Baseline

Baseline report on the KPI Safety Belt and Child Restraint Systems

January 2023

Baseline

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

baseline.vias.be

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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	February 17, 2020	First draft version of format
2.0	April 29, 2022	Second draft version, using data collected in 2021
2.1	July 29, 2022	Updated second draft version
2.2	August 23, 2022	Updated second draft version
2.3	September 15, 2022	Updated second draft version
2.4	November 28, 2022	Updated second draft version
2.5	December 21, 2022	Updated second draft, including latest data
2.6	December 22, 2022	Included CRS data Ireland
2.7	Januari 20, 2023	Final draft, including latest feedback and corrected results of Belgium & Spain
2.8	January 24, 2023	Final draft, including feedback Germany

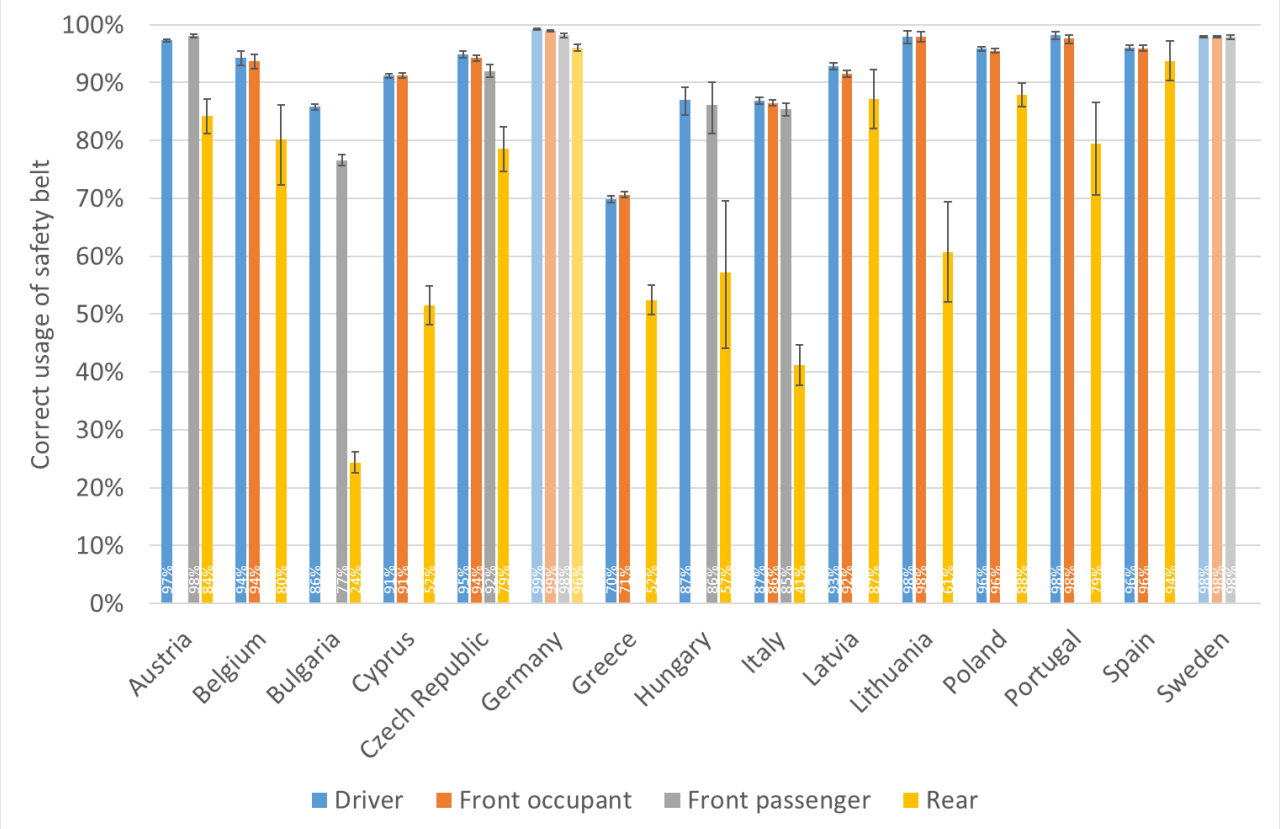
Contents

Executive summary

This document reports information on the KPI safety belts and child restraint systems (CRS), which is defined as the percentage of vehicle occupants using the safety belt or child restraint system correctly. By preventing or reducing injuries caused by crashes, correct safety belts and CRS usage is indicative for road safety. Seventeen Member States provided data on this KPI, and the figure below provides a comparison for occupants of passenger cars during weekday/daytime. It breaks down the share of correct usage of seat belts by position in the vehicle (but some positions are only delivered by some Member States). Germany and Sweden are marked differently as they selected measurement locations non-randomly, as did Denmark and the Netherlands, but the latter two are not in the figure as they provided different aggregates: regarding all days of the week combined, 97% of the drivers and 89% of the rear passengers in Denmark used the safety belt correctly, and 96% of all occupants combined in the Netherlands. The share of rear occupants correctly using a safety belt shows to be lower than that of any front occupants, which shows that a breakdown between front and rear occupants provides additional insight.

Included in the report are also the share of children (correctly) using CRS, and a breakdown by road type. The share of children (correctly) using CRS according to roadside observations starts at just above 35%, hence it is recommended to keep this KPI. The breakdown by road type shows that the share of correct seat belt usage by drivers and rear occupants in passenger cars is highest on motorways and least on urban roads.

Figure 1. Percentage of passenger car occupants correctly using the safety belt during weekday/daytime by position in the vehicle



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 Safety Belt and Child Restraint Systems (CRS)***. This KPI has been defined as:

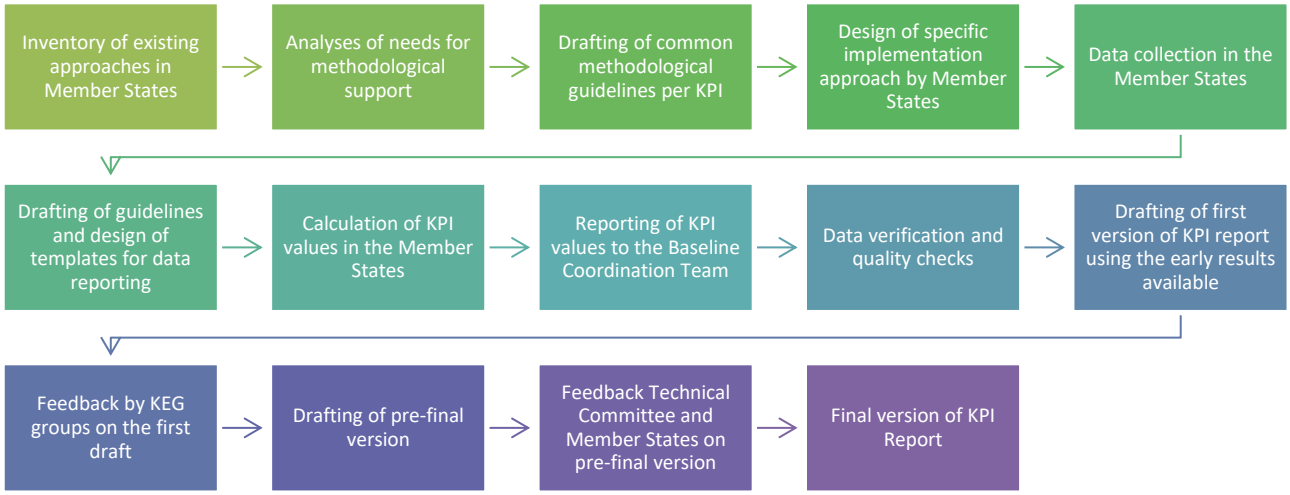
"Percentage of vehicle occupants using the safety belt or child restraint system correctly"

2 Methodology

2.1 Overall process

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

Figure 2. 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 safety belt and CRS indicator consisted of the following persons:

- Philip Temmerman, Vias institute (Belgium),
- Philippe Lesire, LAB (France),
- Alexandra Laiou, 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

Methodological guidelines – KPI safety belts and child restraint systems

Version 3.2, August 26, 2021

The methodological guidelines of the KPI safety belt and CRS can be accessed from the Baseline website via https://www.baseline.vias.be/en/publications/methodological-guidelines-kpi/. 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.

			Front occupant				Rear passenger			
Road Type	Time period	Vehicle Type	N-front	KPI-front	CI (95%) - lower bound	CI (95%) - upper bound	N-rear	KPI-rear	CI (95%) - lower bound	CI (95%) - upper bound
motorways	*(all periods)*	passenger car	1488	99,4%	99,0%	99,8%	291	96,2%	94,0%	98,4%
rural roads	*(all periods)*	passenger car	2085	95,6%	94,7%	96,5%	627	83,1%	80,2%	86,0%
urban roads	*(all periods)*	passenger car	1706	92,8%	91,6%	94,0%	377	83,6%	79,8%	87,3%
(all roads)	**weekday/daytime**	passenger car	2084	92,0%	90,9%	93,2%	442	78,5%	74,7%	82,3%
(all roads)	**weekend/daytime**	passenger car	3195	98,2%	97,7%	98,6%	853	90,2%	88,2%	92,2%
(all roads)	*(all periods)*	**passenger car**	5279	95,8%	95,2%	96,3%	1295	86,2%	84,3%	88,1%

2.3 Definition of correct safety belt and CRS use

Traffic safety is determined by both the risk of getting involved in a crash and the risk of subsequently getting injured. While preventing a crash automatically prevents from injuries, the former may not always be achievable, and thus other measures to prevent or reduce injuries in a crash are important. Among the most effective ones are restraint systems, which are designed to prevent or minimize injuries in case of a crash (European Commission, 2022). This makes the use of restraint systems a factor positively contributing to traffic safety.

Restraint systems are safety measures that are not aimed at preventing the occurrence of vehicle crashes but at minimizing injuries sustained by a crash. More precisely, as summarized by FIA (Foundation for the Automobile and Society, 2009), they should

- "Reduce the risk of contact with the interior of the vehicle or reduce the severity of injuries if this occurs;
- Distribute the forces of a crash over the strongest parts of the human body;
- Prevent the occupant from being ejected from the vehicle in an impact;
- Prevent injury to other occupants (for example in a frontal crash, unbelted rear seated passengers can be catapulted forward and hit other occupants)."

We distinguish two kinds of restraint systems, namely safety belts and child restraint systems (CRS). Safety belts are not matched to the stature of small children and therefore not fit for their protection: a reduction of about 60% in the risk of injuries is gained when correctly restraining a child in an appropriate CRS compared to restraining with a seat belt (Høye, 2013). The CRS that is appropriate for a child depends on the child's size and weight: integral systems, with straps as their own belt system, are designed for babies and toddlers, and non-integral systems, that guide the seat belt over the child's body, are suited for larger children (European Commission, 2022). Correct use of an appropriate CRS is important for not reducing or countering the system's safety effectiveness (Brown and

Bilston, 2007; Kapoor et al., 2011; Lesire et al., 2007). Possible misuses of CRS include wrong fixation of the CRS to the vehicle and wrong fixation of the child to the CRS, and possible misuses of safety belts include putting part of the belt behind the back or under the arm (Temmerman et al., 2021). Correct use of safety belts or CRS is here understood as the complement of "no use" and "misuse", and the KPI for safety belt and CRS use has been defined as "the percentage of vehicle occupants using the safety belt or child restraint system *correctly*."

2.4 Minimum and optional requirements for the KPI safety belt and CRS within Baseline

The minimum requirements for the KPI safety belt and CRS 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.

Table 2. Minimum requirements and optional additions for the KPI Safety belt and CRS

	Minimum requirement	Optional additions
KPI definition	• Percentage of correct use of safety belt by passenger car front occupants • Percentage of correct use of safety belt by passenger car rear occupants • Percentage of correct use of CRS • Unweighted number of drivers the result is based on	• The equivalent percentages and unweighted number of drivers in goods vehicles
Method	• Direct observation or use of camera	
Conditions	• Reasonably good weather conditions • In spring or autumn	• Bad weather conditions • In summer or winter
Sample size	• Min 2000 observed vehicles for seat belt use • Min 500 observed vehicles per road type for seat belt use • Min 200 observed vehicles with children for CRS use • Min 50 observed vehicles with children per road type for CRS use • Min 10 locations per road type • The proportion of observations at each of the three road types should be at least 20%	*If optional vehicles are included, the minimum sample requirements are per vehicle type in order to be considered in the national KPI tables*
Locations	• Random selection	• Stratification by Regions
Vehicle types	• Passenger cars	• Goods vehicles
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	• Weekdays • Weekend • Daylight hours	

3 Results

3.1 Overall results

The Member States that provided data by the time of writing this report are Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Spain and Sweden.

3.1.1 Metadata

An overview per country of the data collection method and conditions including time of the year when data was collected is provided in Table 3. Data was collected through roadside observations by researchers by all countries that provided results on safety belts and CRS use, except in the Netherlands where the measurements at motorways were done from moving vans that drove along with the traffic. Most countries collected data under good weather conditions, only Germany and Sweden did so under unobserved weather conditions, where Sweden noted that the weather is often quite stable during autumn. Observations in most countries took place during spring or autumn, six also observed during summer, and only Belgium exclusively observed during summer. The indicators "driver", "front passenger", "front occupant" and "rear occupant" refer to the percentage of drivers, front passengers, front occupants (both driver and passengers) and rear occupants correctly using a safety belt, and the indicators "CRS" and "CRS in-vehicle" refer to the percentage of children (correctly) using CRS according to roadside observations respectively in-vehicle inspection. It should be kept in mind that correct CRS usage is much harder to judge by roadside observation and by some Member States may just have been an observation of use or no use; this is at least the case for Austria and Belgium, which is why "correct" has been placed in parentheses. All countries provided the indicators "driver" and "rear occupant", either "front passenger" or "front occupant", and at least one indicator on CRS use, except Denmark that provided "driver" and "rear occupant", Greece that provided no indicators on CRS use due to low samples, the Netherlands that provided correct safety belt use by front and rear occupants combined and the indicator "CRS", and Sweden that provided no indicators on safety belt use by rear passengers and no indicators on CRS use. Not included in the table is Ireland, which at the time of writing had only provided results on CRS in-vehicle inspection. Reported here are their results over the observation period 01/01/2022 – 16/12/2022.

Table 3. Methodology

	Data collection method	Weather conditions	Observation period	Indicators
Austria	roadside observations by researchers	good weather conditions	01/05/2021 - 30/07/2021	driver, front passenger, rear occupant, CRS, CRS in-vehicle
Belgium	roadside observations by researchers	good weather conditions	25/05/2022 - 19/06/2022	driver, front occupant, rear occupant, CRS
Bulgaria	roadside observations by researchers	good weather conditions	02/10/2021 - 07/11/2021, 14/03/2021 - 31/05/2022	driver, front passenger, rear occupant, CRS, CRS in-vehicle
Cyprus	roadside observations by researchers	good weather conditions	01/09/2022 - 13/10/2022	driver, front occupant, rear occupant, CRS
Czech Republic	roadside observations by researchers	sunny/cloudy weather	01/09/2021 - 20/10/2021	driver, front passenger, rear occupant, CRS
Denmark	roadside observations by researchers	unregistered, but avoiding heavy rain recommended	18/05/2020 - 14/06/2020	driver, rear occupant
Germany	roadside observations by researchers	all weather conditions; no inclusions/exceptions defined	06/2021, 09/2021	driver, front passenger, rear occupant, CRS
Greece	roadside observations by researchers	good weather conditions	28/03/2022 - 09/07/2022	driver, front occupant, rear occupant

Hungary	roadside observations by researchers	good weather conditions	25/7/2022 - 30/10/2022	driver, front passenger, rear occupant, CRS
Italy	roadside observations by researchers	good weather conditions	16/05/2022 - 12/06/2022	driver, front passenger, rear occupant, CRS, CRS in-vehicle
Latvia	roadside observations by researchers	good weather conditions	09/09/2021 - 01/11/2021	driver, front occupant, rear occupant, CRS in-vehicle
Lithuania	roadside observations by researchers	good weather conditions	14/09/2021 - 17/10/2021	driver, front occupant, rear occupant, CRS, CRS in-vehicle
Netherlands	observations from roadside and while moving along with traffic	mostly dry, sometimes rain	07/09/2021 - 17/09/2021	front and rear occupant combined, CRS
Poland	roadside observations by researchers	mostly sunny, some clouds and also wind	21/09/2021 - 06/11/2021, 30/04/2022 - 24/05/2022	driver, front occupant, rear occupant, CRS
Portugal	roadside observations by researchers	not raining days	10/10/2021 - 17/11/2021	driver, front occupant, rear occupant, CRS in-vehicle
Spain	roadside observations by researchers	good weather conditions	19/10/2021 - 23/11/2021	driver, front occupant, rear occupant, CRS, CRS in-vehicle
Sweden	roadside observations by researchers	not known, weather often quite stable	31/08/2020 - 27/09/2020	driver, front occupant

The disaggregations of the data obtained through roadside observations by country is presented in table 4. Most countries provided data covering weekdays and weekend-days during daytime hours, only Germany and Sweden made observations exclusively during weekdays, and Denmark and the Netherlands provided results on weekdays and weekend-days combined. Data for each of the road types motorway, rural road and urban road were provided by each country, except for Latvia which does not have motorways and therefore could not provide data for this particular road type. The Netherlands provided results for rural and urban roads combined, and Denmark and Sweden did not provide results per road type but for all road types combined. Spain also provided data on expressways, which are roads that meet most but not all requirements of motorways[1], and on which a considerable amount of travelling in Spain also takes place. Data regarding passenger cars was provided by all countries, some also provided data on goods vehicles. Disaggregation of the data into age groups was provided by Austria, all other Member States provided the data for all ages combined. Disaggregation of the data by gender was provided by Austria, the Czech Republic, Portugal and Spain, all other Member States provided the data for both genders combined.

Table 4. Disaggregations of KPI data regarding roadside observations

	Data collection timeslots	Road type	Vehicle types observed	Age groups observed	Genders observed
Austria	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	0-14, 15-17, 18-24, 25-64, 65+, all ages	female, male, both genders
Belgium	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car	all ages	both genders

[1] One notable difference with motorways in Spain is that cyclists over the age of 14 may ride on the shoulders of these roads, unless prohibited by signage for reasons of road safety.

Bulgaria	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car	all ages	both genders
Cyprus	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	both genders
Czech Republic	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	female, male, both genders
Denmark	weekday/daytime and weekend/daytime combined	all roads combined	passenger car, goods vehicle	all ages	both genders
Germany	weekday/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	both genders
Greece	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	both genders
Hungary	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car	all ages	both genders
Italy	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car	all ages	both genders
Latvia	weekday/daytime, weekend/daytime	rural roads, urban roads	passenger car	all ages	both genders
Lithuania	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car	all ages	both genders
Netherlands	weekday/daytime and weekend/daytime combined	motorways, rural and urban roads combined	passenger car, goods vehicle	all ages	both genders
Poland	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	both genders
Portugal	weekday/daytime, weekend/daytime	motorways, rural roads, urban roads	passenger car, goods vehicle	all ages	female, male, both genders
Spain	weekday/daytime, weekend/daytime	motorways, expressways, rural roads, urban roads	passenger car	all ages	female, male, both genders
Sweden	weekday/daytime	all roads combined	passenger car	all ages	both genders

Regarding CRS in-vehicle inspection, each Member State that collected data did so during both weekdays and weekends during daytime, and at each road type, except Latvia which does not have motorways and only collected at urban and rural roads, and Ireland which provided results for all road types combined. It should be noted that Portugal collected all data at locations on urban roads, and that their data on rural roads and motorways refers to drivers who had driven on rural roads and motorways during the same trip, as assessed by questionnaire. The

inspected vehicles were passenger cars only. Austria and Spain also disaggregated their data to age group and trip purpose.

The method of sampling and the number of measurement locations for roadside observations are presented in table 5, as are the number of observed drivers, front and rear occupants, and children[2] in passenger cars. Denmark is not included since it did not provide these numbers, only the number of observed vehicles per road type: 5784 on motorways, 11744 on rural roads, and 15165 on urban roads. Measurement locations in most Member States were selected through simple or stratified random sampling. Observations in Denmark were made at locations in use since 2005 selected to detect changes, in Germany they were made at locations selected non-randomly for good and safe observability and sufficient traffic, in the Netherlands they were made at locations used in previous measurements in 2018 and 2020, and in Sweden they were made at nine non-randomly selected larger roundabouts placed in city outskirts or in semi-central areas, where traffic from urban and rural areas often are mixed. It may be argued how well results from non-randomly selected locations compare to those from randomly selected ones, taking into account how the locations were chosen. For consistency we will mark results obtained from non-randomly selected locations differently from those obtained from randomly selected locations. Since Germany and Sweden made no observations during weekend days, table 5 contains no number of observations during all days combined for Germany and Sweden. The minimum requirement of 10 locations per road type was met in all cases, except motorways and rural roads in Germany for which there are only 6 locations per road type included, motorways in Latvia since Latvia has no motorways, motorways and rural and urban roads in the Netherlands for which there are only 8 and 7 respectively, and in Sweden for reasons already mentioned. The minimum requirement of 2000 observed vehicles in total and 500 per road type for seat belt use in passenger cars is met by all countries for as far as their disaggregation by road type allows. The same recommended number of observations for goods vehicles, for which observation was optional, is also met by Austria, Cyprus, Germany, Greece and Poland, but not entirely by the Czech Republic and Portugal that also observed goods vehicles, so this smaller than recommended sample size should be taken into account when making comparisons. Spain also observed at 30 locations near expressways (not included in the table), where 2877 passenger cars were observed during weekdays and 2308 during weekends.

Table 5. Sampling method and number of measurement locations and observed drivers, front passengers, front and rear occupants, and children regarding roadside observations of passenger cars

				Number of locations	Number of observations				
			Sampling		driver	front passenger	front occupant	rear occupant	child
Austria	**weekday**	**all roads**	stratified random	103	28952	6520	-	583	1050
	weekend			44	6968	2743	-	334	492
	all days	**motorways**		22	6788	1655	-	153	239
		rural roads		35	11303	2900	-	273	507
		urban roads		54	17829	4708	-	491	796
Belgium	**weekday**	**all roads**	stratified random	125	8399	-	11099	497	144
	weekend			125	8090	-	11474	824	203
	all days	**motorways**		20	2354	-	3211	184	37
		rural roads		21	3121	-	4377	241	53
		urban roads		84	11014	-	14985	896	257
Bulgaria	**weekday**	**all roads**	simple random	30	17638	6924	-	2044	504
	weekend			30	15296	8111	-	2578	792
	all days	**motorways**		10	11495	5924	-	1890	450
		rural roads		10	10966	5421	-	1664	428
		urban roads		10	10473	3690	-	1068	418

[2] Drivers and front and rear passengers are occupants in the age category 15+, children are occupants in the age category 0-14.

Cyprus	**weekday**	**all roads**	stratified random	40	18078	-	22404	875	216
	weekend			10	1819	-	2296	141	46
	all days	**motorways**		13	6352	-	8086	359	77
		rural roads		13	5009	-	6258	275	52
		urban roads		14	8536	-	10356	382	133
Czech Republic	**weekday**	**all roads**	simple random	30	7078	2084	9162	442	468
	weekend			30	6120	3195	9315	853	863
	all days	**motorways**		10	3150	1488	4638	291	234
		rural roads		10	5055	2085	7140	627	661
		urban roads		10	4993	1706	6699	377	436
Germany	**weekday**	**all roads**	Non-random but chosen to give representative samples	52	18586	6104	24690	3680	5765
	weekend			-	-	-	-	-	-
	all days	**motorways**		6	-	-	-	-	-
		rural roads		6	-	-	-	-	-
		urban roads		40	-	-	-	-	-
Greece	**weekday**	**all roads**	stratified random	102	22519	-	28067	1467	302
	weekend			28	6535	-	8321	443	76
	all days	**motorways**		32	6865	-	8662	395	66
		rural roads		49	9990	-	12264	670	124
		urban roads		49	12199	-	15462	845	188
Hungary	**weekday**	**all roads**	stratified random	18	2202	752	-	191	200
	weekend			12	1275	742	-	244	242
	all days	**motorways**		10	1088	507	-	130	144
		rural roads		10	1142	519	-	166	132
		urban roads		10	1247	468	-	139	166
Italy	**weekday**	**all roads**	stratified random	54	11253	3927	15180	794	364
	weekend			36	8055	4126	12181	1107	588
	all days	**motorways**		18	5688	3078	8766	854	350
		rural roads		18	6939	2636	9575	540	254
		urban roads		18	6681	2339	9020	507	348
Latvia	**weekday**	**all roads**	stratified random	42	7008	-	8744	166	-
	weekend			17	1781	-	2512	76	-
	all days	**motorways**		-	-	-	-	-	-
		rural roads		13	2863	-	3727	74	-
		urban roads		31	5926	-	7529	168	-
Lithuania	**weekday**	**all roads**	stratified random	30	4622	-	5999	297	204
	weekend			30	2884	-	4410	400	275
	all days	**motorways**		10	2123	-	3056	182	134
		rural roads		10	1263	-	1885	167	76
		urban roads		10	4120	-	5468	348	269
Netherlands	**weekday**	**all roads**	non-random	-	-	-	-	-	-
	weekend			-	-	-	-	-	-
	all days	**motorways**		8	3435	-	-	-	-
		rural and urban roads		7	5543	-	-	-	-
Poland	**weekday**	**all roads**		61	26651	-	34327	1948	1776

	weekend		stratified random	37	17559	-	25761	2569	1985
	all days	**motorways**		28	18620	-	25602	1668	1258
		rural roads		27	12659	-	17098	1472	1225
		urban roads		21	12931	-	17388	1377	1278
Portugal	**weekday**	**all roads**	stratified random	55	3329	-	4333	244	-
	weekend			32	1591	-	2402	231	-
	all days	**motorways**		24	825	-	1174	110	-
		rural roads		19	1636	-	2278	156	-
		urban roads		23	2459	-	3283	209	-
Spain	**weekday**	**all roads**	stratified random	130	12082	-	15534	376	849
	weekend			130	9577	-	13822	585	1111
	all days	**motorways**		10	1923	-	2646	85	100
		rural roads		25	3515	-	4788	156	226
		urban roads		65	11036	-	14492	518	1307
Sweden	**weekday**	**all roads**	Non-random but chosen to include local and long distance traffic	9	25691	6930	32621	-	-
	weekend			-	-	-	-	-	-
	all days	**motorways**		-	-	-	-	-	-
		rural roads		-	-	-	-	-	-
		urban roads		-	-	-	-	-	-

The method of sampling, the number and type of measurement locations and the number of observations for CRS in-vehicle inspection are presented in table 6. Measurement locations in all Member States were selected through simple or stratified random sampling. One exception is Ireland, where results are from events held throughout the country to check correct CRS usage, and which is not included in table 6 as their results are for all periods and road types combined. They made 4785 observation at 142 locations. Spain also made 48 observations at 2 locations near expressways. The measurement locations were mostly parking lots, rest areas, schools and shopping centres or malls, but also kindergartens, playgrounds, parks, petrol stations and sport centres. The minimum requirement of 2 locations per road type was met in all cases, except motorways in Latvia since Latvia has no motorways, and motorways and rural roads in Portugal for reasons already mentioned. The minimum requirement of 200 observed vehicles with children in total and 50 per road type is met by all countries for as far as their disaggregation by road type allows, except for Spain where 40 to 42 observations were made for each of the required road types, although a considerable amount of travelling in Spain also takes place on expressways for which observations have also been provided.

Table 6. Sampling method and number of measurement locations and observed children regarding in-vehicle inspection of passenger cars on the correct use of CRS

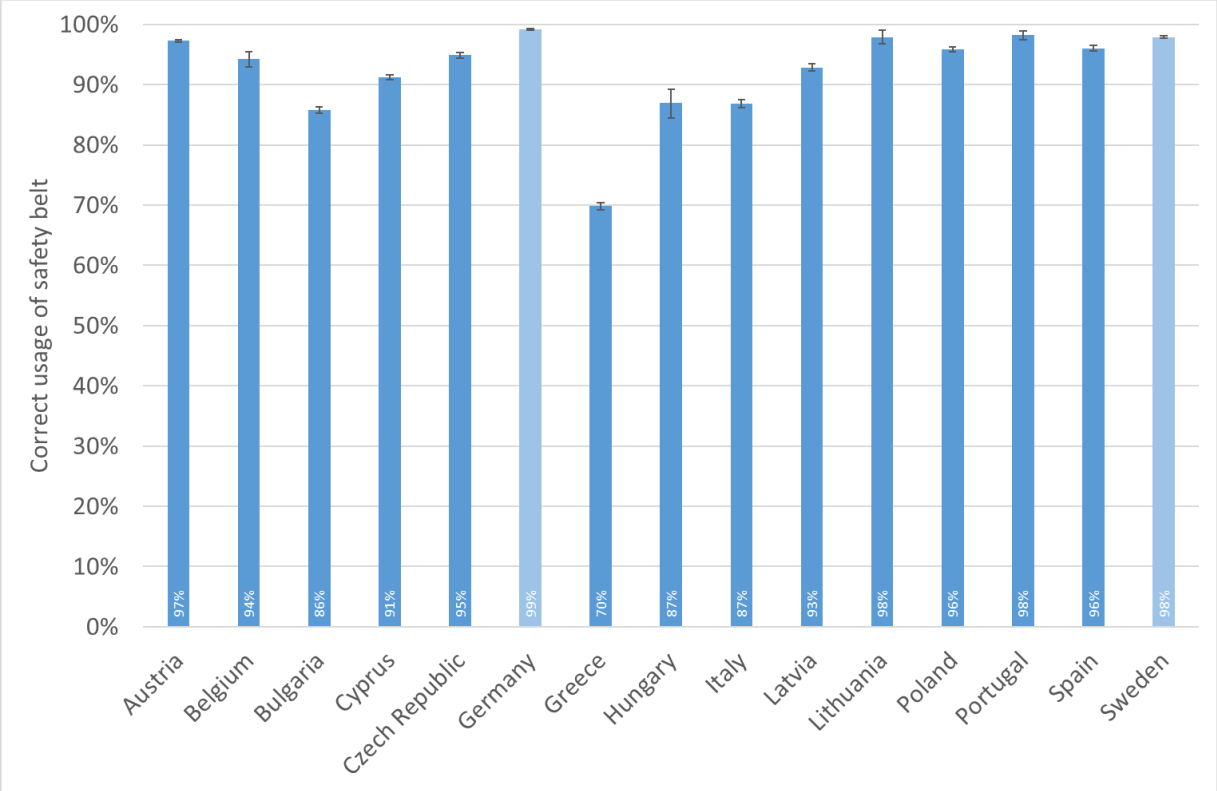
			Sampling	Location type	Number of locations	Number of observations
Austria	**weekday**	**all roads**	stratified random	rest areas, service stations, parking lots of a playground, a zoo, an amusement park, a shopping center	7	88
	weekend				7	123
	all days	**motorways**			3	50
		rural roads			2	85
		urban roads			2	76
Bulgaria	**weekday**	**all roads**	simple random	kindergartens, parking lots, playgrounds, rest areas, schools,	21	129
	weekend				20	88
	all days	**motorways**			5	83
		rural roads			5	53

		urban roads		shopping malls (big and small)	21	81
Italy	**weekday**	**all roads**	stratified random	parking lots, rest areas	29	426
	weekend				23	302
	all days	**motorways**			8	182
		rural roads			11	213
		urban roads			12	333
Latvia	**weekday**	**all roads**	stratified random	events centres, parking lots, petrol stations, shopping centres	21	180
	weekend				7	72
	all days	**motorways**			-	-
		rural roads			10	127
		urban roads			13	125
Lithuania	**weekday**	**all roads**	stratified random	parking lots, rest areas	10	159
	weekend				9	100
	all days	**motorways**			8	69
		rural roads			6	62
		urban roads			5	128
Portugal	**weekday**	**all roads**	stratified random	parks, schools, sport centres	15	525
	weekend				5	135
	all days	**motorways**			-	67
		rural roads			-	174
		urban roads			19	660
Spain	**weekday**	**all roads**	stratified random	schools, shopping centers, sports centers, petrol stations	9	84
	weekend				9	86
	all days	**motorways**			2	42
		rural roads			2	40
		urban roads			3	40

3.1.2 National KPIs on safety belt and CRS use

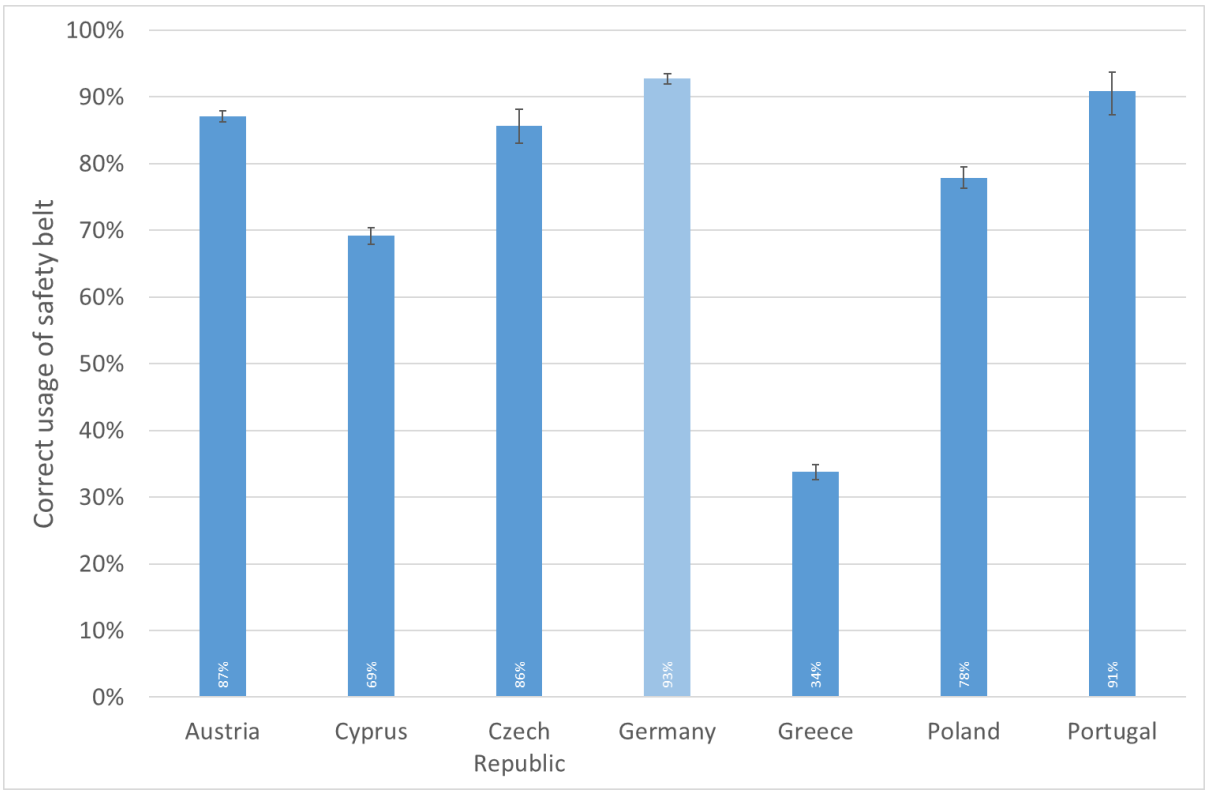
The national KPI values for the correct safety belt use by drivers in passenger cars during weekday/daytime is presented in figure 3. Most Member States provided this KPI. A breakdown by position in the vehicle will be provided further on. The figure contains no values for Denmark and The Netherlands, because theirs were based on measurements during weekdays and weekend-days combined. We refer to Annex 1 for their values. The share ranges from 70 ± 1 percent in Greece to 99.2 ± 0.2 percent in Germany.

Figure 3. Percentage of drivers in passenger cars correctly using safety belt during weekday/daytime



The same KPI but for goods vehicles is presented in figure 4. It contains values for the Member States that provided data on goods vehicles, i.e., Austria, Cyprus, the Czech Republic, Germany, Greece, Poland and Portugal, except Denmark and the Netherlands as they provided only values regarding weekdays and weekend-days combined. We refer to Annex 1 for those results. The share ranges from 34 ± 1 percent in Greece to 93 ± 1 percent in Germany.

Figure 4. Percentage of drivers in goods vehicles correctly using safety belt during weekday/daytime



The percentage of children in passenger cars (correctly) using CRS during weekday/daytime according to roadside observation and according to in-vehicle inspection is presented in figures 5 respectively 6. Austria, Bulgaria, Italy, Lithuania and Spain provided both KPIs. Figure 5 contains no values for the Netherlands and figure 6 contains no values for Ireland as both only provided results for weekdays and weekend-days combined, we refer to Annex 1 for their values. The percentage in Austria based on roadside observations at 99 ± 1 percent is very high, its value based on in-vehicle inspection is notably lower and lies at 73 ± 9 percent. The value recorded in Lithuania based on roadside observations is also higher than that based on in-vehicle inspection, but not greatly. Both in Bulgaria and Italy the values based on roadside observations are notably lower than those based on in-vehicle inspection. The share based on roadside observation ranges from 36 ± 5 percent in Spain to 99 ± 1 percent in Austria and 99 percent in Germany, and that based on in-vehicle inspection ranges from 53 ± 17 in Spain to 92 ± 3 in Portugal. The shares based on in-vehicle inspection in all but Portugal are not meaningfully different from one another.

Figure 5. Percentage of children in passenger cars (correctly) using CRS during weekday/daytime according to roadside observation

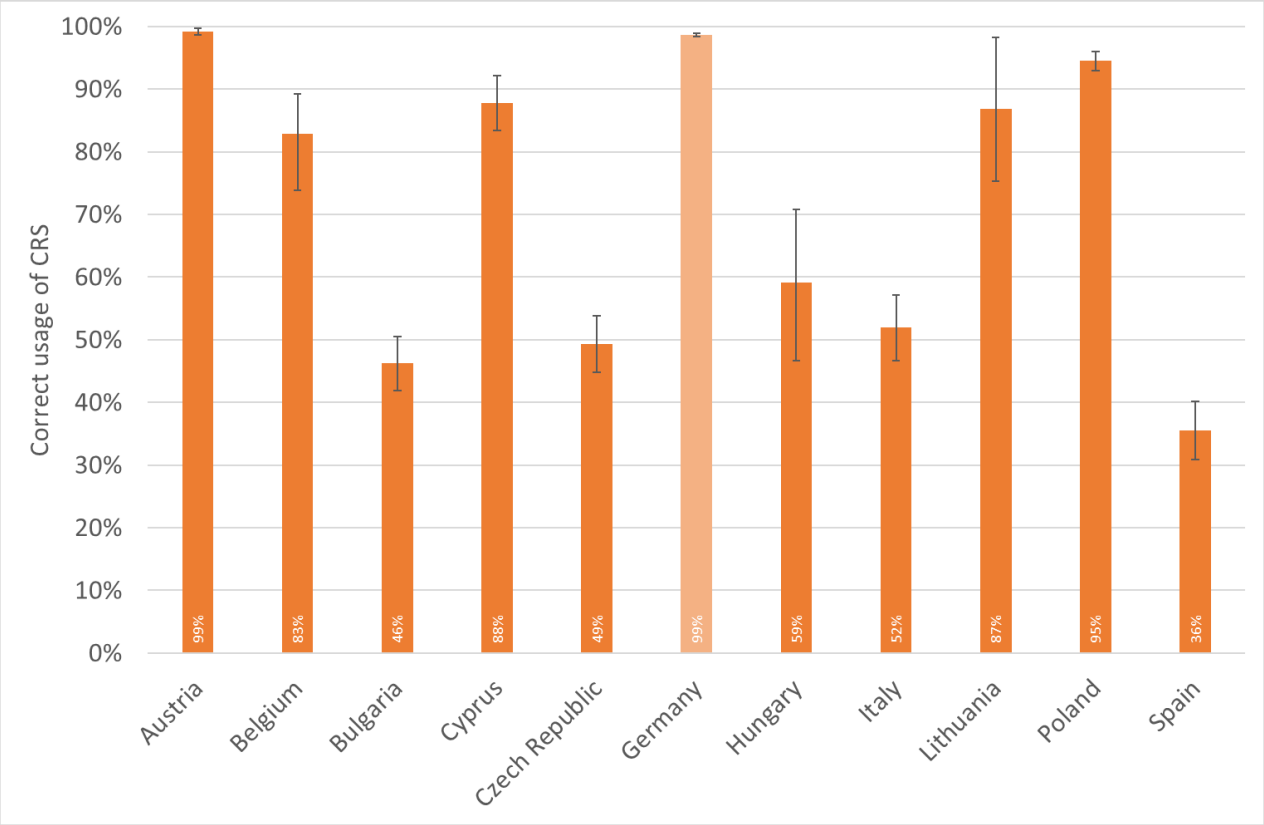
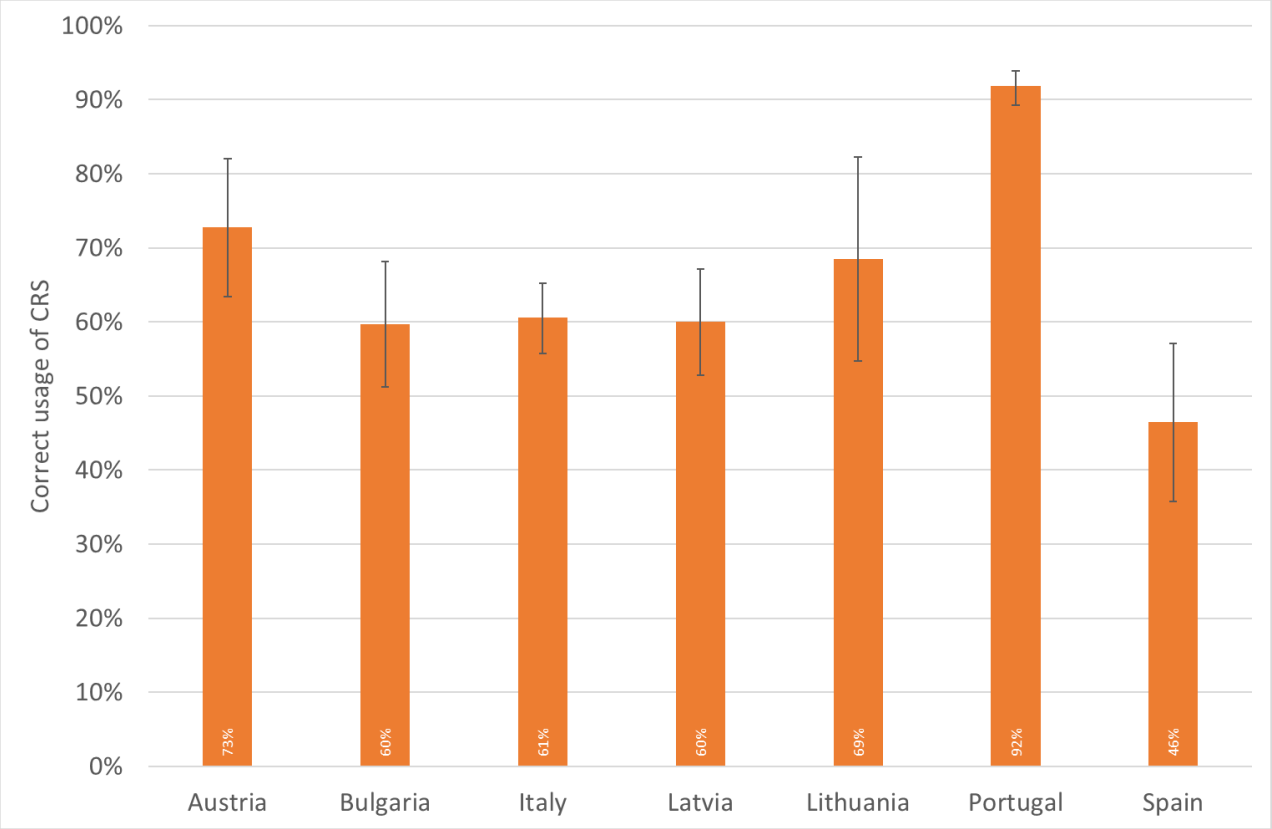


Figure 6. Percentage of children in passenger cars correctly using CRS during weekday/daytime according to in-vehicle inspection



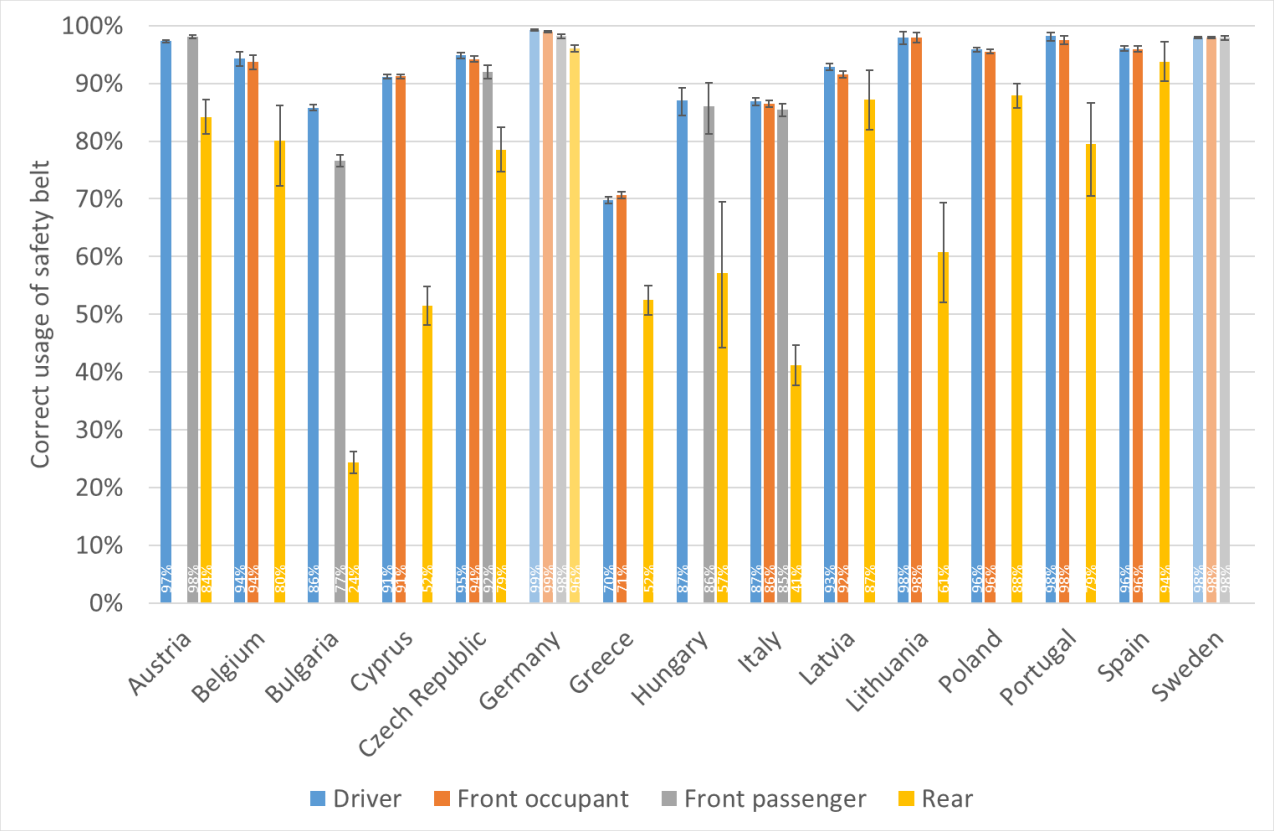
Previous studies on safety belt use include that by ETSC (2022), which considers for several EU Member States the seatbelt wearing rates in front and rear seats of cars and vans in 2010 and 2020.

3.2 Breakdown by position in the vehicle

Results on the use of seat belts by position in the vehicle will be presented initially for the minimum required disaggregations, i.e., for passenger cars only. This is because these were provided by most Member States that delivered data on safety belt use. Results for the optional goods vehicle type were provided by fewer Member States that delivered data on safety belt use.

The percentage of front and rear occupants of passenger cars correctly using a safety belt is presented in figure 7. The percentages for driver and front passenger have also been included, because some Member States provided the percentage for front occupants (i.e., including drivers) and others for front passengers (i.e., excluding drivers). We observe that in each Member State that provided data regarding both front and rear occupants the share of rear occupants correctly using a safety belt is lower than that of any front occupants, whether they be drivers or passengers. It ranges from 24 ± 2 percent in Bulgaria to 96 ± 1 in Germany. As far as can be said based on the available data, the share of drivers and front occupants correctly using a safety belt is not notably different from one another, but that of drivers and front passengers in Austria, Bulgaria, the Czech Republic and Germany is. The similarity between drivers and front occupants may be not that surprising considering that about seventy percent of the observed front occupants are drivers. The share of drivers correctly using a safety belt ranges from 70 ± 1 percent in Greece to 99.2 ± 0.2 percent in Germany, for front passengers it ranges from 77 ± 1 percent in Bulgaria to 98 percent in Austria, Germany and Sweden, and for front occupants it ranges from 71 ± 1 in Greece to 99.0 ± 0.2 in Germany. The shares in Denmark and the Netherlands were only provided for weekdays and weekend-days combined and therefore are not included in the figure. We refer to Annex 1 for their values.

Figure 7. Percentage of front and rear occupants in passenger cars correctly using safety belt during weekday/daytime



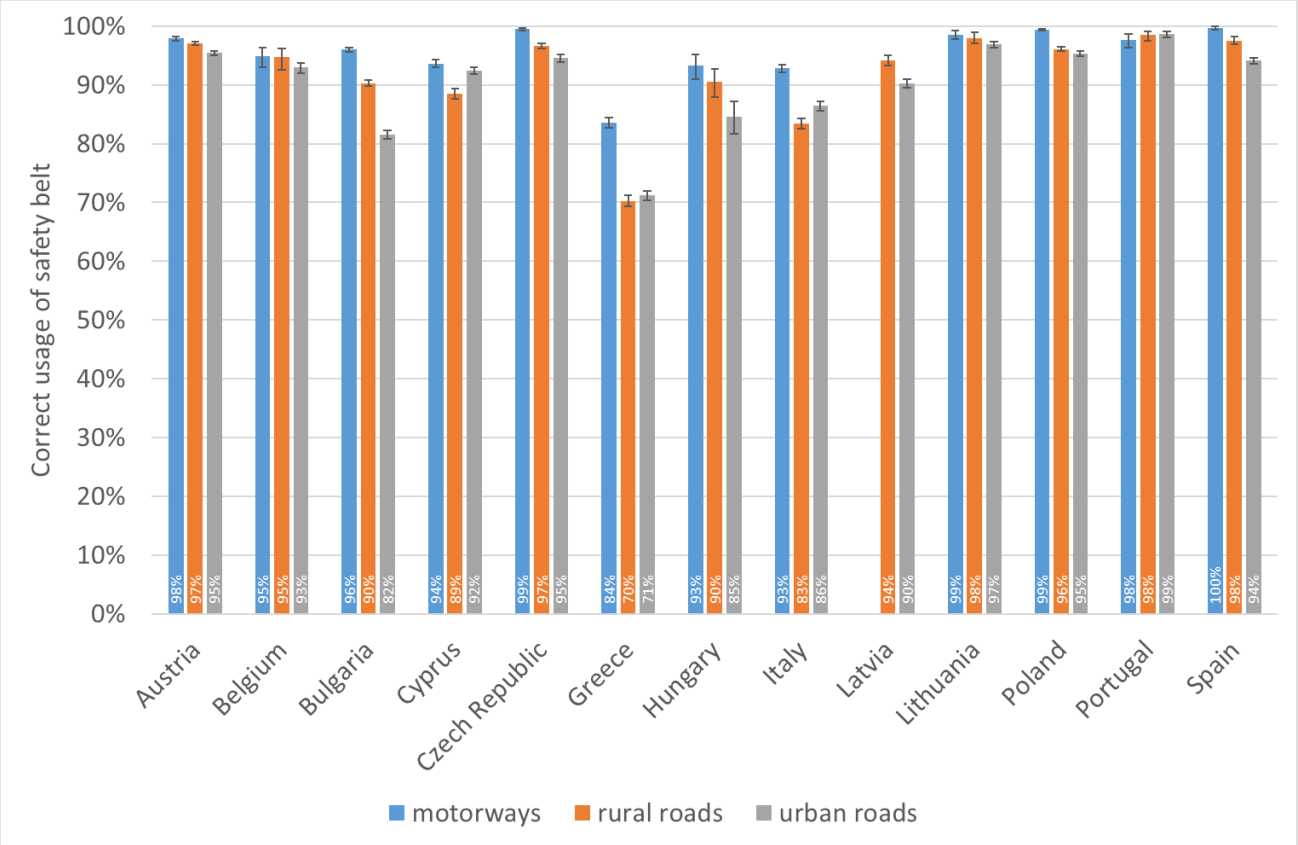
For goods vehicles the percentage of front and rear occupants correctly using a safety belt was provided by Austria, Cyprus, the Czech Republic, Denmark, Germany, Greece, the Netherlands, Poland and Portugal. The required minimal sample size was not entirely met by the Czech Republic, Germany and Portugal, and Denmark, Germany and the Netherlands also differed in their non-random selection of measurement locations, so comparison of results should be done with care. We refer to annex 1 for a more complete and detailed overview of the results. Allowing ourselves to draw comparisons despite these limitations, we observe that similar to the case of passenger cars, as far as can be said based on the available data, the share of drivers and front occupants correctly using a safety belt is not notably different from one another. The share of drivers and front passengers, provided by Austria and the Czech Republic, also in either country is not notably different from one another. The share of drivers correctly using a safety belt ranges from 36.2 ± 1.1 in Greece to 92.7 ± 0.8 in Germany. The share of rear occupants correctly using a safety belt in Austria is notably lower than that of drivers and front passengers. In the Czech Republic and Portugal it does not greatly differ from that of drivers, but note that this is based on small sample sizes.

3.3 Breakdown by road type

The share of correct usage of safety belts and CRS we break down by road type. We do so for individual positions in the vehicle, namely for drivers, rear occupants, and children, the latter both based on roadside observations and on in-vehicle inspections. Results consider passenger cars only, during weekdays and weekend-days combined, for those regarding goods vehicles we refer to Annex 1.

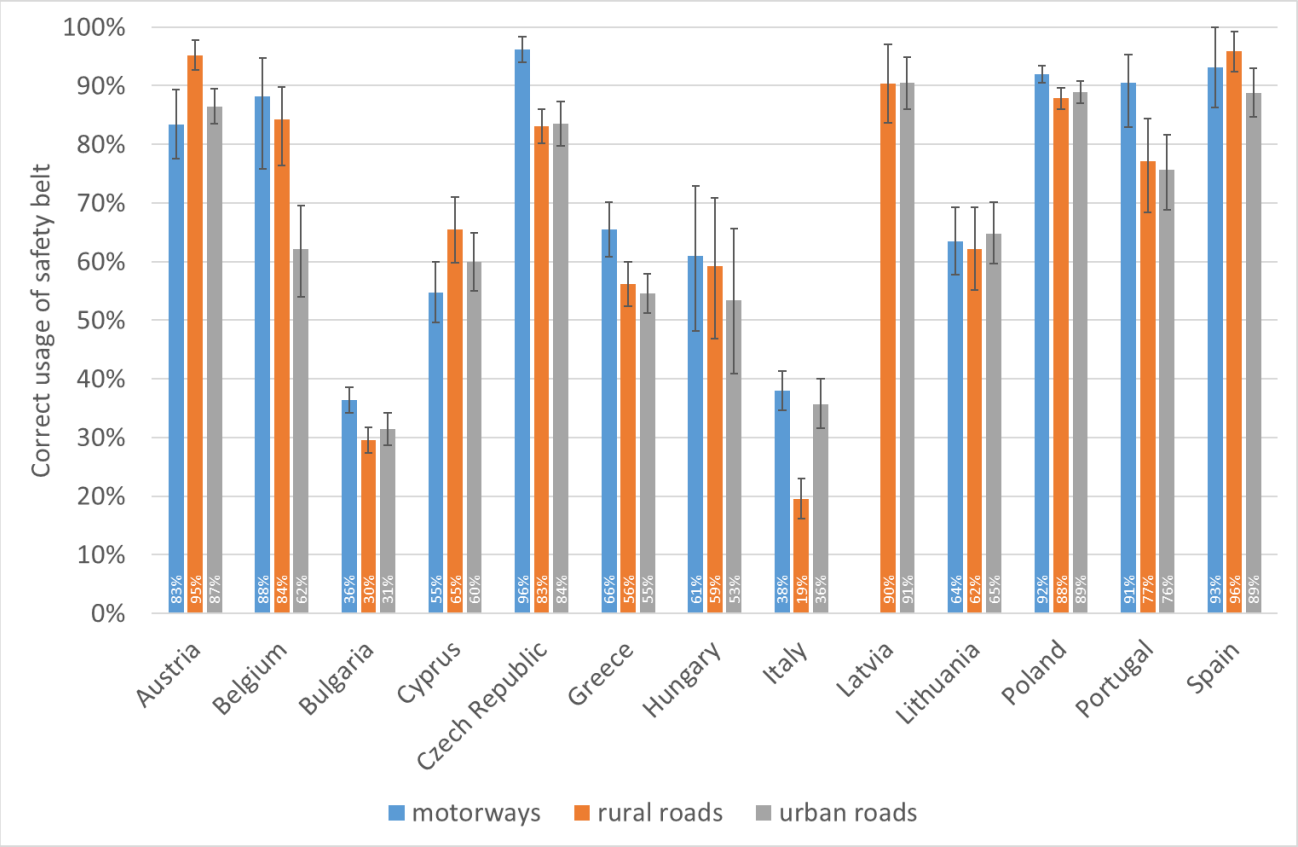
The share of drivers correctly using a safety belt, broken down by road type, is presented in figure 8. Not included in the figure is the share on expressways in Spain, which equals 96 ± 2 percent. In most Member States the share is highest on motorways and least on urban roads. Exceptions are Cyprus, Greece and Italy where it is least on rural roads, Latvia because it has no motorways, and Portugal where it is the other way around, though not by much. The shares of Germany and Sweden were only provided for weekdays and therefore not included in the figure, we refer to Annex 1 for their values.

Figure 8. Percentage by road type of drivers in passenger cars correctly using a safety belt



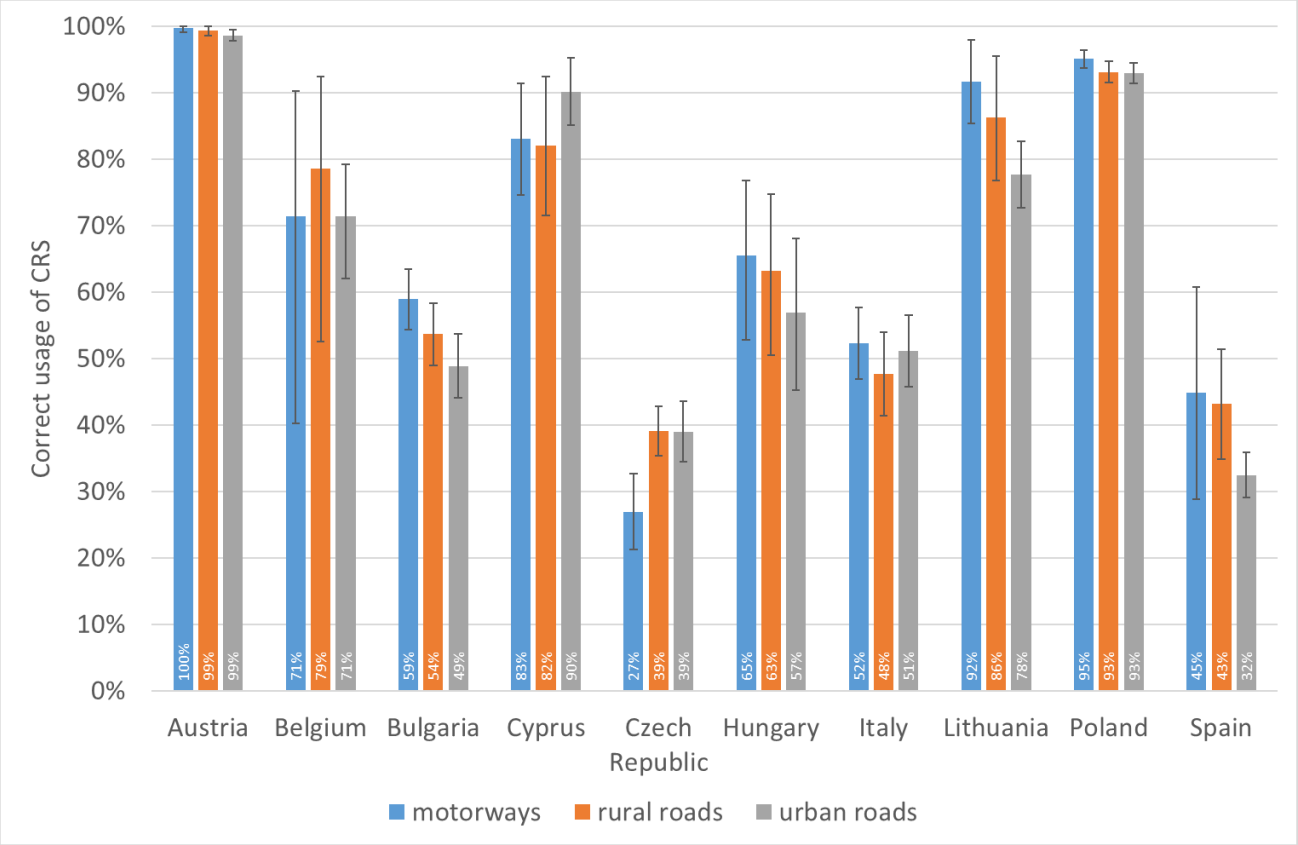
The share of rear occupants correctly using a safety belt, broken down by road type, is presented in figure 9. Not included in the figure is the share on expressways in Spain, which equals 96 ± 4 percent. Similar to the case of drivers, the share is highest on motorways in most Member States, except in Latvia as it has no motorways and in Austria, Cyprus, Lithuania and Spain, but the share on rural roads and on urban roads is not meaningfully different in most Member States. The shares of Germany and Sweden were only provided for weekdays and therefore not included in the figure, we refer to Annex 1 for their values.

Figure 9. Percentage by road type of rear occupants in passenger cars correctly using a safety belt



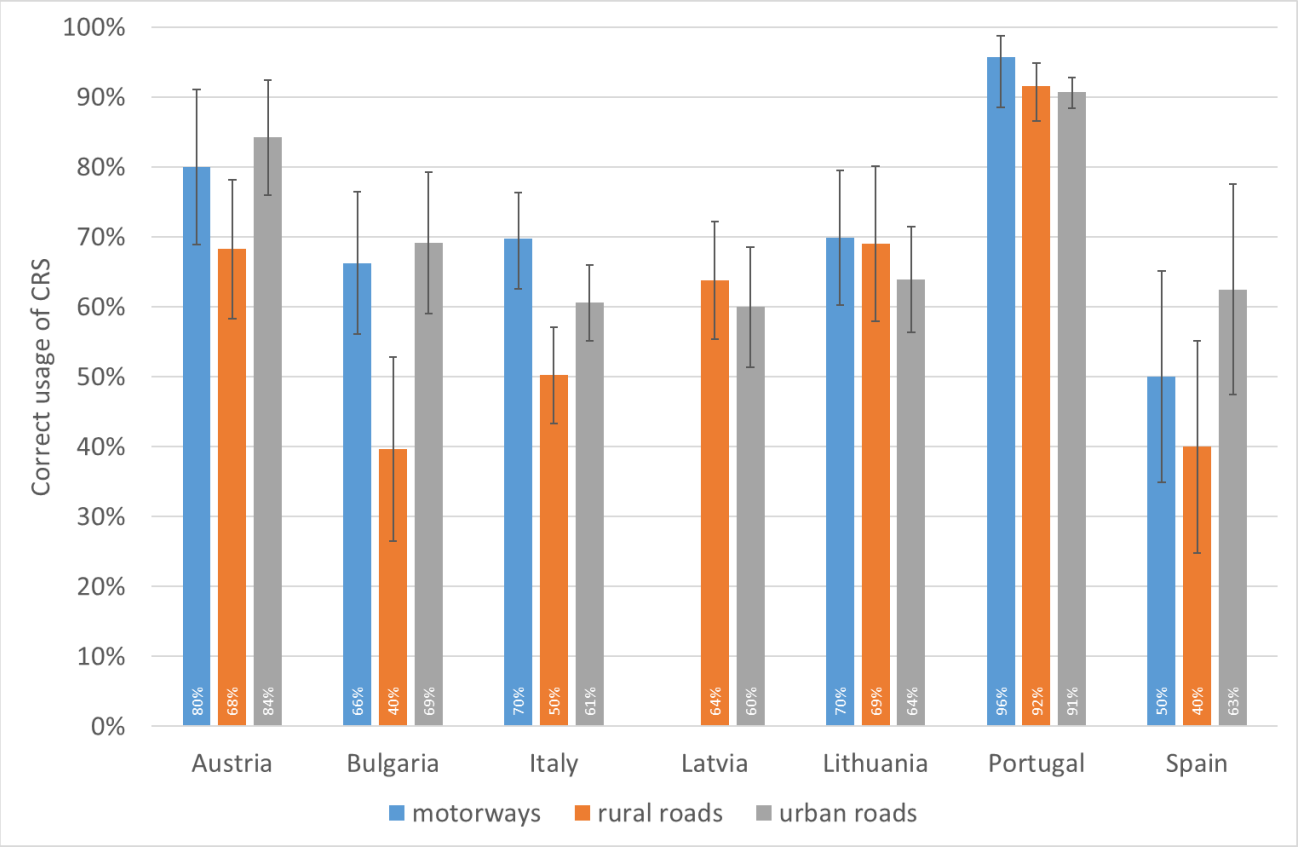
The share of children (correctly) using CRS according to roadside observations, broken down by road type, is presented in figure 10. Not included in the figure is the share on expressways in Spain, which equals 39 ± 13 percent. In most Member States the share is highest on motorways, or not meaningfully lower, except in the Czech Republic where it is lowest on motorways. The share of Germany was only provided for weekdays and therefore not included in the figure, we refer to Annex 1 for its value.

Figure 10. Percentage by road type of children in passenger cars (correctly) using CRS according to roadside observations



The share of children correctly using CRS according to in-vehicle inspection, broken down by road type, is presented in figure 11. Not included in the figure is the share on expressways in Spain, which equals 42 ± 14 percent. In most Member States there is no meaningful difference between the road types, except in Bulgaria and Italy where it is notably higher on motorways compared to rural roads. Sample sizes, however, for in-vehicle inspection were not that large, so it may be no surprise that few meaningful differences can be seen.

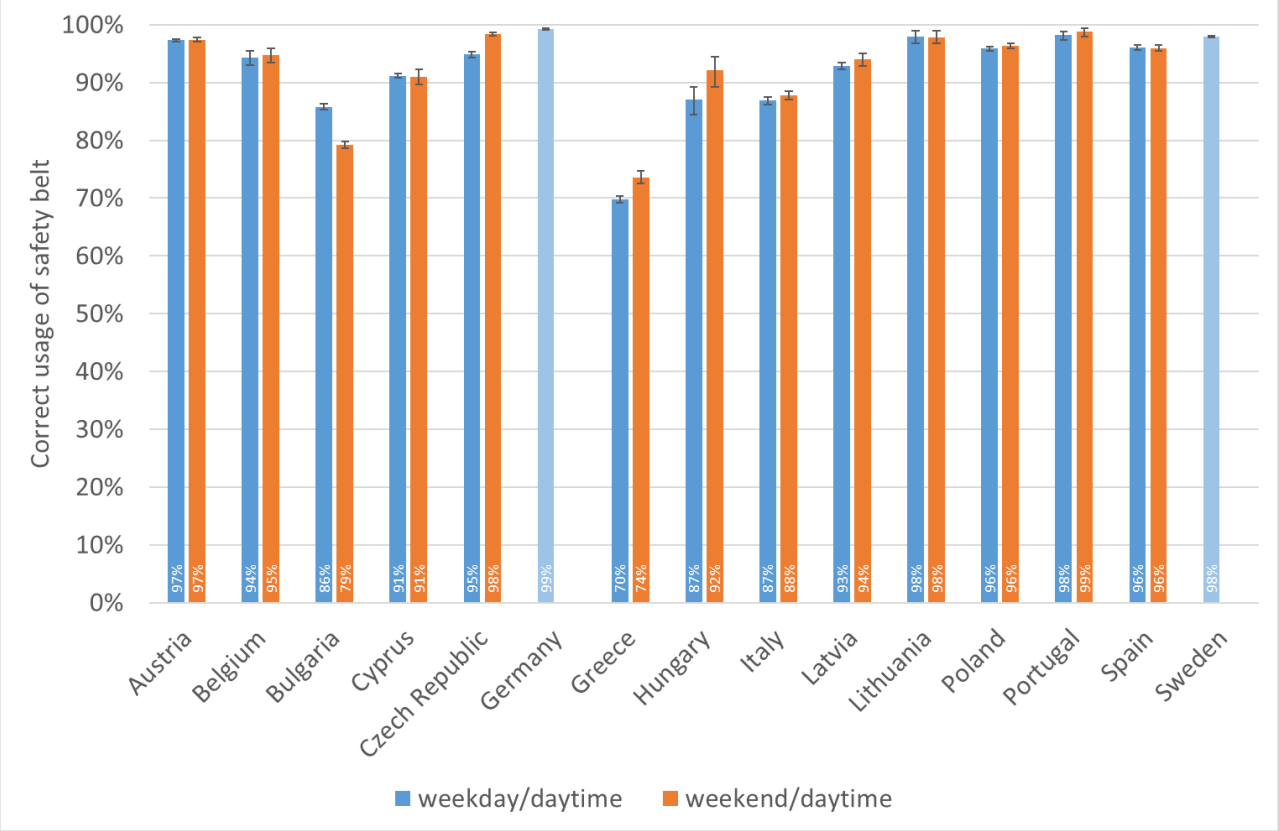
Figure 11. Percentage by road type of children in passenger cars correctly using CRS according to in-vehicle inspection



3.4 Breakdown by time period

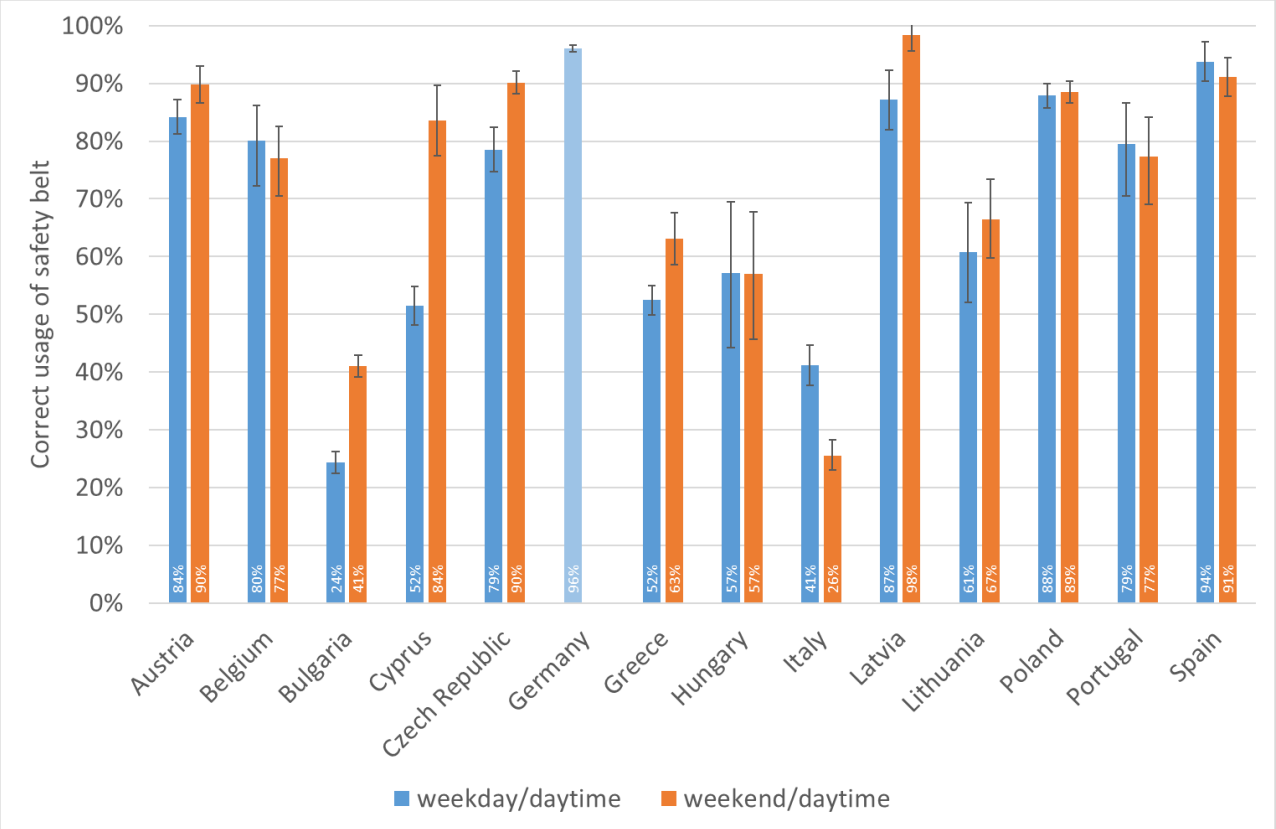
The share of drivers correctly using a safety belt, broken down by time period, is presented in figure 12. In most Member States there is no meaningful difference between weekday/daytime and weekend/daytime, except in Bulgaria where it is notably higher during weekday/daytime compared to weekend/daytime, and in the Czech Republic and Greece where it is the other way around.

Figure 12. Percentage by time period of drivers in passenger cars correctly using a safety belt



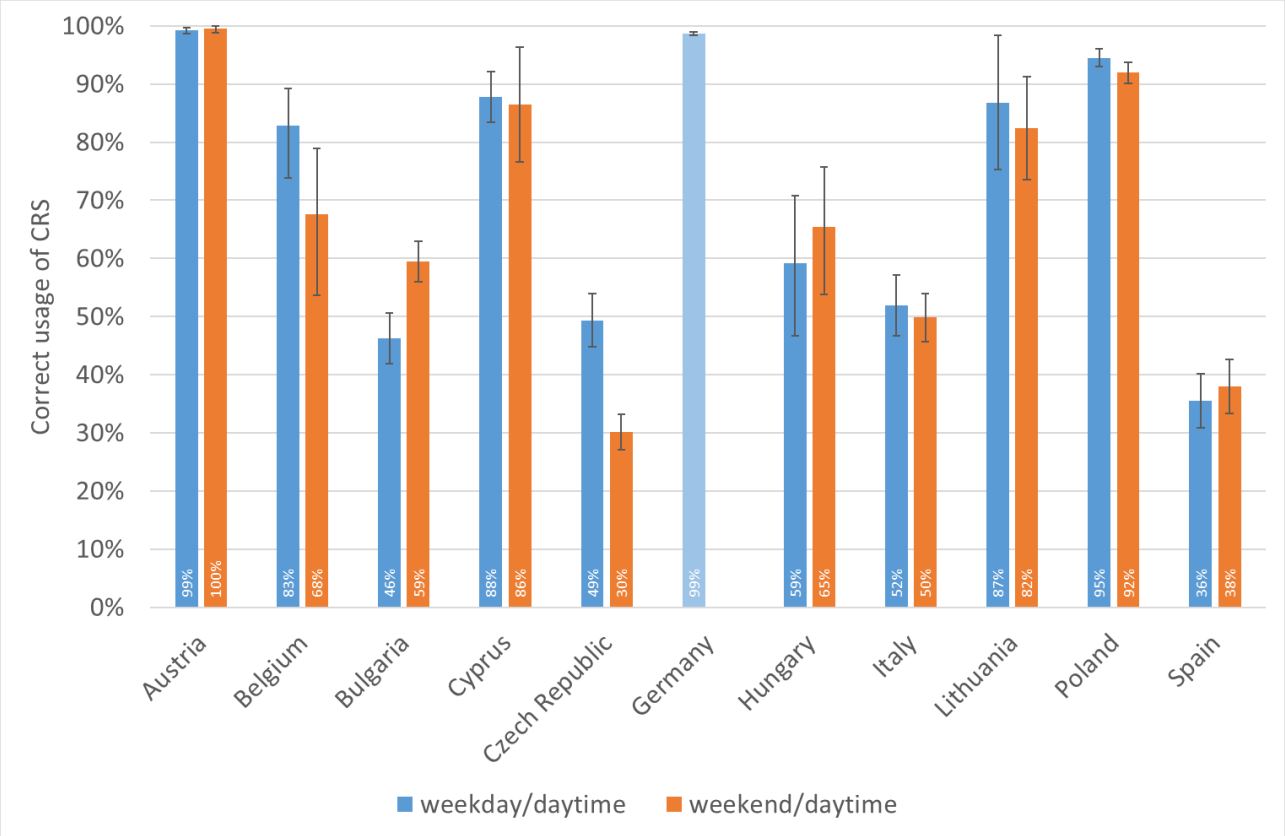
The share of rear occupants correctly using a safety belt, broken down by time period, is presented in figure 13. For half of the Member States there is no meaningful difference between weekday/daytime and weekend/daytime, in Bulgaria, Cyprus, the Czech Republic, Greece and Latvia the share is notably higher during weekend/daytime, and in Italy it is notably lower during weekend/daytime.

Figure 13. Percentage by time period of rear occupants in passenger cars correctly using a safety belt



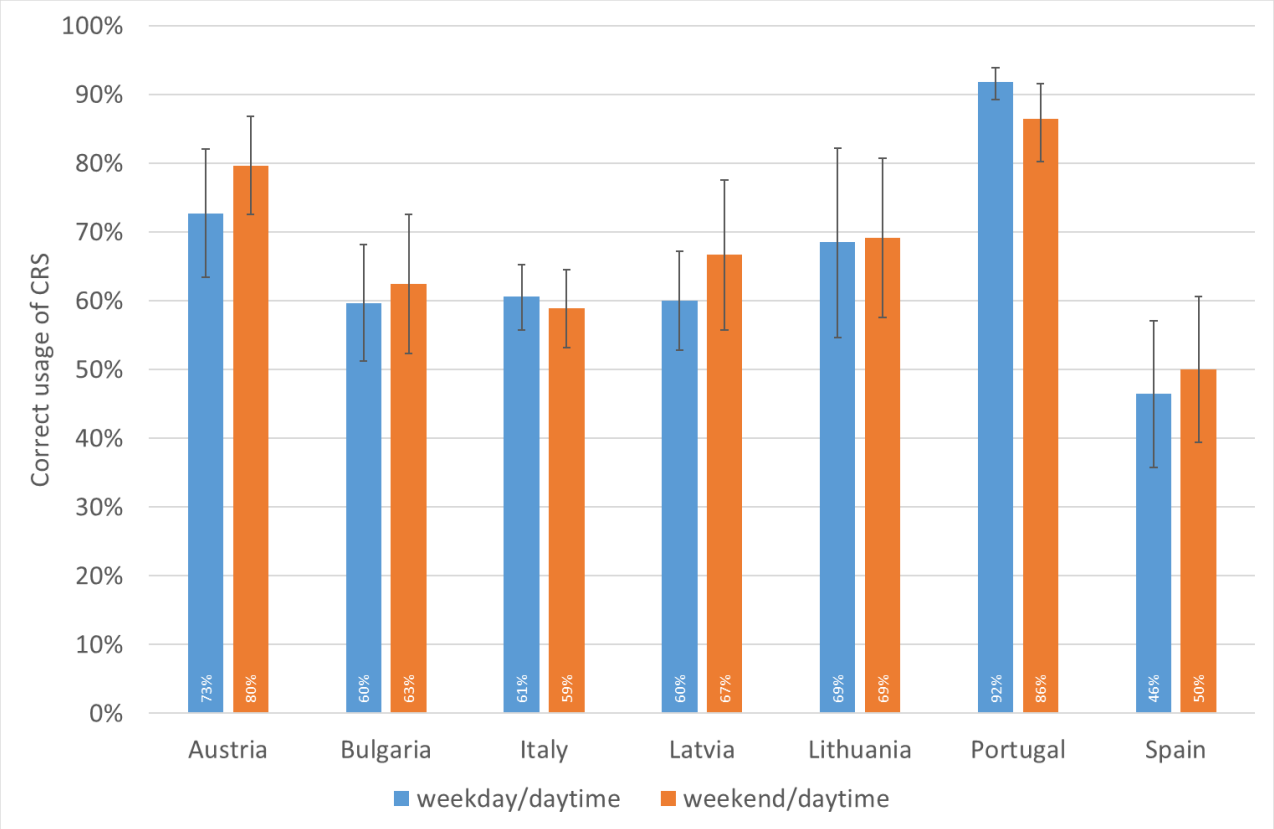
The share of children (correctly) using CRS according to roadside observation, broken down by time period, is presented in figure 14. For most of the Member States there is no meaningful difference between weekday/daytime and weekend/daytime, in Bulgaria the share was notably higher during weekend/daytime, and in the Czech Republic it was notably lower during weekend/daytime.

Figure 14. Percentage by time period of children in passenger cars (correctly) using CRS according to roadside observation



The share of children correctly using CRS according to in-vehicle inspection, broken down by time period, is presented in figure 15. Though differences between weekday/daytime and weekend/daytime can be seen, these are all not very meaningful. This can be understood from the fact that sample sizes for in-vehicle inspection were not that large.

Figure 15. Percentage by time period of children in passenger cars correctly using CRS according to in-vehicle inspection



3.5 Additional indicators

The ESRA2 (2022) survey provides indicators on topics including the use of safety belts. Since it is a survey research, it does not suffer from the typical disadvantages of roadside observations, but results are more subjective as they are based on self-reported data. We speak here only of those countries that regarding the KPI of seat belt and CRS use are both covered in ESRA2 and in Baseline, that is, Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Portugal, Spain and Sweden, but not Cyprus, Latvia and Lithuania as ESRA2 provides no results on these countries.

According to the ESRA2 results, the percentage of drivers not using a seat belt at least once during the past 30 days ranges from 11.8 ± 2.3 percent in Portugal to 33.7 ± 3.5 percent in Bulgaria, with shares on the lower end of this spectrum for Spain, the Netherlands, Denmark, Germany and Belgium and on the higher end for Italy, Poland, Hungary, the Czech Republic and Greece. For rear seat passengers the share not using a seat belt ranges from 20.2 ± 2.9 percent in Denmark to 61.9 ± 3.7 percent in Italy, with shares on the lower end of this spectrum for Germany, the Netherlands and Sweden and on the higher end for Poland, Portugal, Greece, Bulgaria and Hungary. This only partially aligns with the Baseline results, where the reported share of drivers and rear seat passengers not (correctly) using a seat belt is also relatively high in Greece but relatively low rather than high in the Czech Republic and Poland.

The personal acceptability according to ESRA2 to not wear a seat belt ranges from 2.2 ± 1.1 percent in Portugal to 8.4 ± 1.8 percent in Poland, with shares on the lower end of this spectrum in Hungary and the Netherlands and on the higher end the Czech Republic, Austria and Bulgaria. The social acceptability to not wear a seat belt ranges from 3.8 ± 1.3 percent in the Netherlands to 20 ± 6 percent in Greece, with shares on the lower end of this spectrum in Denmark, Portugal, Sweden and Hungary and on the higher end in Bulgaria and Poland. The perceived likelihood to

be checked by the police for wearing a seat belt is least in Sweden, with a percentage of 13.1 ± 2.5, and most in Poland, with a percentage of 53.7 ± 3.5. The support for a legal obligation to have a seat belt reminder system for the front and back seats in new cars ranges from 66.2 ± 2.1 percent in Austria to 90 ± 5 percent in Greece. This is only partially in line with the Baseline results. According to ESRA2 Bulgaria also scores high on the above points, which may explain the relatively low share of share of correct seat belt usage. Poland however also scores high on the above points, and although this need not exclude one another it shows a relatively high share of seat belt usage.

The self-reported percentage of drivers transporting children without using CRS ranges from 12.1 ± 3.2 percent in Germany to 19.0 ± 4.7 percent in Bulgaria, with Spain also having a relatively low share and Italy and Poland having relatively high shares. The personal acceptability to transport a child without securing them using a safety belt or CRS ranges from 0.8 ± 0.7 percent in Portugal to 3.5 ± 1.3 in Poland, and the social acceptability ranges from 1.8 ± 1.0 in the Czech Republic to 9.8 ± 1.9 in Bulgaria. This is only partially in line with the Baseline results, which show that according to roadside observations or in-vehicle inspection the share of children (correctly) using CRS is relatively low in Bulgaria, but also in the Czech Republic, and relatively high in Germany and Portugal, but also in Poland.

4 Initial analyses

Based on the available data, the share of rear occupants correctly using a safety belt shows to be lower than that of any front occupants, whether they be drivers or passengers. In Member States with a relatively low share of drivers in passenger cars correctly using a safety belt, if they reported on (correct) usage of CRS, the share of children (correctly) using CRS is also typically on the lower side, but not vice versa. There appears to be no clear relation between the share of children (correctly) using CRS according to roadside observation and according to in-vehicle inspection: some Member States that gathered both reported a lower share based on in-vehicle inspection and others a higher one. In most Member States the share of correct seat belt usage by drivers and rear occupants in passenger cars is highest on motorways and least on urban roads. There is no meaningful difference between weekday/daytime and weekend/daytime for most Member States in the share of drivers correctly using a seat belt, and for half of the Member States in the share of rear occupants correctly using a seat belt.

When comparing the results with mortality rates (European Commission, 2022), that is, the number of road crash fatalities per one million inhabitants, we see they only partially match. A relatively low share of drivers in passenger cars correctly using a seat belt is encountered in Bulgaria, and a relatively high share in Austria, the Czech Republic, Lithuania, Poland and Portugal, with Italy and Latvia more in between. The mortality rate is relatively high in Bulgaria and Latvia, but also in Lithuania, Poland and Portugal.

Comparison of the results obtained through roadside observation and in-vehicle inspection with those of the ESRA2 survey shows that they are only partially in line with one another. The self-reported share of drivers and rear occupants not using a seat belt only for some Member States agrees with those based on roadside observation. For some Member States the share of correct seat belt usage according to roadside observation is relatively low, which may be explained by the ESRA2 results of a relatively high personal and social acceptability to not wear a seat belt, a relatively high likelihood to be checked by the police for wearing a seat belt, and a relatively low support for a legal obligation to have a seat belt reminder system for the front and the back seats in new cars. For some other Member States, however, the share of correct seat belt usage according to roadside observation is relatively high, yet so are ESRA2 shares such as personal and social acceptability to not wear a seat belt. The self-reported share of drivers transporting children without CRS only agrees with that based on roadside observation or in-vehicle inspection for some Member States, but not for others.

5 Conclusions on data quality and recommendations for the future

5.1 Quality and comparability of data

The data reported on here was collected through roadside observations by researchers or CRS in-vehicle inspection. Most Member States collected data under good weather conditions, only Germany did so under all weather conditions and Denmark and Sweden under unobserved weather conditions, where Sweden noted that the weather is often quite stable during autumn. Observations in most Member States took place during spring or autumn; six also observed during summer, with only one exclusively during summer.

Germany and Sweden only provided results regarding weekdays, and Denmark and the Netherlands only regarding weekdays and weekend-days combined, whereas other Member States did so for weekdays and weekend-days separately. While comparability of results collected during different time periods is not obvious, results show that differences between time periods are not notable for most Member States with respect to the share of drivers correctly using a seat belt, and for half of the Member States with respect to the share of rear occupants correctly using a seat belt.

All Member States that provided indicator values at some or all of the required aggregation levels did so with confidence intervals.

Measurement locations were mostly selected through (stratified) random sampling, except in the case of Denmark, Germany, the Netherlands and Sweden where they were selected non-randomly. This makes comparability of their results with that of other Member States not obvious. It may be argued, however, how much results from non-randomly selected locations differ from those obtained from randomly selected ones, in particular when locations were chosen for reasons such as good observability, sufficient or mixed traffic.

The minimum requirement of 10 locations per road type was met in all cases, except motorways and rural roads in Germany for which there are only 6 locations per road type included, motorways in Latvia since Latvia has no motorways, in the Netherlands which had 8 locations on motorways and 7 on rural and urban roads combined, and in Sweden which had 9 locations for all road types combined. Similar to the method of sampling, it may be argued how necessary a minimum of 10 locations is when these are chosen to yield representative results. The minimum requirement of 2000 observed vehicles in total and 500 per road type for seat belt use in passenger cars is met by all Member States for as far as their disaggregation by road type allows. The same recommended number of observations for goods vehicles, for which observation was optional, is also met by Austria, Cyprus, Germany, Greece and Poland, but not entirely by the Czech Republic and Portugal that also observed goods vehicles, so this smaller than recommended sample size should be taken into account when making comparisons.

5.2 Recommendations

Traffic safety is determined by both the risk of getting involved in a crash and the risk of subsequently getting injured. Preventing a crash may not always be achievable, hence measures to prevent or reduce injuries in a crash are important, and among the most effective ones to do so are restraint system (European Commission, 2022). This makes the use of restraint systems a factor positively contributing to traffic safety.

Most Member States show a notably lower share of rear occupants correctly using a safety belt compared to front occupants, which shows a relevance for a breakdown between front and rear occupants. In only one of seven Member States that delivered the share of front passengers correctly using a safety belt was this share notably lower than that for drivers, in the other Member States both were relatively high, so distinguishing between front passengers and drivers may be of limited added value. The share of children (correctly) using CRS according to roadside observations starts at just above 35%, hence it is recommended to keep this KPI. There appears to be no clear relation between the share of children (correctly) using CRS based on roadside observations and based on in-vehicle inspection, in some Member States the value based on roadside observations is higher than the value based on in-vehicle inspection and in others lower. Some Member States that provided results on CRS use based on in-vehicle inspection included their criteria for correct use, for better judgement of comparability between Member States it may be good to also have these criteria included.

In most Member States the share of correct seat belt usage by drivers and rear occupants in passenger cars is highest on motorways and least on urban roads, hence a breakdown by road type provides additional insight. There is no notable difference between weekday/daytime and weekend/daytime for most Member States in the share of drivers correctly using a seat belt, and for half of the Member States in the share of rear occupants correctly using a seat belt, so the added value provided by a breakdown by time period may be limited. Furthermore, relaxing

requirements on the time period of observation may make data collection more feasible while any harm done to the comparability may be minimal. Sample sizes for roadside observations appear to be sufficient to make breakdowns by road type and time period. While the share of children (correctly) using CRS based on roadside observation shows a dependency on the road type in some Member States, for the share based on in-vehicle inspection it is not possible to say due to too small sample sizes, and an increase in sample size would be required if the influence of the road type should also be researched.

Minimum requirements were put on the method of data collection: locations should be selected randomly and with a minimum of 10 per road type. Several Member States, however, collected data at locations chosen non-randomly for reasons of feasibility or better expected quality of the data, and from fewer than 10 such locations. It may be argued whether results obtained in this way differ substantially from those obtained in ways satisfying the requirements set. This is an issue that deserves further attention. If differences can be expected to be small than the minimum requirements on data collection should be reconsidered to allow for methods that yield results of similar quality. This would both benefit the execution of data collection and allow for comparison between more Member States.

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7 Annex 1. Results by position in the vehicle, time period and road type

7.1 Passenger cars

The percentage of correct usage of seat belts or CRS in passenger cars, broken down by position in the vehicle, time period and road type, is presented in table 7. Results for expressways in Spain have also been included. These are results based on roadside observations.

Table 7. The percentage of drivers, front passengers and occupants, and rear occupants correctly using a seat belt and that of children (correctly) using CRS in passenger cars

			driver	front passenger	front occupant	rear occupant	CRS
Austria	weekday	all roads	97.3 ± 0.2	98.1 ± 0.3	-	84.2 ± 3.0	99.2 ± 0.5
	weekend		97.4 ± 0.4	99.4 ± 0.3	-	89.8 ± 3.2	99.5 ± 0.6
	all days		97.3 ± 0.2	98.6 ± 0.2	-	86.3 ± 2.2	99.4 ± 0.4
		motorways	97.9 ± 0.3	98.8 ± 0.5	-	83.4 ± 5.9	99.7 ± 0.7
		rural roads	97.1 ± 0.3	99.1 ± 0.4	-	95.2 ± 2.5	99.3 ± 0.7
		urban roads	95.4 ± 0.3	97.1 ± 0.5	-	86.5 ± 3.0	98.6 ± 0.8
Belgium	weekday	all roads	94.3 ± 1.3	-	93.7 ± 1.3	80.1 ± 7.9	82.8 ± 9.0
	weekend		94.8 ± 1.4	-	94.0 ± 1.5	77.0 ± 6.6	67.5 ± 13.8
	all days		94.4 ± 1.1	-	93.8 ± 1.0	79.0 ± 5.3	73.3 ± 9.5
		motorways	94.9 ± 2.0	-	94.6 ± 2.0	88.2 ± 12.3	71.4 ± 31.2
		rural roads	94.7 ± 2.1	-	94.2 ± 2.0	84.2 ± 7.8	78.6 ± 26.1
		urban roads	92.9 ± 1.0	-	91.6 ± 1.0	62.1 ± 8.1	71.4 ± 9.3
Bulgaria	weekday	all roads	85.8 ± 0.5	76.6 ± 1.0	-	24.4 ± 1.9	46.2 ± 4.4
	weekend		79.2 ± 0.6	76.3 ± 0.9	-	41.0 ± 1.9	59.5 ± 3.4
	all days		83.3 ± 0.4	76.4 ± 0.7	-	31.2 ± 1.3	50.0 ± 2.7
		motorways	96.0 ± 0.4	94.3 ± 0.6	-	36.4 ± 2.2	58.9 ± 4.5
		rural roads	90.3 ± 0.6	88.3 ± 0.9	-	29.6 ± 2.2	53.6 ± 4.7
		urban roads	81.5 ± 0.7	74.4 ± 1.4	-	31.5 ± 2.8	48.8 ± 4.8
Cyprus	weekday	all roads	91.2 ± 0.4	-	91.2 ± 0.4	51.5 ± 3.3	87.7 ± 4.4
	weekend		91.0 ± 1.3	-	91.1 ± 1.2	83.6 ± 6.1	86.5 ± 9.9
	all days		91.1 ± 0.4	-	91.2 ± 0.4	61.4 ± 3.0	87.3 ± 4.0
		motorways	93.6 ± 0.6	-	93.7 ± 0.5	54.8 ± 5.1	83.0 ± 8.4
		rural roads	88.5 ± 0.9	-	88.5 ± 0.8	65.4 ± 5.6	82.0 ± 10.4
		urban roads	92.4 ± 0.6	-	92.6 ± 0.5	60.0 ± 4.9	90.1 ± 5.1
Czech Republic	weekday	all roads	94.9 ± 0.5	92.0 ± 1.2	94.2 ± 0.5	78.5 ± 3.8	49.4 ± 4.5
	weekend		98.4 ± 0.3	98.2 ± 0.5	98.3 ± 0.3	90.2 ± 2.0	30.1 ± 3.1
	all days		96.5 ± 0.3	95.8 ± 0.5	96.3 ± 0.3	86.2 ± 1.9	36.9 ± 2.6
		motorways	99.5 ± 0.3	99.4 ± 0.4	99.4 ± 0.3	96.2 ± 2.2	26.9 ± 5.7
		rural roads	96.6 ± 0.5	95.6 ± 0.9	96.3 ± 0.5	83.1 ± 2.9	39.0 ± 3.7
		urban roads	94.5 ± 0.6	92.8 ± 1.2	94.1 ± 0.6	83.6 ± 3.7	39.0 ± 4.6
Denmark	weekday	all roads	-	-	-	-	-
	weekend		-	-	-	-	-
	all days		97.2	-	-	88.7	-
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-

		urban roads	-	-	-	-	-
Germany	weekday	all roads	99.2 ± 0.1	98.2 ± 0.4	99.0 ± 0.1	96.1 ± 0.7	98.7 ± 0.3
	weekend		-	-	-	-	-
	all days		-	-	-	-	-
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-
		urban roads	-	-	-	-	-
Greece	weekday	all roads	69.8 ± 0.6	-	70.6 ± 0.5	52.4 ± 2.6	-
	weekend		73.6 ± 1.1	-	74.5 ± 0.9	63.1 ± 4.5	-
	all days		71.0 ± 0.5	-	71.8 ± 0.5	55.8 ± 2.2	-
		motorways	83.5 ± 0.9	-	85.3 ± 0.7	65.5 ± 4.7	-
		rural roads	70.3 ± 0.9	-	70.8 ± 0.8	56.2 ± 3.8	-
		urban roads	71.2 ± 0.8	-	72.4 ± 0.7	54.6 ± 3.4	-
Hungary	weekday	all roads	87.0 ± 2.6	86.1 ± 4.8	-	57.2 ± 13.0	59.2 ± 12.5
	weekend		92.1 ± 2.9	90.4 ± 4.4	-	56.9 ± 11.3	65.4 ± 11.6
	all days		88.5 ± 2.7	87.3 ± 4.7	-	57.1 ± 12.5	60.9 ± 12.3
		motorways	93.3 ± 2.3	92.0 ± 4.1	-	61.0 ± 12.9	65.5 ± 12.8
		rural roads	90.5 ± 2.6	88.4 ± 4.6	-	59.3 ± 12.4	63.2 ± 12.7
		urban roads	84.5 ± 2.9	84.4 ± 5.2	-	53.4 ± 12.5	56.9 ± 11.6
Italy	weekday	all roads	86.9 ± 0.6	85.4 ± 1.1	86.5 ± 0.6	41.2 ± 3.5	51.9 ± 5.3
	weekend		87.8 ± 0.7	88.5 ± 1.0	88.0 ± 0.6	25.6 ± 2.7	49.8 ± 4.1
	all days		87.2 ± 0.5	87.0 ± 0.8	87.2 ± 0.4	32.1 ± 2.2	50.6 ± 3.2
		motorways	92.8 ± 0.7	91.4 ± 1.2	92.3 ± 0.6	37.9 ± 3.4	52.3 ± 5.4
		rural roads	83.5 ± 0.9	83.8 ± 1.5	83.6 ± 0.8	19.4 ± 3.6	47.6 ± 6.3
		urban roads	86.4 ± 0.8	84.8 ± 1.5	86.0 ± 0.7	35.7 ± 4.3	51.1 ± 5.4
Latvia	weekday	all roads	92.9 ± 0.6	-	91.6 ± 0.6	87.1 ± 5.1	-
	weekend		94.0 ± 1.1	-	92.6 ± 1.0	98.4 ± 2.8	-
	all days		93.2 ± 0.5	-	93.6 ± 0.5	90.4 ± 3.7	-
		motorways	-	-	-	-	-
		rural roads	94.2 ± 0.9	-	94.6 ± 0.7	90.4 ± 6.7	-
		urban roads	90.2 ± 0.8	-	90.4 ± 0.7	90.5 ± 4.4	-
Lithuania	weekday	all roads	97.9 ± 1.1	-	97.9 ± 0.9	60.7 ± 8.7	86.8 ± 11.5
	weekend		97.8 ± 1.1	-	98.3 ± 0.8	66.5 ± 6.9	82.4 ± 8.8
	all days		97.9 ± 0.9	-	98.0 ± 0.7	62.4 ± 6.5	85.5 ± 8.7
		motorways	98.5 ± 0.7	-	98.3 ± 0.6	63.5 ± 5.7	91.6 ± 6.3
		rural roads	98.0 ± 0.9	-	98.1 ± 0.7	62.2 ± 7.1	86.2 ± 9.4
		urban roads	96.9 ± 0.5	-	96.8 ± 0.5	64.8 ± 5.3	77.7 ± 5.0
Netherlands	weekday	all roads	-	-	-	-	-
	weekend		-	-	-	-	-
	all days		-	-	-	-	88.3
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-
		urban roads	-	-	-	-	-
Poland	weekday	all roads	95.8 ± 0.4	-	95.5 ± 0.3	87.9 ± 2.1	94.5 ± 1.5

	weekend		96.3 ± 0.4	-	95.8 ± 0.4	88.5 ± 1.9	92.0 ± 1.8
	all days		96.1 ± 0.3	-	95.6 ± 0.2	88.2 ± 1.4	93.1 ± 1.2
		motorways	99.4 ± 0.1	-	98.8 ± 0.2	91.9 ± 1.5	95.1 ± 1.4
		rural roads	96.1 ± 0.4	-	95.5 ± 0.3	87.8 ± 1.9	93.1 ± 1.6
		urban roads	95.4 ± 0.4	-	95.3 ± 0.4	88.9 ± 1.8	93.0 ± 1.6
Portugal	weekday	all roads	98.3 ± 0.8	-	97.6 ± 0.8	79.5 ± 8.9	-
	weekend		98.9 ± 0.9	-	98.7 ± 0.8	77.3 ± 8.2	-
	all days		98.5 ± 0.6	-	98.0 ± 0.6	78.3 ± 5.9	-
		motorways	97.7 ± 1.4	-	97.2 ± 1.2	90.5 ± 7.5	-
		rural roads	98.5 ± 0.9	-	98.0 ± 0.9	77.1 ± 8.7	-
		urban roads	98.7 ± 0.6	-	98.3 ± 0.6	75.7 ± 6.8	-
Spain	weekday	all roads	96.0 ± 0.5	-	96.0 ± 0.5	93.8 ± 3.4	35.5 ± 4.6
	weekend		96.0 ± 0.5	-	95.6 ± 0.5	91.1 ± 3.3	38.0 ± 4.7
	all days		96.0 ± 0.4	-	95.9 ± 0.4	92.8 ± 2.5	36.4 ± 3.4
		motorways	99.7 ± 0.3	-	99.4 ± 0.4	93.2 ± 6.8	44.8 ± 16.0
		expressways	96.4 ± 1.1	-	96.7 ± 0.9	96.3 ± 3.4	38.9 ± 12.5
		rural roads	97.6 ± 0.6	-	97.3 ± 0.6	95.8 ± 3.4	43.1 ± 8.3
		urban roads	94.1 ± 0.6	-	93.9 ± 0.5	88.8 ± 4.1	32.5 ± 3.4
Sweden	weekday	all roads	97.9 ± 0.2	97.9 ± 0.4	97.9 ± 0.2	-	-
	weekend		-	-	-	-	-
	all days		-	-	-	-	-
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-
		urban roads	-	-	-	-	-

The percentage of correct usage of CRS in passenger cars is presented in table 8, broken down by time period and road type. It includes results based on in-vehicle inspection, and for convenience also those based on roadside observation. Results for expressways in Spain have also been included.

Table 8. The percentage of children (correctly) using CRS in passenger cars

			Roadside observation	In-vehicle inspection
Austria	weekday	all roads	99.2 ± 0.5	72.7 ± 9.3
	weekend		99.5 ± 0.6	79.7 ± 7.1
	all days		99.4 ± 0.4	76.8 ± 5.7
		motorways	99.7 ± 0.7	80.0 ± 11.1
		rural roads	99.3 ± 0.7	68.2 ± 9.9
		urban roads	98.6 ± 0.8	84.2 ± 8.2
Belgium	weekday	all roads	82.8 ± 9.0	-
	weekend		67.5 ± 13.8	-
	all days		73.3 ± 9.5	-
		motorways	71.4 ± 31.2	-
		rural roads	78.6 ± 26.1	-
		urban roads	71.4 ± 9.3	-
Bulgaria	weekday	all roads	46.2 ± 4.4	59.7 ± 8.5

	weekend		59.5 ± 3.4	62.5 ± 10.1
	all days		50.0 ± 2.7	60.8 ± 6.5
		motorways	58.9 ± 4.5	66.3 ± 10.2
		rural roads	53.6 ± 4.7	39.6 ± 13.2
		urban roads	48.8 ± 4.8	69.1 ± 10.1
Cyprus	**weekday**	**all roads**	87.7 ± 4.4	-
	weekend		86.5 ± 9.9	-
	all days		87.3 ± 4.0	-
		motorways	83.0 ± 8.4	-
		rural roads	82.0 ± 10.4	-
		urban roads	90.1 ± 5.1	-
Czech Republic	**weekday**	**all roads**	49.4 ± 4.5	-
	weekend		30.1 ± 3.1	-
	all days		36.9 ± 2.6	-
		motorways	26.9 ± 5.7	-
		rural roads	39.0 ± 3.7	-
		urban roads	39.0 ± 4.6	-
Germany	**weekday**	**all roads**	98.7 ± 0.3	-
	weekend		-	-
	all days		-	-
		motorways	-	-
		rural roads	-	-
		urban roads	-	-
Hungary	**weekday**	**all roads**	59.2 ± 12.5	-
	weekend		65.4 ± 11.6	-
	all days		60.9 ± 12.3	-
		motorways	65.5 ± 12.8	-
		rural roads	63.2 ± 12.7	-
		urban roads	56.9 ± 11.6	-
Ireland	**weekday**	**all roads**	-	-
	weekend		-	-
	all days		-	62
		motorways	-	-
		rural roads	-	-
		urban roads	-	-
Italy	**weekday**	**all roads**	51.9 ± 5.3	60.6 ± 4.8
	weekend		49.8 ± 4.1	58.9 ± 5.8
	all days		50.6 ± 3.2	59.9 ± 3.7
		motorways	52.3 ± 5.4	69.8 ± 7.2
		rural roads	47.6 ± 6.3	50.2 ± 6.9
		urban roads	51.1 ± 5.4	60.7 ± 5.5
Latvia	**weekday**	**all roads**	-	60.0 ± 7.2
	weekend		-	66.7 ± 10.9
	all days		-	61.9 ± 6.0

		motorways	-	-
		rural roads	-	63.8 ± 8.4
		urban roads	-	60.0 ± 8.6
Lithuania	**weekday**	**all roads**	86.8 ± 11.5	68.5 ± 13.8
	weekend		82.4 ± 8.8	69.2 ± 11.6
	all days		85.5 ± 8.7	68.6 ± 10.2
		motorways	91.6 ± 6.3	69.9 ± 9.7
		rural roads	86.2 ± 9.4	69.0 ± 11.1
		urban roads	77.7 ± 5.0	63.9 ± 7.6
Netherlands	**weekday**	**all roads**	-	-
	weekend		-	-
	all days		88.3	-
		motorways	-	-
		rural roads	-	-
		urban roads	-	-
Poland	**weekday**	**all roads**	94.5 ± 1.5	-
	weekend		92.0 ± 1.8	-
	all days		93.1 ± 1.2	-
		motorways	95.1 ± 1.4	-
		rural roads	93.1 ± 1.6	-
		urban roads	93.0 ± 1.6	-
Portugal	**weekday**	**all roads**	-	91.8 ± 2.6
	weekend		-	86.4 ± 6.3
	all days		-	90.7 ± 2.4
		motorways	-	95.7 ± 7.1
		rural roads	-	91.6 ± 5.1
		urban roads	-	90.7 ± 2.4
Spain	**weekday**	**all roads**	35.5 ± 4.6	46.4 ± 10.7
	weekend		38.0 ± 4.7	50.0 ± 10.6
	all days		36.4 ± 3.4	48.2 ± 7.5
		motorways	44.8 ± 16.0	50.0 ± 15.1
		expressways	38.9 ± 12.5	41.7 ± 14.0
		rural roads	43.1 ± 8.3	40.0 ± 15.2
		urban roads	32.5 ± 3.4	62.5 ± 15.0

7.2 Goods vehicles

Results on the correct usage of seat belts and CRS in goods vehicles, broken down by position in the vehicle, time period and road type, is provided in table 9. It contains only results of the Member States that collected data on goods vehicles, that is, Austria, Cyprus, the Czech Republic, Denmark, Germany, Greece, Poland and Portugal, except the Netherlands which only reported a share of 85.3 percent of all occupants correctly using the safety belt.

Table 9. The percentage of drivers, front passengers and occupants, and rear occupants correctly using a seat belt in goods vehicles

			driver	front passenger	front occupant	rear occupant	CRS
Austria	**weekday**	**all roads**	87.1 ± 0.8	88.0 ± 1.9	-	42.7 ± 8.2	97.8 ± 4.6
	weekend		88.3 ± 2.7	97.8 ± 2.2	-	-	-
	all days		87.2 ± 0.8	88.5 ± 1.7	-	43.9 ± 7.7	99.1 ± 2.3
		motorways	87.8 ± 1.4	87.9 ± 3.6	-	38.5 ± 15.3	-
		rural roads	85.1 ± 1.5	92.2 ± 2.7	-	60.3 ± 13.4	-
		urban roads	83.7 ± 1.3	85.6 ± 2.7	-	65.9 ± 11.2	-
Cyprus	**weekday**	**all roads**	69.1 ± 1.2	-	69.4 ± 1.1	-	-
	weekend		73.6 ± 4.6	-	74.4 ± 4.1	-	-
	all days		70.5 ± 1.1	-	71.0 ± 1.0	-	-
		motorways	70.8 ± 1.7	-	71.1 ± 1.6	-	-
		rural roads	69.5 ± 2.4	-	73.0 ± 2.1	-	-
		urban roads	71.1 ± 2.0	-	69.7 ± 1.9	-	-
Czech Republic	**weekday**	**all roads**	85.6 ± 2.5	80.4 ± 6.5	84.8 ± 2.5	77.8 ± 27.2	40.0 ± 42.9
	weekend		88.9 ± 2.8	92.2 ± 3.9	89.8 ± 2.5	93.5 ± 8.6	15.4 ± 19.6
	all days		89.8 ± 1.7	89.7 ± 3.2	89.8 ± 1.6	95.2 ± 6.4	22.7 ± 17.5
		motorways	97.4 ± 1.2	95.7 ± 2.6	97.0 ± 1.3	100.0 ± 0.0	9.1 ± 17.0
		rural roads	84.2 ± 3.9	80.8 ± 10.7	83.8 ± 4.0	100.0 ± 0.0	20.0 ± 35.1
		urban roads	72.0 ± 6.4	75.0 ± 10.6	72.7 ± 5.8	66.7 ± 37.7	50.0 ± 40.0
Denmark	**weekday**	**all roads**	-	-	-	-	-
	weekend		-	-	-	-	-
	all days		90.9	-	-	-	-
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-
		urban roads	-	-	-	-	-
Germany	**weekday**	**all roads**	92.7 ± 0.8	-	-	-	-
	weekend		-	-	-	-	-
	all days		-	-	-	-	-
		motorways	-	-	-	-	-
		rural roads	-	-	-	-	-
		urban roads	-	-	-	-	-
Greece	**weekday**	**all roads**	33.8 ± 1.1	-	33.9 ± 1.0	-	-
	weekend		43.6 ± 2.8	-	44.4 ± 2.6	-	-
	all days		36.2 ± 1.1	-	36.5 ± 1.0	-	-
		motorways	47.9 ± 1.7	-	48.5 ± 1.6	-	-
		rural roads	43.5 ± 2.1	-	43.9 ± 1.9	-	-
		urban roads	22.2 ± 1.7	-	22.2 ± 1.5	-	-

Poland	**weekday**	**all roads**	77.9 ± 1.6	-	75.2 ± 1.5	-	81.6 ± 28.1
	weekend		79.5 ± 3.0	-	76.1 ± 2.9	-	56.1 ± 24.8
	all days		78.2 ± 1.4	-	75.4 ± 1.4	-	62.7 ± 20.1
		motorways	89.2 ± 0.8	-	88.4 ± 0.8	-	78.7 ± 22.3
		rural roads	77.2 ± 1.9	-	74.4 ± 1.8	-	58.9 ± 28.4
		urban roads	75.8 ± 2.6	-	72.2 ± 2.4	-	69.8 ± 22.2
Portugal	**weekday**	**all roads**	90.8 ± 3.6	-	90.3 ± 3.3	79.5 ± 38.7	-
	weekend		85.5 ± 8.0	-	85.8 ± 6.9	-	-
	all days		89.7 ± 3.2	-	89.3 ± 2.9	84.2 ± 36.8	-
		motorways	92.2 ± 5.5	-	91.4 ± 5.0	-	-
		rural roads	87.6 ± 4.8	-	87.1 ± 4.4	-	-
		urban roads	95.2 ± 3.3	-	95.1 ± 2.9	44.9 ± 38.7	-

8 Annex 2. Requirements for representative measurements of the use of seatbelts and child restraint systems

8.1 General principles

8.1.1 Definition of correct use, no use, and misuse

The objective is to estimate the percentage of vehicle occupants using the safety belt or child restraint system (CRS) correctly. The theoretical population refers to the total of all movements with the vehicles over the national territory. In other words, this reflects the total number of kilometres driven. Hence, the percentage of vehicle occupants using the safety belt or child restraint system correctly refers to the percentage of kilometres driven using the safety belt or child restraint system correctly.

References for correct use should consist of:

- The national traffic legislation;
- The CRS's conformity and instruction label;
- Common regulations/prescriptions.

It is not required to take into account additional (national) recommendations for the optimal use of CRS (e.g. the Swedish recommendation to use a rearward facing CRS up to and including 4 years of age). Compliance with such recommendations could be included as optional information.

'Correct use' is the complement of 'no use' and 'misuse'. As a result, both 'no use' and misuse must be detected. If there is no indication of no use or misuse, the usage is considered to be correct. If seat belt or child seat usage in the vehicle could not be observed for any of the vehicle occupants, this is an observation with a missing key variable and therefore an invalid observation. If it is possible to observe for some of the occupants, the observation is valid, and the CRS or seat belt use of the remaining occupants can be coded as 'unknown'.

Possible ***misuses*** of ***safety belts*** are (non-exhaustive):

- Belt behind the back
- Belt under arm
- Incorrect height setting of seat belt's top guidance
- Use of 'foreign objects' such as clothespins to deviate the seat belt or reduce its tension

Possible ***misuses*** (non-exhaustive) of ***CRS*** can be grouped into 3 types:

- Inappropriate use
  - o Child not in CRS while it should be (= no use)
  - o Child in wrong group of CRS
- Faulty fixation of CRS to vehicle
  - o Incorrect seat belt guidance around CRS
  - o Back tether or floor support (as complement to Isofix) not attached

  - o CRS wrongly orientated
  - o Frontal airbag not deactivated with rearward mounted CRS on place with frontal airbag
- Faulty fixation of child to CRS
  - o Belts too loose
  - o Wrong belt guidance

8.1.2 Additional observations for misuse of CRS

Given the complexity of determining the correct use of CRS, two types of observations are recommended:

1) During the seat belt observations, the number of children in the car and the presence of CRS can be observed for quantitative purposes
2) An additional detailed in-vehicle inspection of the correct use of CRS. This requires the driver's cooperation and is only possible during dedicated sessions in accessible locations.

8.1.3 Stratification and subpopulations

SWD requires taking into account the following strata:

- Road type
- Vehicle type
- Place in vehicle: front / rear
- Week day / weekend

Another stratum that could influence correct seat belt use or CSR use is the region. Member States are free to consider supplementary stratifications according to region.

Theoretically, the optimal strategy for estimating the overall prevalence of correct seatbelt and CRS use is to sample all strata according to traffic volume of each combination of all the different strata. This overall strategy would, however, be detrimental for the accuracy of specific low volume strata that are of interest. Certain road types could have a lower traffic volume than others, as do weekends compared to weekdays. As a result, strictly proportional sampling would lead to much smaller confidence intervals for certain strata.

8.1.4 Minimum sample size

A **minimum of 2000 observations overall** is recommended for both KPIs. For the first stratification level, a minimum of 500 observations per stratum is advised. In the case of seat belt use and CRS use, the observed unit is a vehicle. However, a minimum of 2000 observed vehicles with children among the occupants is difficult to attain. Therefore, the following sample sizes are requested:

- A minimum of 2000 observed vehicles overall for seat belt use, with a minimum of 500 observations per road type;
- A minimum of 200 observed vehicles with children among the occupants for road side observation of child restraint system use, with a minimum of 50 observations per road type;
- A minimum of 200 observed vehicles with children among the occupants for detailed in-depth inspection of child restraint system use, with a minimum of 50 observations per road type.

Member States not able to achieve the minimum requested number of observations need to justify this in detail.

If **regions** are to be distinguished in the reported results, the above minimum numbers of observations apply to each region. If **vehicle types** are to be distinguished in the reported results, the above minimum numbers of observations apply to each vehicle type. If only passenger cars are considered or where there are insufficient observations of other vehicle types, the above minimum numbers of observations apply to passenger cars.

See Annex 3 for the rationale for the minimal sample requirements.

8.2 Observation method

8.2.1 Observation methods

SWD prescribes **direct observation** as the data collection method. Direct observation should preferably be carried out alongside the road.

SWD allows the use of **cameras** to collect data on seat belt use. In that case, it should be ensured that the cameras will be installed on all road types to avoid selection bias. This technology could have clear advantages compared to using observers in terms of, for example, reliability, 24/7 observation, night-time use etc. Possible disadvantages should however be evaluated (e.g. lacking variables, visibility of rear occupants etc.). Its use should be tested and

validated before deployment. For privacy reasons, faces and license plates should not be caught on camera. Each Member State will have to conform with national and international requirements regarding ethics, privacy, and data protection.

Determining the correct use of CRS requires detailed **in-vehicle inspections**. These sessions can take place in accessible locations such as parking lots, rest areas, etc. and require the driver's voluntary cooperation. Selection bias is inevitable in a survey based on voluntary participation. However, it is the only option for reliably detecting the correct use of CRS.

The COVID-19 pandemic has implications for the in-depth inspection of CRS use. The current COVID-19 situation can limit the willingness to participate and to allow the observer to carry out the in-vehicle inspection. It is important to collect data in/from a sufficiently representative context in order to have representative KPIs. Therefore, it is recommended not to plan data collection for as long as some severe sanitary measures are in force, such as a lockdown, a night curfew, closed schools/day-cares, limitations of social contacts etc.

8.2.2 Coverage of road types

The indicator should cover **motorways, rural non-motorway roads (outside built-up areas), and urban roads (inside built-up areas)**. This is the minimally required categorisation. The results should be presented separately for these three different road types and also aggregated (after weighting) for the whole road network.

Where a Member State's road network does not contain motorways, the overall results are calculated using the remaining road types. Where a Member State's road network does contain all required road types, but not all road types are included in the survey, results cannot be aggregated by the remaining road types and remain disaggregated for each remaining road type.

8.2.3 Selection of locations

Since SWD requires coverage of the three road types, the proportion of observations sampled at each of the three road types mentioned above should be at least 20% to ensure a minimal number of observations for each stratum, even if this would imply disproportionate sampling. It is recommended to sample the three road types according to traffic volume, assuming each of the three road types represents a share of traffic volume above 20% based on available national data (e.g. traffic data per road type from national traffic surveys). If such data is not available, a minimal number of 10 locations per road type should be selected for the national indicator (see section 'Locations' below).

The selection of locations should be as random as possible. There are different options for random location selections: simple random, stratified random, cluster random etc. Cartographic software like ArcGIS can be used for selecting random points, e.g. https://desktop.arcgis.com/en/arcmap/latest/extensions/geostatistical-analyst/anintroduction-to-sampling-monitoring-networks.htm

The appropriate sample size should be estimated and used to determine the required number of locations or observational sessions, taking different vehicle types into account. 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

Sample size calculators can be used to calculate the required minimal number of observations: e.g. https://samplesize.net/confidence-interval-proportion/ (software determining the upper and lower bounds of the confidence interval for a proportion).

The rationale for choosing the observation locations should be documented. These include a minimum traffic flow (e.g. at least 10 relevant vehicles per hour) and a random selection of different regional locations. Ideally, a random sample of all possible locations within a designated area will be used. A random selection of locations will also include roads with low traffic volume. In that case, it is recommended to choose a nearby road with a higher traffic volume instead, if it is assumed that most drivers on the low-volume road drove or will drive on the high-volume road as well. Locations with less than 10 relevant vehicles passing per hour cannot be used. Member States can define a higher minimum.

The minimum number of observation sites for seatbelt and CRS use is 10 per stratum in the first stratification level, which means:

- at least 10 locations on urban roads;
- at least 10 locations on rural roads;

- at least 10 locations on motorways.

Each location can be used for different sessions (at different time intervals) or each location can be assigned (randomly) to a specific time interval.

The minimum number of sites for in-vehicle inspections for CRS is 2 for each combination of time period and road type (6 combinations if all road types are covered).

Basic characteristics of the locations should be documented:

- for road-side observations: coordinates (if possible), address or other geographical information, number of lanes, target lane and direction to be observed, and visibility of the traffic from the location;
- for in-depth inspections: coordinates (if possible), address or other geographical information, location type, related activity/service type (e.g. parking lot of school, shop, day-care etc.).

8.2.4 Methods for observations for different road types

Observations of safety belt use on urban and rural roads can be carried out from a safe place along the road, preferably at locations where driving speed is reduced relative to the speed limit, such as intersections. Observations of child restraint system use on urban and rural roads can be carried out at parking lots of shops or leisure activities.

Observations of safety belt use on motorways are for example possible at:

- the last intersection before on-ramps,
- the first intersection after an off-ramp,
- service stations,
- rest areas,
- toll stations etc.

In-depth investigation of child restraint system use on motorways is possible at service stations or rest areas.

For direct observations, strong wind, precipitation, and very low or high temperatures could negatively affect the observers' endurance and observation quality. The road-side observations should be performed during reasonably good weather. The same applies to the in-vehicle inspections of CRS use.

8.2.5 Observation sessions

Each observation session should last at least 30 minutes, although a duration of 1 hour is advised. It should be kept in mind that this minimal session requirement does not include the time spent on traffic volume counting (see section 'Traffic volume' below). Date and time (to the nearest hour) covered by the measurements should be indicated in the meta-data.

At a minimum, 10 locations per time period (in this case weekdays and weekend) and 2 observation sites for each combination of time period and road type should be observed (6 combinations if all road types are covered). Ideally, the same locations should be observed during weekdays and weekends.

8.3 Other requirements and options to be considered

8.3.1 Vehicle types and occupants to be considered

The road users to be observed are the front occupants and rear occupants of at least passenger cars and preferably of goods vehicles as well (light goods vehicles (LGV/vans) and heavy goods vehicles (HGV/lorries)). Since very few children are expected to be travelling in goods vehicles, it is recommended to only include passenger cars in the CRS observations. At a minimum, separate test results for passenger car front occupants and passenger car rear occupants are expected. If other vehicle categories are also included in the study, these results should be reported separately.

The different vehicle types and their specific categorization should be clearly defined and illustrated for the observers (training, briefing), e.g. some vehicles exist in passenger car and LGV versions with only limited differences such as the presence of rear windows.

Road users to be observed should be randomly selected from all the possible objects at the location where the observation is done. After coding one observation, the next passing target vehicle should be observed.

Vehicle occupants legally exempted from seat belt wearing should be excluded, e.g. postal delivery services, taxi drivers, emergency vehicles etc. The most practical solution is to exclude the whole vehicle from the data collection.

Because the legislation on (and exemptions from) seat belt use and on CRS use can vary between countries, it is requested that all countries document their legislation on seat belt use and CRS use and consequently document which vehicles were excluded from the observations.

Supplementary to safety belt usage, it might be valuable to include one or more of the following occupant characteristics for further analysis:

- Gender (observed)
- Age group (observed)

Age groups are divided as follows: child: 0-18, young: 18-24, medium: 25-64, senior: 65+.

During the in-vehicle inspections on CRS use, it might be valuable to include one or more of the following trip characteristics for further analysis:

- Trip purpose (question to driver)
- Trip length/duration (question to driver)

8.3.2 Temporal requirements

Observations should be timed as follows:

- late spring or early autumn. All months are allowed except for December, January, July and August. In some Member States, the Winter or Summer holiday period could extend to other months as well, such as June, and in such cases these months should also be excluded;
- week days (excluding bank holidays) and weekend, observed and presented separately;
- daylight – observations should cover the whole daytime;
- reasonably good weather.

There should be a balance between all combinations of road types (3) and the different time factors above, to avoid a systematic sample bias.

Where Member States have historical series of measurements, it is recommended to use the same period(s) of the year as for the earlier measurements.

Member States willing to organise more than one roadside survey to deliver the KPIs (e.g. one in spring and one in autumn) can apply the minimal sample size requirements on the combination of both measurements. The data of both measures can be combined to deliver the main and disaggregate indicators.

8.3.3 Optional breakdown by region

Optionally, Member States can decide to distinguish different regions in the survey. In that case, countries can consider collecting data from each region or from a representative selection of regions. Member States wishing to have meaningful KPIs at regional level should take into account that the national indicators on minimum sizes of the location sample (10 per road type; see section 'Selection of locations' above) and driver sample (2000 per vehicle type; see section 'Minimum ample size') should ideally be applied in each region. If stratification in regions is used, results should be weighted according to traffic volumes by region.

8.4 Data analysis

8.4.1 Data to be recorded

This section gives a preliminary overview of the variables to include in the survey. However, this will be covered in more detail by the data templates that will be provided later.

Data to collect with regard to the locations:

- Unique location ID
- Region (if applicable)
- Road type
- Road number, address
- Coordinates of exact observation spot (either here or in observation session details)
- In case of CSR inspection: related activity/service type (e.g. parking lot of school, shop, day-care etc.)
- Number of lanes
- Target lane and direction to be observed (either here or in observation session details)
- Visibility of the traffic from the location (either here or in observation session details)

Data to collect with regard to the observation sessions:

- Unique session ID
- Location (from which road type can be derived)
- Date (from which time period can be derived)
- Begin time of observations
- End time of observations
- Total duration of observation session (end time – begin time – count duration)
- Traffic count duration (not for in-depth CRS inspection sessions)
- Traffic count results per relevant vehicle type (not for in-depth CRS inspection sessions)
- Traffic count results per relevant vehicle type extrapolated to session duration (not for in-depth CRS inspection sessions)
- Short weather description

Data to collect with regard to the observations themselves (one data point = one observed vehicle):

- Vehicle type
- Driver seat belt use (correct use / misuse / no use)
- Front passenger 1 seat belt use (correct use / misuse / no use)
- Front passenger 2 seat belt use (correct use / misuse / no use)
- Rear passenger 1 seat belt use (correct use / misuse / no use)
- Rear passenger 2 seat belt use (correct use / misuse / no use)
- …

Optionally, estimated age group, gender and other additional variables can be recorded per occupant as well

Data to collect with regard to the in-depth CRS inspections (one data point = one observed vehicle):

- Place of child in vehicle
- Frontal airbag on place of child (not present / activated / deactivated)
- Seat belt type on place of child (not present / 2-point / 3-point)
- Isofix on place of CRS
- Child not fixed / seat belt / in CRS
- Orientation of CRS (forward, rearward, sideways)
- CRS group
- CRS homologation label
- Length of child
- Weight of child
- Seat belt guidance (correct / false / NA)
- Seat belt tension (correct / too tight / too loose / NA)
- CRS belts guidance (correct / false / NA)
- CRS belts tension (correct / too tight / too loose / NA)

Requirements for the data delivery and data matrix for the Baseline dataset will be provided in a separate document.

8.4.2 Post stratification weights and statistical analysis

For each level of stratification, results should be weighted according to traffic volumes (see next section) by level of stratification. It is recommended to use the exact values for each combination of stratification levels considered (e.g. traffic volume of passenger cars on weekdays on motorways). 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 'observed vehicles with children among the occupants' should serve as a quantitative basis for the weighting of the qualitative data gathered with the in-depth inspections of CRS use.

Traffic volumes can either be inferred from existing national mobility data or estimated using traffic counts during the observation sessions. When traffic counts are used to infer traffic volumes per stratum, road network length by road type should also be considered in the weight calculation. If official data on network length per road type are unavailable, it is advised to request estimates from experts from the relevant public services.

Statistical analysis techniques and tools should be determined by the Member State and clearly described in the method section. Since sampling will typically be nested in locations, it is recommended to use appropriate multilevel

models for two-stage stratified sampling (1st stage= road type and 2nd stage= period). Approximations assuming simple random sampling can be used as long as results are weighted according to traffic volumes.

Further instructions on weighting and statistical analysis will follow at a later stage.

8.4.3 Measuring traffic volume

For the roadside observations, traffic counts should be performed at each location and each observation session. This information is necessary to correctly calculate the confidence intervals and weighing factors. For the roadside observations. For the detailed inspections of CRS this is not necessary.

Traffic volumes should be estimated by traffic counts during the observation session: ideally either by counting all passing relevant vehicles (only the vehicle categories that are being observed) during the session, or by counting all passing relevant vehicles during a short interval in the middle, or partly before and partly after the measure. The counting should be done for the same vehicle categories at the same location and direction as the observations. The counting of all relevant vehicle categories should last at least 10 minutes. Optionally, an automatic counter can be used to determine traffic volume. Note that in that case it might not be possible to exclude certain vehicle types.

These counts should then be extrapolated to the whole duration of the session. When observing at service stations or rest areas, the traffic volume to consider is the vehicles entering the service station or rest area.

8.4.4 KPI values to provide

The main KPI value to provide is the percentage of vehicle occupants using the restraints correctly across all times and all locations. At a minimum, the percentage of correct use of safety belt by passenger car front occupant, of safety belt by passenger car rear occupants, and of child restraint systems should be provided. The equivalent percentages in goods vehicles is desired but not mandatory. Results should also include the unweighted number of drivers the result is based on.

A point estimate and a corresponding 95% confidence interval is expected for each level of the following stratification variables:

- Road type (3 levels: motorways, rural non-motorway roads, and urban roads)
- Front vs rear occupant (in case of seat belt use in passenger car)
- Period (2 levels: weekdays vs weekend)
- Vehicle type (if applicable)
- Region (if applicable)

Specific estimates for combinations hereof are not expected since some countries will not have sufficient sample sizes for each combination.

Three levels of aggregation can be considered:

1) minimal level: estimates for all levels of each level of disaggregation, including CI estimates
2) medium level: crossed-level matrix of all levels of disaggregation (+ CIs)
3) ideal level: cleaned raw data (not pure raw data).

'Cleaned data' refers to data that is corrected (if possible) when improperly formatted or incorrectly recorded and discarded from any incorrect or incomplete observations that cannot be corrected, are irrelevant or duplicate.

Together with the above estimates, a report should be submitted that describes the specificities of the methodology of the field work and the statistical techniques used to weight and analyse the results, and to calculate the CIs.

8.4.5 Confidence intervals

Assuming a simple random sampling and depending on prevalence levels, the 95% confidence intervals (CI) for n=2000, n=500, n=200 and n=50 are[3]:

	n=2000		n=500		n=200		n=50	
Prevalence	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
50%	47,8%	52,2%	45,5%	54,5%	42,9%	57,1%	35,5%	64,5%
75%	73,0%	76,9%	71,0%	78,7%	68,4%	80,8%	-	-

[3] https://sample-size.net/confidence-interval-proportion/

90%	88,6%	91,3%	87,0%	92,5%	85,0%	93,8%	78,2%	96,7%

9 Annex 3. Rationale for 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.