**97,2%**	95,5%	98,3%	**97,0%**	95,4%	98,1%	**97,1%**	96,0%	97,9%	**98,6%**	96,9%	99,4%
Austria	**96,6%**	96,1%	97,1%	**97,9%**	97,4%	98,4%	**97,3%**	97,0%	97,6%	**98,5%**	98,1%	99,0%
Czech Republic							**96,8%**	96,1%	97,4%	**97,2%**	96,4%	98,0%
Poland							**95,0%**	94,1%	95,9%	**97,4%**	96,4%	98,5%
Greece							**92,9%**	92,3%	93,5%	**96,3%**	95,6%	97,1%
Spain*							**93,4%**	92,0%	94,8%	**91,2%**	89,3%	93,2%
Cyprus							**91,0%**	90,1%	91,8%	**85,6%**	82,8%	88,4%
Urban roads												
	Weekday peak	95% CI		**Weekday off peak**	95% CI		**Weekday**	95% CI		**Weekend day**	95% CI	
Belgium	**98,2%**	97,2%	98,8%	**97,9%**	96,7%	98,6%	**98,1%**	97,3%	98,6%	**97,7%**	96,5%	98,5%
Czech Republic							**96,9%**	96,3%	97,5%	**98,1%**	97,4%	98,7%

Austria	**96,9%**	96,5%	97,3%	**95,3%**	94,8%	95,8%	**96,0%**	95,7%	96,3%	**97,2%**	96,7%	97,8%
Poland							**94,6%**	93,7%	95,6%	**96,4%**	95,6%	97,2%
Greece							**90,5%**	89,9%	91,1%	**91,6%**	90,6%	92,6%
Spain*							**88,8%**	87,0%	90,7%	**86,5%**	84,2%	88,7%
Cyprus							**90,7%**	90,1%	91,4%	**87,5%**	84,8%	90,3%

*Marked orange: minor deviation from the minimum sample requirement. Marked red: clear deviation from the minimum sample requirement. *Austria, Greece, Cyprus: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

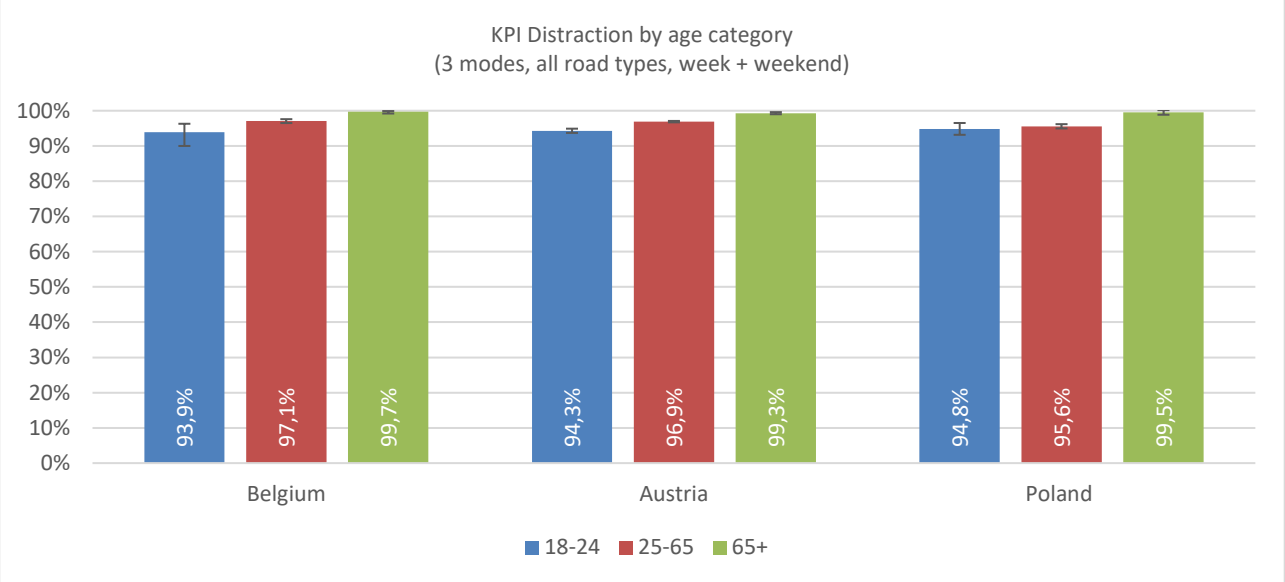
4.7 Breakdown by driver age and gender

In this section, distraction KPI's by the recommended age categories (18-24; 25-65, 65+) and by gender are provided, for the 3 modes *together* and for passenger cars only. All subsamples achieve the minimum sample requirement. For LGV (and bus) drivers the samples of the youngest and older age category and of females are generally too small.

Three MS provided KPIs for the 3 age categories for the 3 modes *together*.

In Belgium and Austria the KPI increases (less device use) significantly with increasing age category. In Poland the oldest group also uses significantly less mobile device while driving, compared to the two younger groups. For 65+ drivers the KPI ranges from 99,3% (Austria) to 99,7% (Belgium). For young drivers (18-24) the KPI ranges between 93,9% (Belgium) and 94,8% (Poland). For the middle age category 25-65 the KPI ranges between 95,6% (Poland) and 97,1% (Belgium). The KPI distraction is generally higher (less device use) for 65+ drivers than for younger drivers. This percentage increases (less device use) with each increase of age category.

Figure 12. KPI distraction by age category (all vehicle types)



*Austria: % not using a handheld mobile phone.

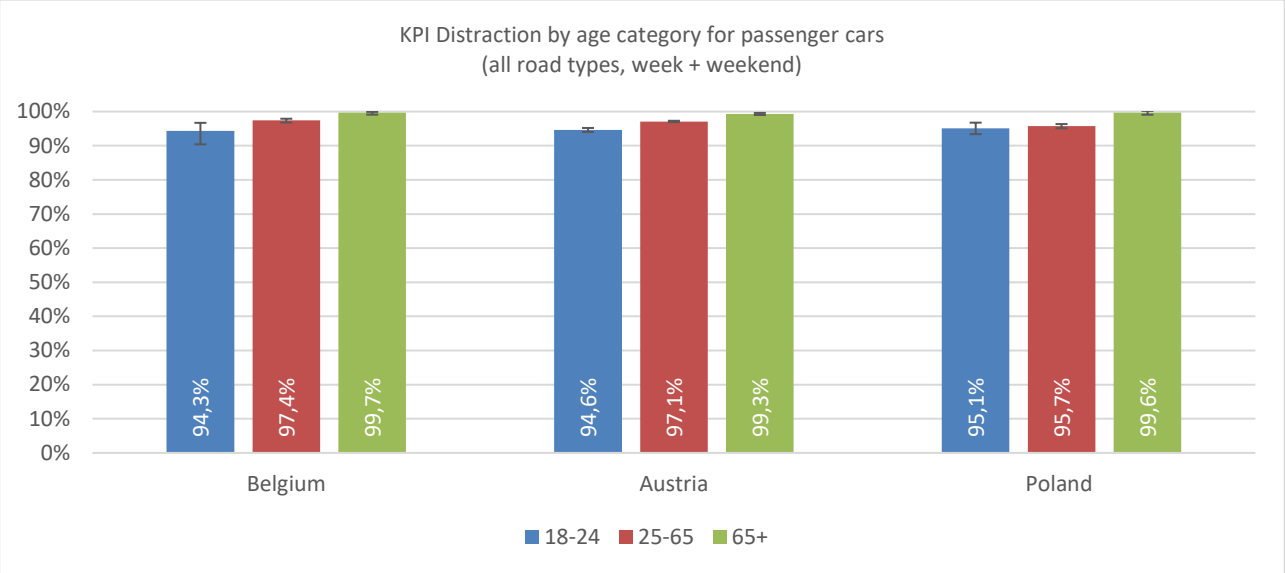
Table 20. KPI distraction by age category (all vehicle types)

	18-24	95% CI		25-65	95% CI		65+	95% CI	
Belgium	**93,9%**	90,0%	96,3%	**97,1%**	96,5%	97,6%	**99,7%**	99,2%	99,9%
Austria	**94,3%**	93,7%	94,9%	**96,9%**	96,7%	97,1%	**99,3%**	99,0%	99,6%
Poland	**94,8%**	93,2%	96,5%	**95,6%**	95,0%	96,2%	**99,5%**	98,9%	100,0%

*Austria: % not using a handheld mobile phone.

The same three MS provided separate indicators for the 3 age categories for passenger cars only. These results show the same pattern as for all vehicle types together (oldest group uses least a handheld device).

Figure 13. KPI distraction by age category for passenger cars



*Austria: % not using a handheld mobile phone.

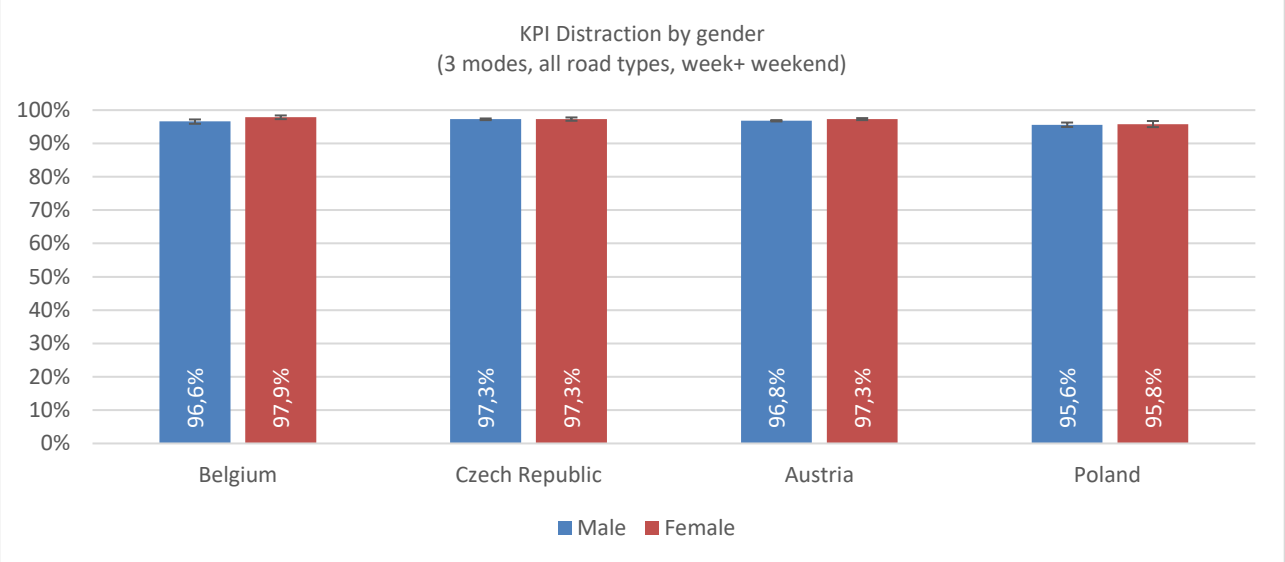
Table 21. KPI distraction by age category for passenger cars

	18-24	95% CI		25-65	95% CI		65+	95% CI	
Belgium	**94,3%**	90,4%	96,7%	**97,4%**	96,8%	97,9%	**99,7%**	99,1%	99,9%
Austria	**94,6%**	94,0%	95,2%	**97,1%**	96,9%	97,3%	**99,3%**	99,0%	99,6%
Poland	**95,1%**	93,4%	96,8%	**95,7%**	95,1%	96,3%	**99,6%**	99,1%	100,0%

*Austria: % not using a handheld mobile phone.

Four MS provided KPIs by gender for the 3 modes *together* (+ Spain in the table due to a broader KPI definition used). For male drivers the KPI ranges from 95,6% (Poland) to 97,3% (Czech Republic). For female drivers the KPI ranges from 89,4% (Spain) to 97,9% (Belgium). There is no common pattern in the results. In 2 MS the KPI for females is higher (less device use) (Belgium, Austria), while in the other 2 MS the difference is minimal.

Figure 14. KPI distraction by gender (all vehicle types)



*Austria: % not using a handheld mobile phone.

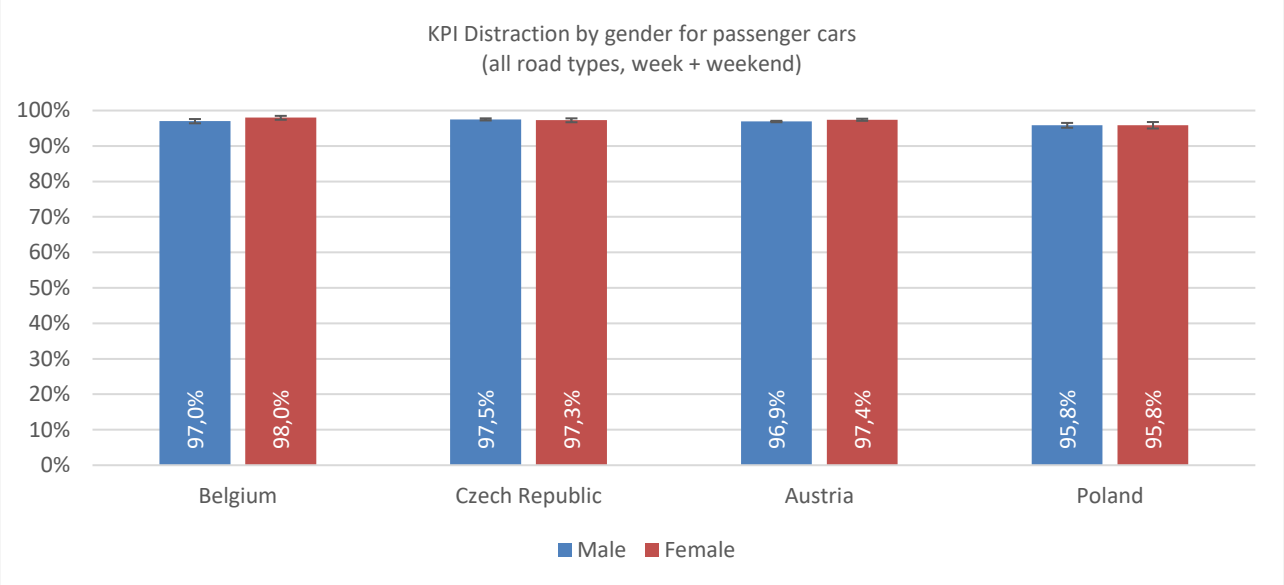
Table 22. KPI distraction by gender (all vehicle types)

	Male	95% CI		Female	95% CI	
Belgium	**96,6%**	95,9%	97,2%	**97,9%**	97,3%	98,4%
Czech Republic	**97,3%**	97,0%	97,5%	**97,3%**	96,8%	97,8%
Austria	**96,8%**	96,6%	97,0%	**97,3%**	97,0%	97,6%
Poland	**95,6%**	95,0%	96,3%	**95,8%**	94,9%	96,7%
Spain*	**90,3%**	89,4%	91,2%	**89,4%**	87,7%	91,0%

*Austria: % not using a handheld mobile phone. *Spain: broader KPI: *"% having or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

The same four MS (+ Spain in the table) provided indicators by gender for passenger cars only, with minimal difference between both genders.

Figure 15. KPI distraction by gender for passenger cars (optional)



*Austria: % not using a handheld mobile phone.

Table 23. KPI distraction by gender for passenger cars

	Male	95% CI		Female	95% CI low	
Belgium	**97,0%**	96,4%	97,6%	**98,0%**	97,4%	98,5%
Czech Republic	**97,5%**	97,0%	98,5%	**97,3%**	98,0%	99,1%
Austria	**96,9%**	97,2%	97,8%	**97,4%**	96,7%	97,8%
Poland	**95,8%**	95,2%	96,5%	**95,8%**	94,9%	96,8%
Spain*	**90,5%**	89,6%	91,5%	**89,3%**	87,6%	91,0%

*Austria: % not using a handheld mobile phone. *Spain: broader KPI: *"% having in the hand or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board."*

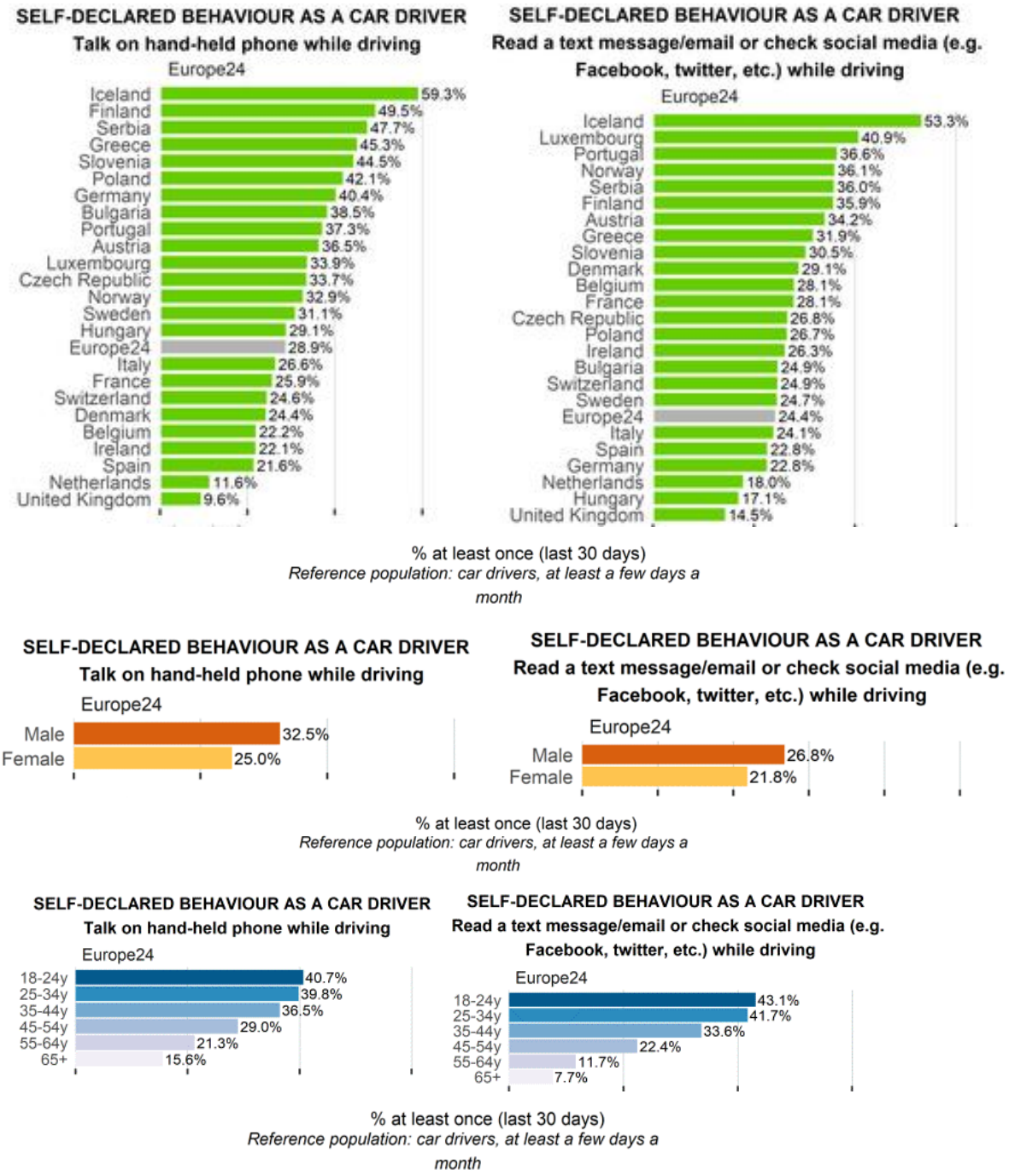
4.8 Additional indicators

In this section additional indicators on distraction, outside the scope of Baseline, are included from ESRA2 (https://www.esranet.eu/). The aim of ESRA (E-Survey of Road users' Attitudes) is to collect and analyse comparable data on self-reported road safety performance, in particular road safety culture and behaviour of road users. The ESRA2 survey took place in 2018 and collected data from a nationally representative sample of drivers from 48 countries, of which 24 are European countries.

Some of the ESRA indicators approximate the Baseline KPI distraction, namely the self-reported frequency (at least once, by car drivers) of 'talking on a hand-held phone while driving', and of 'reading a text message/email or checking social media while driving' in the last 30 days. These indicators refer to period-based prevalence measurement on a representative sample of persons (with generally higher %), while the Baseline measurements are based on 'point-measurements' (measurement of the frequency of handheld mobile device use on specific locations/moments) on a representative sample of locations (with generally smaller %), so both are clearly different but also related and mainly complementary.

The figures underneath include ESRA indicators which can be used for comparison with the Baseline indicators over MS as well as for comparisons related to risk factors like age and gender. Other ESRA indicators provide contextual or road safety cultural information which can support the interpretation of certain MS results in Baseline.

Figure 16. Self-declared behaviour as a car driver in Europe 24 (ESRA, 2018)



The ranking of MS based on the ESRA2 self-reported handheld mobile phone use and Baseline KPI distraction indicators for car drivers does not correspond with the ranking in Baseline, e.g. Finland is among the least performing MS in ESRA2 while it is the best performing MS in Baseline.

While the result in ESRA2 clearly shows that female car driver report less often to have used their mobile phone while driving, this is less clear from the few Baseline KPIs although it goes for 2 of the 5 MS also in that direction.

The ESRA2 and Baseline indicators correspond in the fact that 65+ car drivers use their mobile phone/device less often than younger drivers.

Figures 17-19 provide self-reported contextual information per MS (enforcement) as well as perceived accident risk and social acceptability of mobile phone related behaviour while driving in EU24.

Figure 17. Perceived likelihood to be checked and risk perception in Europe 24 (ESRA, 2018)

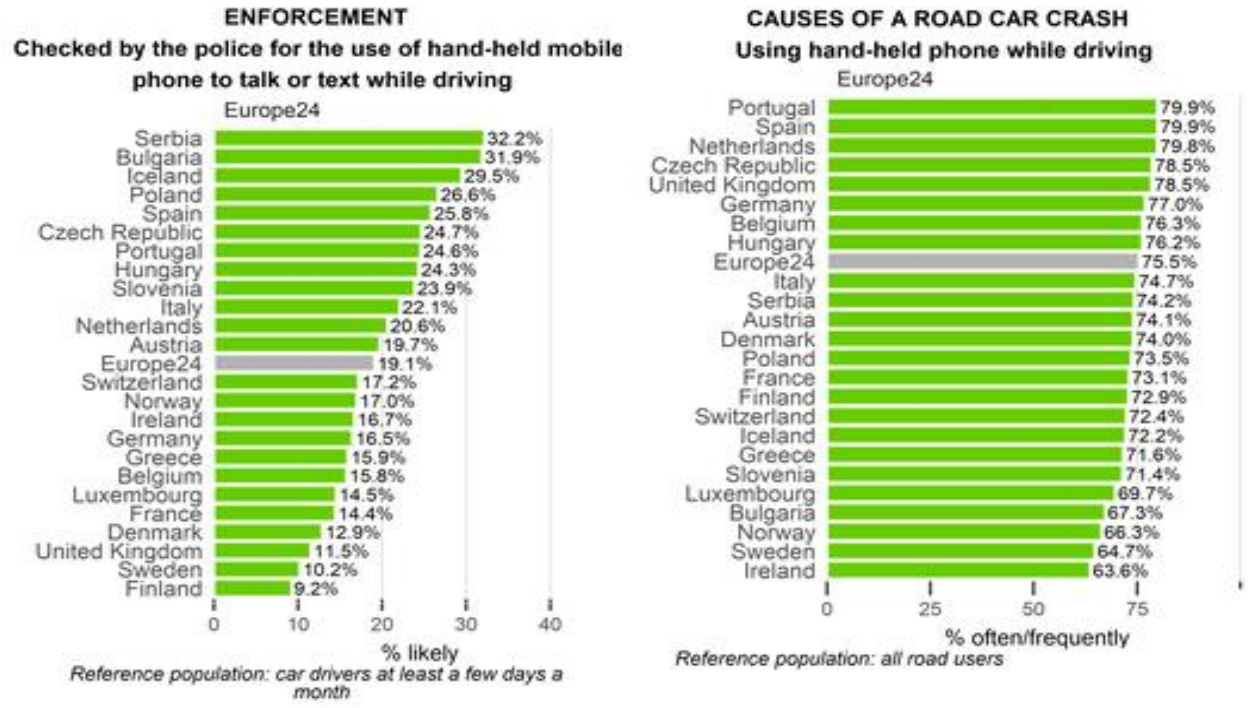


Figure 18. Perceived social acceptability of handheld mobile phone use in Europe 24 (ESRA, 2018)

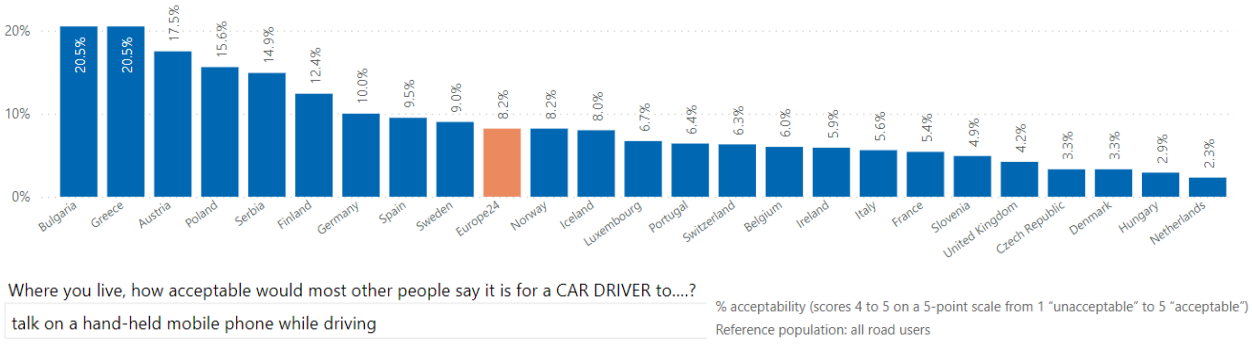
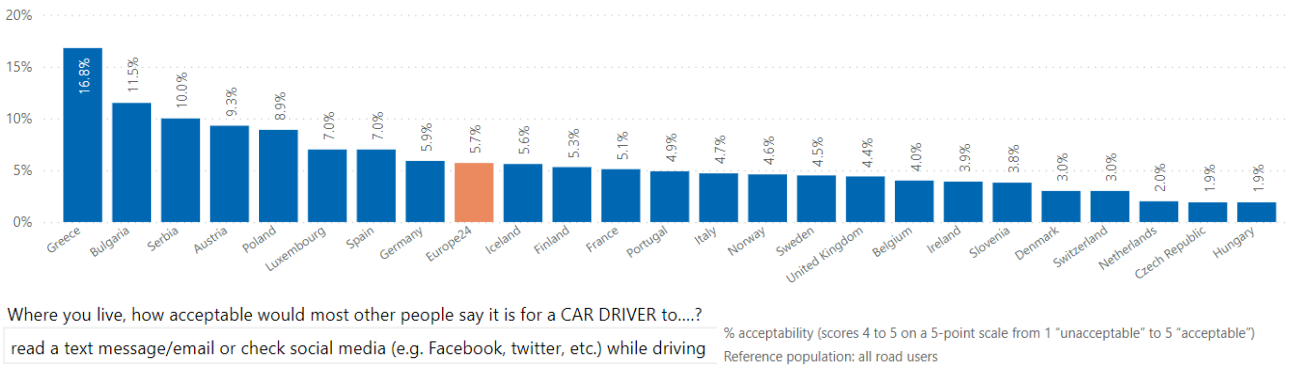
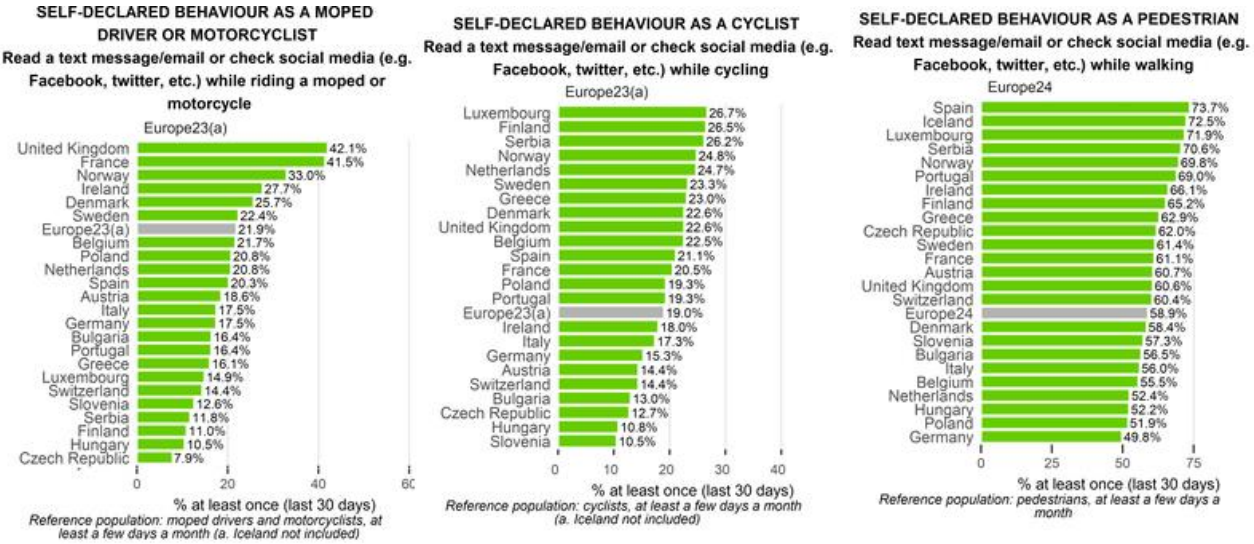


Figure 19. Perceived social acceptability of texting or checking social media in Europe 24 (ESRA, 2018)



Finally, as Figure 19 indicates ESRA2 not only questions car drivers. Also vulnerable road users form a relevant target group for measuring mobile device use while riding/moving.

Figure 20. Self-declared behaviour as moped driver/motorcyclist, cyclist and pedestrian in Europe 24 (ESRA, 2018)



5. Conclusions on data quality and recommendations for the future

5.1 Quality and comparability of data

Baseline KPI datafiles were provided by 15 MS. All MS indicated to have provided the Baseline **KPI** Distraction, but in some MS this KPI refers to '% not using a handheld mobile phone' (AT, GR, CY) – referring to their national legislation – while the other MS' KPI refers to '% not using a handheld mobile device' (broader than phone) – referring to their national legislation and to the exact definition of the KPI. The Spanish KPI refers to more broad distraction behaviour namely '% having or operating with the hand a mobile phone or other electronic devices (GPS, tablets, monitors, etc.), whether mobile or on-board' and is therefor not comparable with the other national KPIs.

Most MS used direct observation by trained **observers** along the road (13). For motorways, some MS used observations from a riding vehicle going with the traffic flow with the observer on the backseat, but others considered this complex and used observers along the motorways (rest areas) and from bridges. Such detailed fieldwork method information was not systematically collected in the meta-data so this is only available for some MS. Two MS used **camera** images (Finland – see Annex 6 – and Lithuania) which were manually coded. For Finland, the reasoning behind using cameras (2 cameras: first one detected license plates and second one took a picture of the driver) was that data can be collected from larger samples with reasonable resources and that the reliability of detection is assumed to be higher with a static picture than from a live observer on the side of the road (Peltola, 2022). The main lessons learned for Finland after the experience were that 1) phone use identification was sometimes uncertain due to (relatively) low resolution and dynamic range of the camera sensor (it's easier to detect not holding a phone), 2) the method was considered suitable for the purpose (fewer resources required for analysing images than for video footage; and static pictures allow analysis by several persons and for longer times), and 3) the image quality and coverage of the traffic stream can be improved.

The vast majority of MS indicated to have used a stratified **random sample** of locations (by road type, sometimes combined with region). Some MS used convenience samples but these were considered representative. Germany uses a historical representative set of locations with good and safe observability and sufficient traffic in a representative set of regions for the country. Some MS indicated 'simple' random sampling but with a same number of locations per road type, it is mostly a disproportionately stratified sample according to road type. No further details on the actual sampling procedure were requested in the meta-data. Only Malta provided more details on how GIS was used for location sampling.

All studies were conducted as required during daylight hours, in flowing traffic and sufficiently good weather conditions.

The number of sessions per MS varies greatly (from 30 to 520) and session duration varies from 20-30 minutes to 3:15h (observers), and up to more than 5 hours in Finland using cameras.

All MS provided KPIs for the 3 minimum required **vehicle types** together (passenger cars, light goods vehicles and busses/coaches), except for Germany (only passenger cars). Five MS only provided KPIs for the 3 vehicle types together, which is conform with the minimum requirement. Nine MS provided KPIs for the 3 vehicle types together as well as per vehicle type (3) which was optional but recommended. The bus/coach sample is generally too small though for any further subgroup analysis. Some MS also collected data on trucks or HGV, with bigger samples than for busses/coaches, but this mode was not part of the required Baseline data collection and was thus not included in this report. An issue with the aggregate KPI for the 3 types *together*, is that the proportions of the different vehicle types (especially for LGV and busses) differs in the different national samples. It generally remains unclear if the sampled proportions correspond to the actual traffic streams, and if not, if this was/could be corrected by weighting (e.g. using traffic volume and/or count weight per vehicle type).

All MS provided KPIs for the 3 minimum required **road types**, except for Latvia and Malta because these MS do not have motorways in their national road network. Their national KPI thus only includes 2 road types. Poland and Spain also referred to 'expressways', which were in Poland included in the motorway KPI, while in Spain these were considered as a separate fourth road type. Some MS provided very detailed descriptions of the road types while others referred to that more briefly. It seems that the operational definition of urban (inside built-up area) and rural (outside built-up area) is not as easy to take into account in the location sampling (e.g. no category in GIS) as well as for data weighting (e.g. no national data available on length in road network nor on traffic volume data based on this categorisation) as compared to, for instance, speed regimes or other common road categorisations. Main characteristics mentioned for motorways are: public dual carriageways with at least two lanes each way, central barrier or median, no crossing, signposted exists/entrances, only for heavier motor vehicles (no quadricycles, mopeds), 120-140 km/h speed limit. Poland and Spain refer also to expressways (in the motorway category for Poland; separate category for Spain). For rural roads main characteristics mentioned are: 1st and 2nd class roads

outside built-up area, 70-90km/h speed limit. For urban roads main characteristics mentioned are: inside built-up area, 30-50km/h.

Fourteen MS provided the minimum required '**weekday** only' KPIs, and 8 of these also provided weekend day indicators as well as indicators for 'all periods' (week- + weekend days). Seven MS also provided weekday peak vs. off-peak indicators. Almost all MS did include peak and off-peak hours in the fieldwork set-up (cfr. the minimum Baseline requirement to measure during a mix of daytime hours, on and off-peak, balanced over road types/locations).

Five MS provided KPIs by **gender** and 3 by **age** category (optional). Seven MS provided indicators for several 3- to 5-level crossed stratifications (AT, BE, CY, CZ, GR, PL, ES). Three of these MS additionally provided separate indicators for 'private' vs. 'professional' drivers. This report focussed on the main stratifications and 2-level crossings for 'total' drivers. This means that more data is available than taken up in this report.

Some MS measured handheld mobile '**phone'** use, while others measured handheld mobile '**device'** (more broad) use, e.g. in line with national regulations.

Compliance with the minimum **sample size** requirements, for locations and for drivers, is overall good. The number of locations per road type ranges between 8 and 78. Germany (8 locations per road type) deviates slightly from the requirement to include 10 locations per road type, but in turn they had the most extensive fieldwork leading to data collection of 145.040 car driver. The overall driver sample for the 3 vehicle types 'together' ranges from 3.834 to 33.974 on weekdays (16.526 to 41.489 on week- + weekend days). All MS meet the minimum required total driver sample of 2.000. The minimum driver sample per road type is 500, which is also reached by all MS. The location and driver samples are even big enough for different MS to provide additional recommended crossed strata KPIs. Crossings of stratifications with sufficient sample (road type x vehicle type, time period x vehicle type, road type x time period): 6 to 10 MS, but with several minor and bigger deviations from the required sample for a few of the strata cells.

Weighting guidelines were developed in Baseline (Silverans & Boets, 2021), but the applied procedures vary greatly. All MS did apply weighting of their data but there was a big difference in the level and quality of the weighting sources and approaches. This complicates the comparability of the aggregate KPIs. Some KPIs are representative for national traffic volumes while other KPIs are a close or more distant proxy to that. In the absence of traffic volume data it remains unclear to what extent KPIs are representative. Even when traffic volume data was available, it was not always clear if this is also available for different week periods and for different vehicle types. Ideally traffic volume data is available for all crossings of road x time x mode. Some MS considered different time periods in their fieldwork, but it is not always clear if the sessions were proportionate to reality (e.g. 5/7 week, 2/7 weekend) for each road type and, if not, if any disproportionate sampling was correctly weighted for. Traffic volume data could be used by 6 MS. Some MS only used traffic volume data for weighting, i.e. estimates of driven vehicle kms per road type, sometimes crossed with region and/or vehicle category, but generally not including time period differences (except Germany). Session weights (traffic counts during sessions) and stratum weights (road type share on the total road network, and time period share duration on a total week) were often applied as a minimum by the MS not having national traffic volume estimates.

5.2 Recommendations

The main conclusions and recommendations for the KPI Distraction can be summarized as follows:

- With regard to the definition of the KPI distraction (EC SWD), "using a handheld mobile device use while driving" refers to illegal behaviour with a clear increased accident risk (cfr. EC, 2022). The KPI is relevant and a good proxy for the distraction problem, acknowledging that it focusses on one aspect of distraction, while also other distinctive behaviours lead to increased risk, e.g. in-vehicle systems requiring visual-manual handling. By excluding certain types of distraction, it is possible that new trends will be missed. It may be considered to **extend the KPI with other observable behaviour with also a clearly increased accident risk**, e.g., manipulation of in-vehicle systems (even though this is not illegal behaviour). Spain already provided a KPI within Baseline based on such broader distraction behaviour, including manual actions on on-board devices. Some MS already measure other types of distraction while driving (cfr. FERSI guidelines from Vollrath et al., 2019).
- Due to a small difference in the **final KPI** delivered between MS (AT, GR and CY delivered '% not using a handheld mobile phone' – in correspondence with their national legislation – while the KPI for other MS refers to the main Baseline definition '% not using a handheld mobile device') it is important to collect the actual definition of the KPI from each MS. For international comparison it is important that all MS define their KPI in the same way.

- Both methods, **observers and camera/pictures** proved to be feasible for data collection on distraction. Both have specific pros and cons though which should be considered well beforehand. When considering the use of cameras it would be good to organise a pilot study first for evaluating technical feasibility and camera quality (e.g. on higher speed regimes, in different weather conditions, of different vehicle types like also the higher ones - trucks and busses - , on roads with different lanes). Also, a major issue when using cameras are the GDPR constraints, which should be well covered beforehand. For more information on the use of cameras, see Annex 6 on the Finnish experience and Stelling-Kończak et al. (2020): For analysing pictures, high quality cameras, directed at a proper angle and preventing light reflection are crucial. Otherwise it can be difficult to differentiate using a phone with other types of gestures such as touching the hair or glasses. Using pictures is in some MS not possible though due to GDPR issues. Some MS indicated that working with observers was more difficult on motorways. A recommendation remains to use static observations for lower speed roads, for higher speed roads to use a moving vehicle or to stand on overpassing bridges, and for observing busses/ trucks to use a moving higher vehicle (e.g. a bus with several observers inside). The use of cameras especially for high speed roads could also be explored.
- The Baseline experience showed that the main minimum methodological requirements for the KPI Distraction were feasible for most MS (random sampling, minimum location and driver sample sizes, minimum stratifications).
    - The minimum required aggregate KPI for the 3 **vehicle types** *together* was feasible for all MS, but two third of them could also provide separate indicators per vehicle type with generally sufficient samples for cars and LGV (not for busses). Given the general pattern in the results that the KPI distraction differs according to vehicle type, it would be recommended to collect sufficient data per vehicle type and not for the combination of vehicle types. The minimum sample of 2000 drivers per vehicle type could be considered, certainly for cars, but ideally also for LGV. The currently proposed sampling method generally does not lead to sufficient sample size for busses. Together with the fact that the KPI for busses is generally higher than for the other types, it could be considered to replace the busses/coaches by trucks/HGV. Different MS indicate they collected (or wanted to collect) data on HGV/trucks too, and the MS that collected already data generally indicated to have sufficient sample sizes, and results indicating a (significant) lower KPI then for car drivers (e.g. in Belgium).
    - If the KPI is mainly used for temporal monitoring, it is sufficient to use a core period – weekday, as this is the period with most traffic volume in a week. The KPI results show some differences according to week period, but no clear general pattern. Other time periods are recommended for MS willing to have a representative estimate for the entire week. Moreover, if week and weekend are considered disproportionately in the data sampling, this should be correctly weighted for actual time period (duration) proportion.
    - The definitions behind the **road types** in the MS differs, and the operationalization of urban/rural roads (EC SWD) into inside/outside built-up area within Baseline was not ideal for sampling (e.g., not available in GIS classifications) nor weighting (e.g., no national estimates of traffic volume by this categorisation). It should be checked if other common road categorizations can be used. Moreover two MS now included 'expressways' in a different way (included in the motorway road type in PL vs. as a separate road type in ES). This should be avoided in future.
    - Reliability: CI sizes are generally small for the minimum KPIs and bigger for specific optional strata.
- Different MS have developed **support tools** and apps for data collection, adapted to the Baseline requirements, e.g. CZ, BE, PL. These could be used by other MS.
- As indicated in Section 5.1 the **weighting** procedures vary greatly, with differences in the 'representativity' of the national aggregate KPIs, and thus complicating international comparison. Ideally more common weighting procedures are applied, but this also requires availability of common core data/estimates for the weighting. National traffic volume data is often lacking (only 6 MS could use this). This indicates a need for mobility/exposure data, or good proxy data, ideally per vehicle type x road type x time period to weight the data and optimize the KPI interpretation (validity of results).
- On a more general level, reversed KPIs (% drivers using a handheld device) are more easy to communicate and to highlight risk factors.
- Finally, other interesting distraction related KPIs are
    - % of pedestrians and cyclists distracted by smartphone or music,
    - % of road users checked at least once for distraction by phone,
    - % of drivers visibly distracted according to all the different distraction indicated in the FERSI recommendation (Vollrath et al., 2019).

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7. Annexes

Annex 1: Requirements for representative distraction measurements

This is the complete extract of the original Baseline methodological guidelines for the KPI Distraction (Boets et al., 2021).

1. Scope

1.1 General principles

The EC SWD (see Annex 2) allows "***direct observation*** *by trained observers on the roadside or from moving vehicles. Other alternatives could be used if available, e.g. automatic detection. To be decided by Member States.*"

The main method proposed is observational roadside studies, in which all (relevant) drivers or a random selection of (the relevant) drivers are observed. The use of a handheld device is directly observed and coded by trained observers, possibly together with some optional supplementary basic information about the driver (e.g. age, gender).

The objective of the roadside observation study is to estimate the percentage of drivers NOT using a handheld mobile device. The theoretical population refers to the total of all journeys (or at least from the vehicle types targeted) over the national territory. In other words, this reflects the total number of kilometres driven. Hence, the percentage of drivers NOT using a handheld mobile device refers to the percentage of kilometres driven without using a handheld mobile device.

The basic aim is for all participating Member States to have comparable indicators for the minimum required stratifications. Optional disaggregated indicators will only be compared for countries that are able to deliver those.

Self-report methods (e.g. roadside interviews or self-report surveys) are outside the scope of this KPI.

1.2 Type of distraction to be observed

The KPI states "*handheld mobile device use*". The use of 'device' instead of 'phone' makes this KPI futureproof. A mobile device can be defined as "a computer small enough to hold and operate in the hand" (e.g. https://en.wikipedia.org/wiki/Mobile_device), such as: mobile phones (e.g. smartphones), mobile computers (e.g. tablets), personal navigation devices, digital cameras.

Most Member States have a ban on mobile phone use while driving, while in some States this has meanwhile been extended to mobile electronic 'devices'. Participating Member States are expected to provide metadata on the applied regulations and procedures related to this.

As an absolute minimum, two clearly visible distraction categories, excluding each other, should be recorded in each observation:

- **Having a mobile device in the hand (driver is holding a mobile device in the hand, which can be held at the ear, at the steering wheel or anywhere else)**
- **Not having a mobile device in the hand (rest category).**

Although the KPI refers to 'use of a handheld mobile device', this categorization is based on what is visibly detectable during an on-road observation study. This allows a clear and uniform observation procedure, even though handheld mobile device use will be underestimated because drivers often hide their mobile device under the dashboard or on their laps.

Optionally, as a function of their own research questions, Member States can decide to collect additional information on different basic tasks related to using a mobile device in the hand (e.g. phoning or texting), and/or to distinguish mobile phones from other mobile electronic devices. This latter distinction can be especially interesting for Member States with legislation which so far refers to mobile phones only.

The following categories are based on FERSI (Vollrath et al., 2019) and can be used:

- Having a mobile phone in the hand:
  - Handheld phoning: the driver is visibly holding a mobile phone in the hand and is pressing it at his/her ear or is holding it in front of the mouth. He/she is either talking or listening.
  - Texting/keying numbers handheld (mobile phone): the driver is visibly holding a mobile phone in the hand and is operating it.

    - Handheld reading/watching without operating (mobile phone): the driver is visibly holding a mobile phone in the hand and is looking at the phone without operating or handling it.
- Having another mobile device in the hand:
    - Operating another mobile electronic device [with screen] in the hand: the driver is operating an electronic device other than a mobile phone (e.g., tablet, navigation system) and is holding this device in the hand.
    - No mobile phone or device in the hand (rest category)

Optionally, even more distraction categories could be collected (see e.g. recommended categories by FERSI – Vollrath et al., 2019, Annex 4). When defining more (differentiated) distraction categories, it should always remain possible to derive the minimum distraction category for the KPI (handheld mobile device use vs. NO handheld mobile device use) from the data.

1.3 Vehicle types to be included

SWD requires the inclusion of "*Cars, light goods vehicles, and buses/coaches as a minimum. Other user types if possible (disaggregated by user type)*".

The target groups to include at a minimum are (see CARE definitions[2]):

- passenger cars
- light goods vehicles (LGV; often from companies)
- buses/coaches (including mini-buses and public transport buses).

The data collection should include a variable "vehicle type" with these three categories.

The **minimum requirement is to provide aggregated results for these three different vehicle types 'together'.** This means that the data from the three vehicles types can be combined to provide the KPI. No separate KPI per vehicle type is required. The further specified minimum sample sizes consider the three vehicle types 'together'.

Although providing disaggregated results is not requested, it is recommended to also provide differentiated results by vehicle type if the respective sample sizes are large enough to allow this (see section "Minimum total sample size").

The different vehicle types and their specific categorization should be clearly defined and illustrated for the observers (training) and in the methodological report: for example, some cars and vans share the same brand/model like Renault Kangoo (a passenger car is a vehicle with backseat windows and passenger seats; a van has no backseat windows and no rear passenger seats).

Heavy goods vehicles[3] (HGV) or trucks are not mentioned in the SWD. It is recommended however to include this vehicle type if there is a specific interest of a Member State in distraction in this vehicle type. Of course, this should be feasible and a sufficiently large sample for this extra vehicle type should be reached to provide sufficiently accurate separate results (see section "Minimum total sample size").

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[2] CARE (2018) definitions:

- [Car or taxi] Motor vehicle with 3 or 4 wheels, mainly used to transport people, seating for no more than 9 occupants (including the driver). Motor vehicles with these characteristics used as taxis as well as motor caravans are also included.
- [*Light goods vehicle*] Goods vehicle under 3,5 tonnes maximum gross weight: Lorry: goods vehicle under 3,5t. Smaller motor vehicle used only for the transport of goods. *(= also van for transport of equipment by workers such as electricians, plumbers…)*
- [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.

[3] Based on CARE (2018) definition of heavy goods vehicle: Includes road tractors, goods vehicle over 3,5 tonnes maximum gross weight, and "goods vehicles". 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 3,5 tonnes mgw: larger motor vehicle used only for the transport of goods. Goods vehicle: motor vehicles used only for the transport of goods (irrespectively from vehicle weight). Includes road tractors and road tractors with semi-trailers. Type C driving licence required.

1.4 Driver characteristics (optional)

Member States with an interest in additional information on risk factors or predictors of distraction while driving, are encouraged to optionally record some easily observable extra variables such as:

- gender of the driver
- estimated driver age category (e.g. Vollrath et al. (2019) FERSI recommendation: young (18-24 years), medium (25 to 65 years), older (> 65 years))
- private vs. professional vehicle or driver (e.g. taxi)
- presence of passengers (yes/no)

Such additional variables can provide valuable input for evidence-based and risk group-oriented countermeasures (e.g. education and awareness building activities such as campaigns).

2. Measurement procedure

2.1 Sampling individuals

Sampling of drivers (of the relevant vehicle categories) **should be random**. Target drivers should always be randomly selected from all the possible drivers at the location where the observation is done. The easiest way to guarantee random sampling is that after finalisation of the coding of one observation, the first next passing target driver (on the specified road lane and direction) should be observed.

Most of the observed drivers will be car drivers as this is the most frequent vehicle type in motorized traffic. **While there are generally less light goods vehicles and buses/coaches, the observer should give no specific priority to them in the measurement**. Only if the first next passing vehicle in the observation lane is a LGV or a bus/coach this driver should be coded.

Observations should be made in flowing traffic only, so of drivers while driving, since distraction behaviour is different when stationary, e.g. waiting at traffic lights. **No observation should be made of stationary drivers** (see also section "Sampling and selection of locations").

2.2 Minimum total sample size

Defining a minimum required sample size is by definition arbitrary since it depends on the level of accuracy that is considered adequate. Assuming an overall prevalence percentage of 5% to 10 % for handheld mobile device use while driving, accuracy in the order of 5% ±1 to 10% ±1,3 for this KPI can be considered acceptable (see Table 25).

$$\mathrm{CI} = \text{prevalence}^{4} \pm z * \sqrt{\frac{prevalence\ (100\ -\ prevalence)}{n}}$$

Prevalence	Lower bound CI, n=2000	Upper bound CI, n=2000	Lower bound CI, n=500	Upper bound CI, n=500
5%	4,04%	5,96%	3,09%	6,91%
10%	8,69%	11,31%	7,37%	12,63%

Table 24. Expected 95% confidence intervals for different samples assuming simple random sampling and depending on prevalence levels between 5% and 10% for handheld mobile device use

A sample size of about 2,000 observations should therefore be sufficient to provide frequency estimations (percentages) of the order of 1-1,3% with a 95% confidence interval. **Thus, as an absolute minimum 2.000 observations overall** (for the three minimally required vehicle types together) **is required**. This minimum refers to valid datapoints in the study dataset in order to be considered for the national KPIs. No minimum sample size for the different vehicle types is defined because the minimum requested KPI is the aggregated result for the three types.

[4] z value 1.960 for 95% CI

Member States aiming at having higher accuracy can calculate the required sample size to gather results with a specified accuracy level and confidence interval, using this formula: (FERSI - Vollrath et al., 2019)

When planning the study, the sample size required for the respective purpose should be considered. For example, to estimate the prevalence of texting on the mobile phone with a precision of 1% (width of 95% confidence interval) and it is assumed that the percentage lies around 5%, one can use the following formula to determine the required number of observations.

$$N_{required} = \frac{1.96^2 * (P * (100 - P))}{Precision^2}$$

When using a P = 5% and a Precision of 1%, this gives:

$$N_{required} = \frac{1.96^2 * (5 * (100 - 5))}{1^2} = 1825$$

Accuracy for different subgroups or stratifications, such as the three road types, will by definition be lower. If higher accuracy levels are expected for particular strata (road type, regions) , it is strongly recommended to increase the total sample size. Ideally, a multiple of the minimum sample size can be obtained, which increases the accuracy of the estimates, and optionally can allow delivery of reliable estimates for separate categories of vehicle types or for further (crossed) stratifications (e.g. per road type x time period, per region).

Annex 3 gives an overview of the argumentation behind the minimum driver sample. If, optionally, Member States aim at having disaggregated results by vehicle type, then the minimum sample size of 2.000 drivers should be applied to each vehicle type.

If similar accuracy levels are expected for particular stratifications/subgroups, it is strongly recommended to increase the total sample size. Member States optionally willing to have reliable KPI estimates for different possible combinations of stratifications (e.g. road type x time period; region x road type; region x road type x time period) should have a design with minimum 500 observations for the different relevant crossed strata (e.g. 3 regions x 3 road types x 3 time periods = 27 strata x 500 observations = needed sample of 13.500 drivers).

2.3 Sample size per road type

On-road observation studies should provide a representative sample of all traffic in the considered study area. For distraction the **minimum stratification to take into account is road type**. This covers three main road types: **motorways[5], rural non-motorway roads** (defined as roads outside built-up areas)**, and urban roads** (defined as roads inside built-up areas). **This is the minimum required categorization**.

If Member States historically use a different road categorization, an attempt should be made to infer the minimum required road types. The road types considered and any deviation from the minimum requirements should be explained in the methodology (general characteristics like traffic signs to define inside/outside built-up area, possible speed regimes and number of lanes…).
In order to ensure a minimum number of observations for each road type, even if this would imply disproportionate sampling, **at least 500 observations for each category of road type are required, thus:**

- **minimum 500 drivers on urban roads**
- **minimum 500 drivers on rural roads**
- **minimum 500 drivers on motorways** (this requirement does not apply to Member States with no motorways or where the network of motorways is very limited).

It should be noted that this leads to bigger error margins for the point estimate for each of these roads. Given an overall prevalence of distraction of 5% to 10% this would give the following 95% confidence intervals for this level of aggregation: 5% ±1,9 to 10% ±2,6 (see Table 24).

[5] Motorways are defined by CARE (2018) as: Public road with dual carriageways, and at least two lanes each way. Entrance and exit signposted. Road with grade separated interchanges. Road with a central barrier or central reservation. No crossing permitted. No stopping permitted unless in an emergency. Entry prohibited for pedestrians, animals, bicycles, mopeds, agricultural vehicles.

2.4 Sampling and selection of locations

The **selection of locations should be as random as possible,** covering the geographical area of the country. There are different options for random location selections, such as simple random and stratified random (e.g. random sampling in different regions). The basic process for the random selection of locations consists of three steps:

(1) Step 1: The required number of different locations (for the country or per region) is determined.

(2) Step 2: The number of locations is randomly selected on the 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 do not have to be taken into account at this point. This step is to ensure a reasonable geographical spread of the randomly selected locations.

(3) Step 3: The final locations that will be used for the observations 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), inclusion/exclusion criteria (if applicable) and practical considerations. This final selection can be made using Google Street View. 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 automatically selects location points within defined areas randomly (e.g. https://desktop.arcgis.com/en/arcmap/latest/extensions/geostatistical-analyst/an-introduction-to-sampling-monitoring-networks.htm). 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.

Since a random selection of locations will also include low volume roads, it is expected that several low volume locations will be available for each stratum. If however traffic flow is too low, it is also be acceptable not to include them. It is acceptable not to include locations with less than 10 relevant vehicles passing per hour.

Pragmatical considerations related to the locations should be taken into account: the observers should have a good view of the passing traffic while also ensuring that the observations can be conducted safely and inconspicuously (see also section "Practical organisation of the observations").

Furthermore, typical criteria for observation studies on distraction are related to the free flow of the traffic, so ideally no locations should be chosen in front of traffic lights. Observation can take place near intersections but **only drivers who are driving should be observed, not drivers who are stationary**.

It is recommended to sample locations for the three road types proportionally to traffic volume on the road types (or proportionally to the kilometres driven on each road type in a country), assuming that each of the three road types represent a share of traffic volume above 20%, with this based on available national data (e.g. traffic/mobility data by road type from national traffic surveys). If traffic volume data is not available, or if the traffic volume share of a road type is less than 20%, then an **absolute minimum of 10 different locations per road type** should be selected in order to ensure representative results for the entire road network (see Annex 3 for the argumentation behind the minimum location sample of 10 locations per road type):

- **Minimum 10 locations on urban roads**
- **Minimum 10 locations on rural roads**
- **Minimum 10 locations (or sections) on motorways**

Taking into account the other criteria (Sections "Minimum total sample size" and "Sample size per road type"), this comes down to a mean minimum of 67 observations per location, if 30 locations are chosen. It is allowed to re-use the same sampling location for different times of day or days of week (different sessions).

When, optionally, stratification according to time period is used too, a minimum of 2 different locations for each combination of strata should be used (e.g. 3 road types x 3 time periods = 9 crossed strata).
For more information on random sampling of locations and for determination of the minimal sample size, reference can be made to the SafetyNet general recommendations for SPI (safety performance indicators): http://www.dacota-project.eu/Links/erso/safetynet/fixed/WP3/sn_wp3_d3p8_spi_manual.pdf

To summarize, the minimum required sample sizes to provide the KPIs are:

- **Minimum 2,000 observations in total (aggregated vehicle types)**
- **Minimum 500 observations per road type (3)**
- **Minimum 10 locations per road type (3) = min. 30 locations in total.**

2.5 Optional further stratifications

Stratification by time period

SWD only requires the observations "*during daylight*" and no differentiation regarding week-weekend is requested. The **minimum requirement is to plan the observation sessions at mixed time intervals during daylight hours in normal working days - weekdays. The mix of possible moments should be balanced over the three road types (i.e. to have a similar variation of considered day hours for the three road types).**

Optionally, time period can also be considered as an additional stratification for Member States willing to have results for different relevant time periods. In such cases the FERSI recommendation of using three time periods (weekday peak, weekday off-peak and weekend day) can be considered, cf. FERSI (Vollrath et al., 2019):

> *"It is recommended that observations cover the whole daytime and different working days. This can be achieved by doing observations at least at two time intervals: peak hours (commuters) and off-peak hours and from Mondays to Saturdays to be able to differentiate between week-weekend. This allows to work with three time intervals: week-peak (e.g. 7-9, 16-18), week-off-peak (e.g. 10-15), weekend (e.g. 10-18).*
>
> If different time intervals are selected, these should be randomly allocated to the different (stratified) locations within each location type selection (either one location is assigned a specific time interval, or different (time interval) sessions are organized at one location). It should be checked that the distribution of road types and time intervals is proportional to traffic volumes x time intervals OR that it's is balanced with a minimal number of sessions in each combination for proper data analysis (and application of weights afterwards). Observation sessions within a specific time interval should start and end within this time interval."

If stratification according to different time periods is also aimed for, then the minimum of 500 observations and 10 locations should be used per time period also. To ensure a balanced sampling for road types and time periods, a minimum of 2 locations for each combination of road type and time period should be used.

Stratification 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). In that case countries can consider collecting data from each region or from a representative selection of regions.

Member States aiming at having meaningful KPIs at the regional level, including road type differentiation per region, will need a multiplication of the required minimum location sample and driver sample. The minimum location and driver sample requirements are then required for each region surveyed (see sections "Minimum total sample size", "Sample size per road type" and "Sampling and selection of locations").

2.6 Practical organisation of the observations

Fieldwork set-up and procedure

A uniform fieldwork procedure should be chosen. Member States can estimate how many sessions and observation hours will be needed in order to reach the required or aimed at driver sample size, taking also the minimum location requirements into account. **One observation session should last at least 30 minutes.** Ideally and for practical reasons however 1 hour or longer (e.g. up to 3h) sessions are recommended. Furthermore, different sessions can be spread over mixed hours (or, optionally, over different time periods) at one location (e.g. spreading and balancing time per location) or each location can be used for one session (i.e. balancing time over locations within road types; this is the minimum requirement). **When planning the fieldwork sessions, one should ensure a balanced combination of the 3 road types and the time periods considered**, to avoid a systematic sampling bias (e.g. all motorway sessions in the morning and all urban sessions in the afternoon).

Prerequisites for carrying out observations are generally: good enough weather conditions (no heavy rain, no storm, no snow), good visibility (no darkness, no fog), good road conditions (no ice), flowing traffic (no accident or construction site).

Observation of drivers in trucks may be more difficult than observation of car drivers due to their high seat position and windows, even as compared to bus/coach drivers which generally have more extended lower windows. For observing 'higher' positioned drivers, observers should have a high enough observation position or viewpoint. Suggestions are to use a safe and stable device to stand upon; taller observers will also have an advantage. When observations from a moving vehicle are used (e.g. on high speed roads, see section "Observations on motorways") then ideally a vehicle with a higher seat position is used.

The **observations should be made by well-trained observers along the road or from moving vehicles**. As indicated by FERSI (Vollrath et al., 2019),

> *"…this requires a thorough training of the observers, ideally both theoretically (e.g. a briefing explaining aim, variables and definitions, coding tool, complete procedure) and practically (e.g. exercises on the road with a trainer), and ideally also including a performance test to ensure a high inter-rater reliability between the observers. This is ideally checked from time to time during the fieldwork in order to ensure a high data quality.*
>
> *Regarding the number of observers for one observation session, one well-trained observer can be used. This has the advantage of being unobtrusive and efficient. At very busy sections it may be advisable to have two observers, e.g. one doing the observation and telling the results to the second observer, who is recording them. However, when using a limited number of variables even single observers are well able to observe and record at the same time."*

For the on-site coding, paper sheets or tablet computers/smartphones can be used. Using a tablet or smartphone can have some advantages (e.g. direct coding, real-time central data collection, automatic coding of meta-data like the exact location, date and time of each coding, which also could serve for quality assessment), but the tool should be tested beforehand (user friendliness, speed, correction possibilities…) and be evaluated to be better than paper coding. Some examples of existing programs are:

- FERSI (Vollrath et al., 2019): for Windows tablets, free and configurable software is provided by TU Braunschweig: www.tu-braunschweig.de/psychologie/verkehrspsychologie/software [05.08.2019]
- CDV mobile phone app created for certain road side surveys (*more info on this tool can be provided if requested*)
- Example tablet/smartphone app display (Belgian distraction roadside survey, 2020 – in Dutch):

Driver and main distraction categories:

Observations at urban and rural roads

Stationary and moving observations on low and high speed roads should always be carried out in accordance with the applicable (road) safety regulations.

Observations on urban and rural roads can be made from a **safe place along the road**.

It is recalled that observation can take place near intersections but **only drivers who are driving should be observed, not drivers who are stationary**. If the traffic flow is disturbed at a selected location (e.g. due to works or an accident), then the observer should choose a new location on the same lane or nearby (within the same road category). Furthermore, more complex traffic situations requiring the full driver's attention are also best avoided.

Observations on motorways

Observations on motorways (or high speed roads) are possible from locations along the motorway that are easily reachable for observers (e.g. on rest/parking areas) and where observers can stand behind a safety barrier to observe oncoming and passing vehicles on the motorway lanes. It is important that these locations allow observation of traffic travelling undisturbed (not therefore locations where drivers have to stop or pay special

attention to circumstances). This observation location should at least be usable for observation of vehicles on the lane closest to the observer (right lane) and for vehicles driving generally slower (e.g. buses/coaches). Observing vehicles on the lanes further away or vehicles at high speed may be more difficult.

A complementary or alternative method on motorways is to make observations from a moving vehicle in real traffic, with a driver and an observer on the backseat, which allows observing overtaking and overtaken vehicles on different lanes and also observing vehicles riding at different (also high) speeds (e.g. Riguelle & Roynard, 2014). Using this method, the geographical location is rather determined as a section (from location x to location y) than as one specific location on a certain motorway. These sections should reflect as far as possible the required min. 30 minutes duration of driving/observation. The lanes and speeds of the observation vehicle should be varied in a systematic way in order to carry out the observations in a representative way (e.g. 15 min. driving on the right lane at 90km/h and observing overtaking vehicles on the middle lane, then 15 min. driving on the middle lane at 120 km/h and observing overtaking and overtaken vehicles) within one observation session. In order to carry out the required traffic counts, the observer can stop at a safe location along the motorway section (e.g. behind a barrier overlooking the motorway at a rest/parking area).

The method of observation from moving vehicles (e.g. on the middle and left lanes) can be combined with stationary observation of vehicles on the right lane. Ideally, vehicles with a higher seat position should be used for a better view of the drivers. If this is not possible, observations from overpasses can also be considered, as long as these are not too high and provide a good viewpoint on the lanes; but a possible drawback is that observers in that position may be more noticeable by drivers which makes inconspicuous observation more difficult.

Camera observation may also be considered for safety reasons on higher speed roads, even though this method also presents some disadvantages (see section "Requirements for automatic detection via road side cameras").

Counting of traffic

Traffic volumes should be counted during each observation session, even when national traffic volume statistics are available. This information is needed for the calculation of the percentage of drivers not holding a mobile device for each observation session and for correct calculation of the confidence intervals (weighting).

Counting of traffic during a session is ideally done by counting all (including the observed) passing relevant vehicles (i.e. the types that are considered in the study; this can be combined for the three vehicle types but if separate KPIs per vehicle type are aimed at (optional), this should be done also separately per vehicle type), in the same lane(s) and in the same direction as the observation. In the ideal situation where each passing relevant vehicle can be observed in a session, the total number of observed vehicles corresponds to the total session count.

Minimum manual traffic counts are made by counting all the passing relevant vehicles in the same lane(s) and in the same direction as the observation, during a 10 minute break in the middle of the session, or 5 minutes before and 5 minutes after the session. This break is in addition to the minimum 30 minutes (ideally for practicality min. 1h) observation session. If disaggregated results for different vehicle types are aimed for (optionally) then the vehicle types should be counted separately. Additional counting can also be done with an automatic counter during the whole session (e.g. loop on the road) so as to have an indication of the general traffic volume (optional).

Time of the year

SWD does not set a specification for time of the year (months). **Holiday periods (bank and school holidays) and hard winter conditions should however be avoided**, as these disturb normal traffic patterns. All months are allowed except for December-February to avoid a higher risk of (very) adverse weather conditions which may influence driver behaviour and can complicate the observational work (e.g. due to the weather conditions and shorter daylight periods), as well as July-August (in some Member States June too) to avoid typical holiday periods in the interests of representativeness. For the other months, sessions during official holidays should therefore also be avoided.

When Member States have historical series of measurements it is recommended to use the same periods of the year as for the earlier measurements. Member States intending to organise more than one roadside observation study to deliver the KPIs (e.g. one in Spring and one in Autumn) need to apply the minimum sample size requirements to the combination of both measurements. The data from both measures can be combined to deliver the indicators.

Regarding the impact of the COVID-19 pandemic on timing, it is recalled that the observation studies are ideally done in as normal driving situations as possible. Studies should not take place when a country or region is in a severe lockdown, with e.g. restrictions on journeys, closure of schools, and/or closure of non-essential shops. When less or less severe restrictions apply and there is a sufficiently normalised traffic flow (e.g. 75% of the normal flow),

observation studies for distraction can be conducted. A night curfew is less relevant for the distraction study as daylight measures only are required.

3. Data analyses

3.1 Data coding

Detailed specifications for the data delivery and data matrix for the Baseline dataset will be provided at a later stage.

As a first guideline, it is suggested to include for each datapoint (i.e. each observation or each driver) in the dataset, the following variables:

- vehicle type (3)
- distraction: use or no use of a handheld mobile device (2)
- road type (3)
- date
- start hour
- end hour
- total observation duration
- unique location code (to know which observations belong to the same session)
- unique session code (only needed if the same location is used for different sessions)
- observation session duration
- traffic count duration
- *traffic count total (at a minimum all relevant vehicle types together, ideally per considered type)*

Variables such as road type, time period, location code, session code, day and time of a session, traffic counts can be coded once per session by the observers. These variables should then be added in the dataset to each datapoint (each observed driver) in the same observation session.

The following list gives some additional variables which can optionally be coded and included in the dataset:

- Coded per vehicle observation:
  - driver characteristics: age category, gender, private/professional
  - presence of passengers
- Coded per observation session (once per session) and included in the dataset for each observation line from one session:
  - region
  - time period category (e.g. weekday off-peak, weekend day, weekday peak)
  - code of the observer(s)
  - weather condition
  - road condition
  - flow of traffic
  - number of lanes
  - observation lane(s)
  - observation direction.

3.2 Post stratification weights and statistical analysis

For this section, reference should be made to the Baseline guidelines on data weighting from Silverans & Boets (2021).

For each Member State, a general estimate of the percentage of drivers NOT using a handheld mobile device should be provided, as well as of the confidence interval (CI). Since the total population of drivers to which these estimates relate consists of the total of all vehicle movements over an entire territory over the entire period of the measurement, these overall estimates refer to the percentage of vehicle kilometres driven while drivers are not using a handheld mobile device.

For each level of stratification used for the sampling of observation locations – at least road type, but possibly also vehicle type, time period and region - results should be weighted according to traffic volumes by level of stratification. The weighting should be done according to traffic volume data, at least by type of road. If, optionally, other stratifications are also considered, then the weighting should be done according to traffic volume data by the considered stratifications (e.g. by region, by time period).

Traffic volumes are ideally obtained/estimated from national statistical mobility data (e.g. mobility surveys), and otherwise **should at minimum be estimated by using traffic counts during the observation sessions**. It is recommended to use the exact values for each combination of stratification levels considered (e.g. traffic volume for motorways on weekend days in a certain region). If these combined data are not available, the second best option is to assume independence of all levels of stratification and use combinations of marginal totals to estimate specific combinations. The use of traffic volume data (either officially available data or traffic counts) is required to ensure comparability. The results of the Member States should be weighted in a similar way.

Even when national traffic volume statistics are available, traffic volumes should be counted during each control session. Since selection probabilities of observed drivers included in the sample depend on the amount of passing traffic during each observation session (traffic density), this information is also necessary to allow correct calculation of the confidence intervals (weighting). **When traffic counts are used to infer traffic volumes per stratum, (estimated) road network length by road type should also be considered for calculating the weights.** If no official data on roads lengths are available, it is recommended to request estimates from experts from the relevant administration services.

Statistical analysis techniques and tools should be determined by each Member State and these should be clearly described in the methodological report. Since driver sampling will typically be nested in locations, it is recommended to use appropriate multilevel models for two-stage stratified sampling (level 1: random selection of locations, level 2: random selection of drivers within locations). Approximations assuming simple random sampling can be used as long as results are weighted according to traffic volumes.

3.3 Expected results and data delivery

For each indicator defined below, a point estimate as well as a 95% confidence interval is expected. Results should also include the unweighted number of drivers the result is based on.

The main indicator is the percentage of drivers not using a handheld mobile device across all day times and road types (locations). When optional vehicle types are included in the observations (e.g. trucks, motorcycles or bicycles), the main KPI should only include the three required vehicle types.

Furthermore, KPI values (point estimates and confidence intervals) are also required for each of the three road types.

It is optional to also provide estimates for specific categories of road users and for additional stratifications, if sample sizes are sufficiently large:

- by vehicle type (cars; possibly also light goods vehicles, buses/coaches)
- by time period (e.g. FERSI: weekday peak, weekday off-peak, weekend day)
- by region (if applicable)
- by age group (e.g. FERSI: young (18-24 years), medium (25 to 65 years), older (> 65 years))
- by gender
- by private vs. professional vehicle or driver (e.g. taxi)

It is also recommended to provide estimates for combinations of these, if sample sizes allow this.

For the **data delivery** (minimum and optional data, info on methodology), reference should be made to the Baseline datafiles (aggregate and semi-aggregate datafiles, including a meta-data sheet): **https://baseline.vias.be/en/publications/guidelines/**

4. Requirements for automatic detection via roadside cameras

The EC SWD also allows other observation methods if available, e.g. automatic detection. Smart cameras could automatically detect whether drivers have a mobile phone or device in the hand. This technology seems promising and could have clear advantages as compared to using observers in terms of e.g. reliability, data collection duration, night time use… Possible drawbacks should however be evaluated (e.g. lacking variables). This is new technology on the market and should therefore have been tested and validated before use. For privacy considerations, faces should not be caught on camera.

Example pictures:

The experience with such smart cameras for detecting mobile device use, in enforcement and certainly for research purposes, is still very scarce. Stelling-Kończak et al. (2020) recently performed a study into various enforcement methods for mobile device detection including camera-based enforcement. Some insights and conclusions from their study are:

- *"Cameras can be fixed (unmanned; mostly installed for weeks or months) or mobile (manned, easily movable from location to location; e.g. placed device on the ground), as well as have different levels of intelligence or smartness:*
- *not intelligent: camera makes images of all passing vehicles and these have to be manually checked*
- *partly intelligent: camera makes images of drivers that presumably are using their mobile device (based on intelligent image recognition software) and these have to be manually confirmed*
- *fully intelligent: camera fully automatically identifies drivers using a mobile device (based on intelligent image recognition software) without a need for a manual confirmation.*

Such cameras are still rarely used (for enforcement), and if used, responses indicated that slightly more often mobile cameras are used than fixed, and so far only not or party intelligent cameras. As yet, 'smart', partly automated cameras are only used in a few countries, among which Australia, Saudi Arabia and (on a small scale) the Netherlands. […] The most important reasons mentioned for not using these cameras are: technical and legal barriers and for mobile cameras the high costs.

Technical issues such as polarizer filter and infrared light for night and bad weather observations are often present. Viewing angle positions have to be changed in order to observe either lower vehicles (cars, vans) or higher vehicles (trucks). Not all cameras can be placed on all road types (motorways, urban and rural roads). Mostly they are placed at a height. The steeper the viewing angle, the deeper the view inside the vehicle can be.

In the Netherlands different legislations specify that police are allowed to use these cameras. Based on the first trials with their mobile camera, they conclude that improvements of the technology and legal interpretations are possible (image not always sufficiently clear, not always sufficiently visible if there is a device in the hand).

A general concern about the use of such cameras (mainly in the USA and Australia) is that they are a violation of privacy because an image is taken from the driver (and passengers). Generally this violation of privacy is [or can be] minimised by erasing pictures without an offence immediately. In the Netherlands furthermore passengers are automatically detected and if so, that part of the image is automatically 'masked', so not visible during the manual check/confirmation.

Experiences [with partly automated cameras] are positive, but new technological developments are expected to offer more application possibilities. Thus, artificial intelligence will presumably make it easier to recognise offenders, reducing the time needed to manually check and confirm the images. … The difficulty with … camera-based enforcement is that drivers often try to hold their phones in such a way, for example on their laps or close to the car

door, that they are hard to detect from the outside. … For camera-based enforcement a good view inside passing cars is also important. To achieve this, cameras should be directed downwards at an angle that is as straight as possible. In addition, further improvements are possible in preventing light reflection from windscreens and in the ability to simply combine monitoring of car drivers on the one hand, and truck and bus drivers on the other hand."

Proposed further reading by the authors:
https://roadsafety.transport.nsw.gov.au/stayingsafe/mobilephones/technology.html

When smart cameras are used, in general, the same minimum requirements, expected results and data delivery as for roadside studies with observers apply (see sections "Scope" up to "Data analysis"): with regard to vehicle types (inclusion of 3 vehicle types: cars, vans and buses/coaches), road types (motorway, urban and rural roads) and locations (as random as possible), time of the observation (mixed time intervals at daytime hours on weekdays), sampling (random) and sample sizes (min. 10 locations per road type, min. 2,000 drivers (combined for the 3 vehicle types) and min. 500 drivers per road type).

Member States aiming to use cameras should evaluate the feasibility of these minimal requirements for delivering the KPI for distraction. Some issues are for instance:

- Which national (regional, local) regulations (admission, procedures…) apply to using this method
- What is the reliability of the camera (false negatives, false positives)
- Because data collection is not only required of drivers using a handheld device, minimally the number of all passing relevant vehicles during the observation should be counted. Ideally, data collection (images) includes both drivers with and without a handheld mobile device. This would allow a manual check, although time consuming, and may allow also coding additional variables, such as driver variables.
- Can vehicle type be determined by the image (car, van, bus/coach)? The data collection should include these three vehicle types at a minimum; if other vehicle types are also included the type of vehicle should be coded, because disaggregated results are then needed.
- If cameras made for deployment on overpasses are used, this restricts the random location sampling procedure and may also complicate the inclusion of the three road types.

Member States aiming at using this technology should provide **detailed information in the methodological report** on the technical aspects of the camera, sampling procedures (locations and drivers; vehicle types included), camera accuracy (false positive/negative ratio), data-collection/coding procedures, data quality and correction procedures, data treatment, and data analysis including weighting procedures. As for the roadside studies with observers, the results should be weighted according to traffic volumes by type of road (and other considered stratification variables). The dataset should minimally include datapoints for handheld mobile device users and non-handheld mobile device users, including the minimum measurement session variables in which the observations are nested (location code, road type, date, start and stop time… see section "Data coding").

Within Baseline, 2 MS (Finlands and Lithuania) used camera detection for the KPI distraction. Annex 6 provides a description of the method used in Finland.

Annex 2: EC SWD KPI 5 for driver distraction by handheld devices

European Commission Staff Working Document - EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero, SWD (2019) 238, https://transport.ec.europa.eu/system/files/2021-10/SWD2190283.pdf

Rationale

Driver distraction is considered as a collision factor of growing importance due to the increased use of mobile devices - mainly smartphones - during the past years, and the widespread use of texting applications has aggravated the existing problem of phone calls. This is why the use of a handheld mobile device while driving is proposed as a proxy to assess the driver distraction problem.

Definition of the KPI

Percentage of drivers NOT using a handheld mobile device.

Minimum methodological requirements

Data collection method	Direct observation by trained observers on roadside or from moving vehicles. Other alternatives could be used if available, e.g. automatic detection. To be decided by Member States.
Road type coverage	The indicator should cover motorways, rural non-motorway roads, and urban areas. The results may be presented separately for these three different road types.
Vehicle/user type	Cars, light goods vehicles, buses/coaches as a minimum. Other user types if possible (disaggregated by user type).
Location	Random sample (methodology for Member States to decide).
Time of day	Observations to take place during daylight.

Annex 3: Rationale behind the minimum sample requirements

The methodological guidelines for all KPIs are designed to ensure international comparability between KPI values while taking into account feasibility and affordability. To that end the methodological guidelines have been defined in such a way that accurate and representative results can be obtained for all parameters of interest at a reasonable cost.

Obviously, the larger the sample of observations and locations for observation, the more accurate the KPI estimates for the different strata will be (e.g. a KPI value for a particular type of road, or a particular part of the week). Increasing the number of observations and locations however implies increasing field work costs. Statistically, the required minimum sample size depends mainly on the desired accuracy of the final estimates, for which no absolute value can be determined *a priori*. Therefore, for the main KPI estimates a pragmatic evaluation was made of the expected confidence intervals at different sample sizes and population parameters. Giving priority to feasibility and affordability, as a rule of thumb the minimum total number of observations was set at 2,000, the minimum number of observations for different strata at 500. It was agreed that this should allow to identify statistically meaningful differences between countries at an affordable price. For some countries, this will imply disproportionate sampling of certain strata compared to the distribution of traffic volumes over different strata. This is however required to allow statistically meaningful international comparisons at the level of each of the strata at interest.

The same pragmatic logic was followed for determining the minimum number of 10 locations for observation for each of the required road types of interest. Once again, there is no statistical rationale for determining the required minimum number of locations to ensure representativeness of the observations for the entire country. This mainly depends on the amount of variance between locations and within a country. Giving priority to affordability, a rule of thumb was also used to define the minimum number of locations at 10 per stratum. In order to ensure representativeness for the entire country larger numbers of locations might be required for larger countries. Taking field work costs into account, it was however decided to only identify the minimum requirements and leave decisions on the final number of locations to the discretion of the member states. Equally importantly, in order to ensure representativeness of the measurement locations these should be randomly selected as far as possible.

The main objective in defining the minimum methodological requirements is to keep a balance between affordability of the field work and the requirements to make meaningful international and historical comparisons. Therefore, the emphasis is placed on the minimum requirements that can also be taken into account by smaller countries. It is however of interest to any member state to increase the accuracy of the KPI estimates by boosting the number of locations and the number of observations.

Annex 4: Overview of the main FERSI recommendations

Vollrath, M., Schumacher, M., Boets, S., & Meesman, U. (2019) Guidelines for assessing the prevalence of mobile phone use in traffic. FERSI technical paper. Retrieved from https://fersi.org/wp-content/uploads/2019/11/Guidelines-prevalence-mobile-phone-use.pdf

5. Summary and overview of recommendations

The next three Tables present an overview of the most relevant recommendations related to the estimation of point prevalence of mobile phone use in traffic, distinguishing between BAsic (BA) recommendations for epidemiological studies (Table 2), recommendations for Roadside Observational Studies (ROS; Table 3), and recommendations for Self-Report Studies (SRS) - roadside interview, telephone interview, and online survey(Table 4).The list of recommendations is not aimed to be exhaustive.

Table 2: Summary of BAsic (BA) recommendations for epidemiological studies

BAsic (BA) recommendations for epidemiological studies	
BA1	In all epidemiological studies a thorough control and documentation of possible influencing context factors is needed (e.g., region, road type, traffic density, day of week, time of day, weather).
BA2	In all epidemiological studies a uniform definition of basic tasks should be used.
BA3	The main distraction categories should be assessed in all epidemiological studies. When reporting the results, the full definition of the categories should be given.
BA4	In each epidemiological study, a core set of subject characteristics should be included.

Table 3: Summary of recommendations for Roadside Observational Studies (ROS)

Recommendations for Roadside Observational Studies (ROS)	
ROS 1	To estimate the extent of the problem of mobile phone use in traffic, or to investigate the effect of a campaign or legal measure, observational studies deliver most direct and valid data, and are therefore the preferred methodological option.
ROS 2	To better understand the subjective background of mobile phone use in traffic or to describe the traffic participants' behaviours in more detail, self-report studies are more suitable.
ROS 3	To get a full understanding of the problem of mobile phone use, a combination of ROS and self-report studies is recommended, taking the advantages of each method while compensating for their shortcomings.
ROS 4	When planning an observational study a set of basic methodological aspects should be considered. These should also be documented in the report.
ROS 5	The report should include an exhaustive definition of all variables which are observed or are recorded.
ROS 6	Each observational study requires a thorough training of the observers including a performance test to ensure a high inter-rater reliability.
ROS 7	The rationale for choosing the locations of the observations should be provided.
ROS 8	The basic characteristics of the observation sites should be recorded and included in the report.
ROS 9	Observations should cover the whole daytime and different working days. This can be achieved by selecting at least three time-intervals per day and by doing observations at least from Mondays to Saturdays.
ROS 10	In order to ensure a high quality of the data, observations should only be done if some basic requirements are met (e.g., weather, light, road condition).
ROS 11	External validity of the results requires that the target group is clearly defined.
ROS 12	For car drivers, cyclists and pedestrians the observation study should always include private traffic participants (including those on their way to/from work) as they represent the largest part of traffic.
ROS 13	Target objects should always be randomly selected from all the possible objects at the location where the observation is done.

ROS 14	For the observers, there has to be a clear definition which of the traffic participants belongs to the target group with regard to their characteristics, but also their location.
ROS 15	It is recommended to use tablet computers for the observations.
ROS 16	At the beginning of each observation session, a key set of variables describing the location should be recorded.
ROS 17	When planning the study, the appropriate sample size should be estimated and used to determine the required number of observational sessions, taking the different types of traffic participants (car drivers, cyclists, pedestrians) into account.
ROS 18	When selecting the locations of the observations, it must be ensured that the observations can be conducted safely and inconspicuously.
ROS 19	Each data set (one observation) should include the information about the location and observation time as well as the individual information about the traffic object observed.
ROS 20	Data could be weighted according to traffic volumes at the different locations of observation.
ROS 21	Even more importantly, when the results aim to be representative, a weighing with regard to relevant characteristics of the traffic participants and their mobility should be done.

Annex 5: Summary of on-road observation study requirements and recommendations

SWD minimum requirements	Baseline minimum requirements for on-road observation study	Baseline recommended options for on-road observation study
KPI: % not using a handheld mobile device - Method: observation - Road type: rural, urban, motorway - Vehicle type: min. cars, light goods vehicles and buses/coaches - Locations: random - Time: day	- % no device in the hand + CI aggregated - % no device in the hand + CI per road type (3) - Direct observation by well-trained observers along the road or from moving vehicles - Locations: good view, safe, inconspicuous - Min. sample size: 2,000 observations for the 3 vehicle types together (it is allowed not to report disaggregate data for the three included vehicle types) - Min. 500 observations/road type (3) - Min. 10 different locations/road type - 1 location = min. 1 observation session of min. 30 minutes - Fieldwork organisation: mix of daytime hours: on and off peak on week days, balanced over road types/locations - Not during holidays or heavy winter period - Exclude observations of stopped vehicles, include all other - Traffic counts during sessions (10 min) for weighing data + estimates of road network length (3 types)	- Boost sample size for more accurate estimates and further (crossed) stratifications - Geographical coverage - Complete disaggregated data (crossed strata) - Different types of distraction - Driver characteristics - Exclusion of locations with <10 vehicles/hour is allowed - Time period stratification: week day peak, week day off-peak, weekend day (min. 10 locations per time period; min. 2 locations per time period x road type; min. 500 observations/ time period) - Region stratification (e.g. NUTS1; min. sample size separately) - Vehicle type stratification (min. sample size separately) - Use available traffic volume data to sample locations and to weigh data according to included stratifications

Annex 6: Description of the use of camera detection in Finland

The measurements were made with a combination of two cameras: camera 1 detected the licence plates from passing vehicles. Camera 2, which was a higher-resolution device intended to photograph the driver, was triggered whenever camera 1 detected a licence plate in its field of view. A polarisation shield was installed to camera 2 to minimise the reflections from the windshield of the vehicle. The equipment was adjusted so that it would take one picture of each passing vehicle. The reason for automatising the data collection was to enable larger sample sizes to be obtained from the traffic stream with reasonable resources. In addition, the reliability of detecting phone use and other KPIs were assumed to be higher from a static picture than from a live observer at the side of the road. The camera used to recognise the license plates was assessed to function reliably also in situations when the licence plate is dirty or foreign. The equipment was battery-powered with the battery located on the ground next to the equipment with the cameras.

A sign including basic information on the measurements was attached near the equipment. The sign also included an internet link with access to the privacy statement. The pictures taken during the measurements will be deleted after the analysis is finalised.

Some examples of locations where our camera system was in use are presented in Figure 21, Figure 22 and Figure 23.

Figure 21. Example of location where the cameras were installed in a tree near the road.

Figure 22. Example 2 of location where cameras were installed in a pole with several other already existing equipment.

Figure 23. Example 3 of location where cameras were installed near road signs and in a pole with some other equipment.

The processing of pictures was done manually. However, an annotation tool was developed to speed up the otherwise labour-intensive process. The tool consisted of a graphic interface with keyboard shortcuts for the

required classifications. The tool was created with Python and the open source QT5 software library. The identification of the vehicle type was done by the rater based on the pictures alone. The projection of the camera taking pictures of the cockpit was optimised to take pictures of passenger cars, hence a higher share of pictures of trucks and buses were unusable compared to passenger cars due to the glare from the windshield or interior being too dark.

The total sample included 18.259 pictures. From this sample 2.508 pictures were duplicates or otherwise erroneous and/or unusable (i.e. driver not clearly visible e.g. due to the glare, rain or too dark interior), and 2.056 pictures were too unclear to reliably identify the mobile phone usage. The remaining sample was 13.695. This final sample covered 70.3% of the passing vehicles (calculated over all measuring points (27/30) with nearby loop detector calculating the total traffic count).

One person analysed the whole dataset according to the pre-defined criteria. This analysis was used to calculate the weighted KPI values (reported to the coordinator by using the excel template). In addition, an interrater reliability check was done to a smaller sample of pictures. In total, 1.394 of pictures (slightly over 10 % of final sample) were analysed by two extra persons (three persons in total). The pictures for this additional check were selected randomly from the whole dataset so that all road types were equally covered.

This reliability check showed that identification of phone usage is challenging and not always indisputable. From the analysed sample, all raters agreed that 1,29% of drivers were using mobile phone while driving. The estimated mobile phone usage by rater varied between 1,94–2,87%. In total, 3,80% of drivers were estimated to use a mobile phone based on at least one rater.

We did not employ an "unclear" category for the annotation process, as the amount of images forced us to be economical in the number of classifications or "tags" for each image. In short, the vehicle types were easily seen from the images, whereas phone use had some ambiguity due to the (relatively) low resolution and dynamic range of the camera sensor. Seatbelt usage proved to be impossible for this particular reason – in some images the seatbelt could be seen, but it was impossible to confirm the absence of the seatbelt. For phone use it was easier to recognize that the driver was *not* holding a phone, with some ambiguity in the positive classification due to arm position etc. While we cannot provide a quantitative estimate for the amount of ambiguous classifications, overall we consider that amount to be low for the KPIs reported.

In general, we think that this method was rather suitable for this purpose. Analysis of pictures (1 picture per vehicle) requires significantly less resources to analyse the data compared to video footage. In addition, compared to the onsite observations, pictures allow assessments to be done by several persons and looking at the situation for longer than the time the vehicle is passing by the location. However, we agree that our method was not either perfect. In the future, some development work could be done, for example, to improve the quality of the pictures and to improve the coverage of the passing by traffic stream.