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THE FUTURE OF TRANSPORT

General Safety Regulation

Overview and summary of technical regulations

October 2025

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General Safety Regulation

Overview

- Framework contract with European Commission - DG GROW
- Since 2014 involved in updating the General and Pedestrian Safety Regulations
- TRL's project phases:
  - GSR1 (2015): 50+ safety measures; indicative cost-benefit analyses and feasibility assessments; shortlist of candidate measures
  - GSR2 (2017): Evidence review and large-scale stakeholder consultation; suggested input values for cost-effectiveness analysis
  - GSR3/4 (2018): Cost-effectiveness analysis for Commission's impact assessment
  - GSR5 (2021-on): Support Commission in the development of secondary type approval legislation

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General Safety Regulation

GSR-1

- Over 50 candidate implementing measures
  - Active safety
  - Car occupant and pedestrian secondary safety
  - Crashworthiness, HGV and fuel system safety
  - Driver interface, distraction and ITS

Benefit and Feasibility of a Range of New Technologies and Unregulated Measures in the fields of Vehicle Occupant Safety and Protection of Vulnerable Road Users

Summary of findings for 'green' measures

'Green' Measures					
Code	**Measure**	**Feasible?**	**BCR**	**Legislate?**	**Recommendations/Notes**
AEB	Expansion and enhancement of AEB, BAS and LDW to avoid or mitigate collisions, including inter-urban, city and those with VRU	✓	~1	●	Greatest casualty benefit for AEBS is for M1 then N1 vehicles, although cost-benefit less clear than for N2/N3. System cost estimates suggest 'city safety' systems may be getting to the breakeven cost point
ISA	Speed limiters controlled by road speed limit (speed assist, intelligent speed adaptation)	✓	>1	●	BCR>1 for 6 Member States, for voluntary activation (switched on/off by the driver) and mandatory activation, and public acceptability of the systems considered to be growing. BCR higher for mandatory activation system, but both have positive BCR
LKA	Lane keeping system	✓	>1	●	Costs higher than LDW and similar to LCA, but benefits higher because higher expected effectiveness than LDW/LCA
REV	Reversing detection and reversing camera systems to prevent accidents involving children behind reversing cars	✓	>1	●	BCR>1 when including damage-only accident mitigation and regulatory requirements are being introduced in the US (mandated from May 2018), so the technology is likely to become commonplace and costs are likely to reduce further
EBD	Standard fitment of the emergency brake light display (i.e. rapidly blinking brake lamps) in case of hard braking	✓	>1	●	No formal BCR for EBD were identified, but costs likely to be very low and collision and injury benefits expected - therefore BCR may be >1
SFS	Protection of far-side occupants in side impact collisions	✓	>1	●	Likely to be cost-beneficial (spans 1, and cost estimate considered to be high) and already in production vehicles. Work would be required to define suitable test and assessment procedures
SBR	Seat-belt reminder systems in front and rear passenger seating positions	✓	>1	●	Cost-beneficial for M1 driver and outboard passenger seat, M2 and M3 passengers, all seat positions for N1, N2, N3. Could consider legislation for M1 second and other row seats on basis of safety equality and being nearly cost effective
FCO	Compatibility with crash partners (incorporating HGV rear under-run)	✓	<1 (>1)	●	Insufficient benefit from testing for geometric alignment of M1 frontal energy absorbing structures; consideration could be given to a voluntary agreement for height of energy absorbing structures in a similar way as in the US. For HGV, improved rear under-run guard likely to have BCR>1
LAT	Lateral protection of trailers/trucks (removal of some exemptions)	✓	<1 to 1	●	Cost benefit likely to be less than 1 for vehicles that genuinely need either an exemption or adjustable side guards; however, the classification of these vehicles should be improved, which will reduce the number of vehicles receiving an exemption
DIM	Safer HGV front end design (enabled by changes to the weights and dimensions legislation)	✓	>1	●	Breakeven cost per vehicle €1,448–€4,889, so likely to be cost-beneficial. Further work needed to define suitable requirements, which will affect costs, so final BCR should be updated. Alternative active safety systems should also be investigated to ensure that the best benefit is delivered for a given cost

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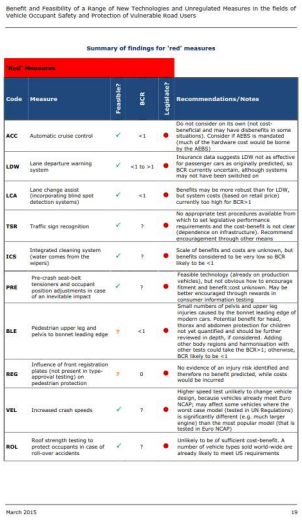
General Safety Regulation

GSR-1

- Each reviewed for
  - Definition of the problem
  - Potential mitigation strategies
  - Feasibility
  - Costs
  - Benefits
  - Indicative benefit:cost ratio (BCR)
    - **As an isolated measure**
- 24 measures taken forward to GSR-2



Benefit and Feasibility of a Range of New Technologies and Unregulated Measures in the fields of Vehicle Occupant Safety and Protection of vulnerable Road Users

Summary of findings for 'red' measures

'Red' Measures

Code	Measure	Feasible?	BCR	Legislate?	Recommendations/Notes
ACC	Automatic cruise control	✓	<1	●	Do not consider on its own (not cost-beneficial and may have disbenefits in some situations). Consider if AEBS is mandated (much of the hardware cost would be borne by the AEBS)
LDW	Lane departure warning system	✓	<1 to >1	●	Insurance data suggests LDW not as effective for passenger cars as originally predicted, so BCR currently uncertain, although systems may not have been switched on
LCA	Lane change assist (incorporating blind spot detection systems)	✓	<1	●	Benefits may be more robust than for LDW, but system costs (based on retail price) currently too high for BCR>1
TSR	Traffic sign recognition	✓	?	●	No appropriate test procedures available from which to set legislative performance requirements and the cost-benefit is not clear (dependence on infrastructure). Recommend encouragement through other means
ICS	Integrated cleaning system (water comes from the wipers)	✓	?	●	Scale of benefits and costs are unknown, but benefits considered to be very low so BCR likely to be <1
PRE	Pre-crash seat-belt tensioners and occupant position adjustments in case of an inevitable impact	✓	?	●	Feasible technology (already on production vehicles), but not obvious how to encourage fitment and benefit:cost unknown. May be better encouraged through rewards in Consumer Information schemes
BLE	Pedestrian upper leg and pelvis to bonnet leading edge	?	<1	●	Small numbers of pelvis and upper leg injuries caused by the bonnet leading edge of modern cars. Potential benefit for head, thorax and abdomen protection for children not yet quantified and should be further reviewed in depth, if considered. Adding other body regions and harmonisation with other tools could take the BCR>1; otherwise, BCR likely to be <1
REG	Influence of front registration plates (not present in type-approval testing) on pedestrian protection	?	0	●	No evidence of an injury risk identified and therefore no benefit predicted, while costs would be incurred
VEL	Increased crash speeds	✓	?	●	Higher speed test unlikely to change vehicle design, because vehicles already meet Euro NCAP; may affect some vehicles where the worst case model (tested in UN Regulations) is significantly different (e.g. much larger engine) than the most popular model (that is tested in Euro NCAP)
ROL	Roof strength testing to protect occupants in case of roll-over accidents	✓	?	●	Unlikely to be of sufficient cost-benefit. A number of vehicle types sold world-wide are already likely to meet US requirements

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GSR-2

- Multiple measures cannot be assessed in isolation
  - Each interacts with the others
  - Recently implemented measures (ESC)
  - Driver Assistance (ISA, TPMS, …)
  - Active safety (AEB, LKA, …)
  - Passive safety (Frontal crash Reg 94, side crash Reg 95, …)

General Safety 2

Table 1: Overview of the 24 candidate measures reviewed for General Safety 2 and the vehicle categories affected

Code	Description	Applicable vehicle categories						
AEBe	Autonomous Emergency Brakingε	M1ε	ε	ε	N1ε	ε	ε	ε
AEB-PCDe	Autonomous Emergency Braking for Pedestrians and Cyclistse	M1ε	ε	ε	N1ε	ε	ε	ε
ALCe	Alcohol Interlock Installation Documentε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	ε
BFS-AFEe	Bus Fire Safety – Automatic Fire Extinguishersε	ε	M2ε	M3ε	ε	ε	ε	ε
BFS-CNGe	Bus Fire Safety – CNG pressure reliefε	ε	M2ε	M3ε	ε	ε	ε	ε
DDREe	Drowsiness and Distraction Recognitionε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	ε
EDRe	Event Data Recordersε	M1ε	ε	ε	N1ε	ε	ε	ε
ESSe	Emergency Stop Signalsε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	ε
FP94e	Regulation 94 Frontal Offset Occupant Protection – Removal of Exemptionsε	M1ε	ε	ε	N1ε	ε	ε	ε
FFWe	Full-width Frontal Occupant Protectionε	M1ε	ε	ε	N1ε	ε	ε	ε
FSOe	Small Overlap Frontal Occupant Protectionε	M1ε	ε	ε	ε	ε	ε	ε
HEDe	Adult Head to Windscreen Area Protectionε	M1ε	ε	ε	N1ε	ε	ε	ε
ISAe	Intelligent Speed Assistanceε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	ε
LATe	Lateral Side-Guardsε	ε	ε	ε	ε	N2ε	N3ε	O3ε
LKAe	Lane Keeping Assistε	M1ε	ε	ε	N1ε	ε	ε	ε
PSIe	Pole Side Impact Occupant Protectionε	M1ε	ε	ε	N1ε	ε	ε	ε
REVe	Reversing Detection or Camera Systems εε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	O3ε
RFTe	Rear Impact Protection of the Fuel Tankε	M1ε	ε	ε	N1ε	ε	ε	ε
RUPe	Rear Underrun Protectionε	ε	ε	ε	ε	N2ε	N3ε	O3ε
S95e	Regulation 95 Side Impact Occupant Protection – Removal of Exemptionsε	M1ε	ε	ε	N1ε	ε	ε	ε
SBRe	Seat-Belt Reminderεε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	ε
SFSe	Side impact collision protection for Far-Side occupantsε	M1ε	ε	ε	N1ε	ε	ε	ε
TPMe	Tyre Pressure Monitoring Systemεε	M1ε	M2ε	M3ε	N1ε	N2ε	N3ε	O3ε
VISe	Direct Vision and VRU detectionsε	ε	M2ε	M3ε	ε	N2ε	N3ε	ε

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General Safety Regulation

GSR-2

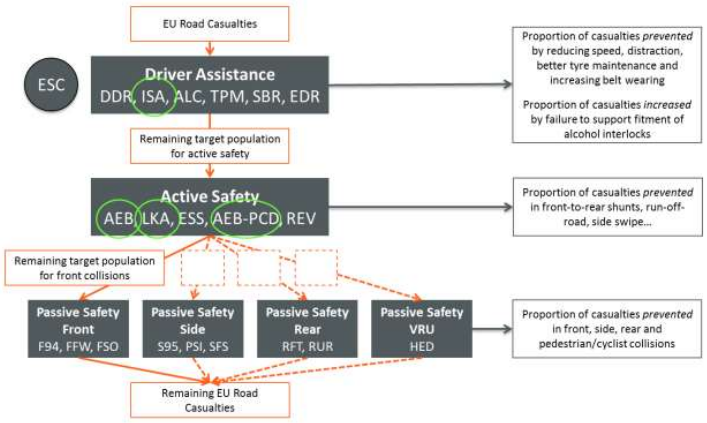

Table 1: Overview of the 24 candidate measures reviewed for General Safety 2 and the vehicle categories affected

Code	Description	Applicable vehicle categories						
AEBe	Autonomous Emergency Braking	M1e	x	x	N1e	x	x	x
AEB-PCDe	Autonomous Emergency Braking for Pedestrians and Cyclists	M1e	x	x	N1e	x	x	x
ALCe	Alcohol Interlock Installation Documente	M1e	M2e	M3e	N1e	N2e	N3e	x
BFS-AFDe	Bus Fire Safety – Automatic Fire Extinguishere	x	M2e	M3e	x	x	x	x
BFS-CNGe	Bus Fire Safety – CNG pressure relefe	x	M2e	M3e	x	x	x	x
DDRe	Drowsiness and Distraction Recognitione	M1e	M2e	M3e	N1e	N2e	N3e	x
EDRe	Event Data Recordere	M1e	x	x	N1e	x	x	x
ESSe	Emergency Stop Signale	M1e	M2e	M3e	N1e	N2e	N3e	x
F94e	Regulation 94 Frontal Offset Occupant Protection – Removal of Exemptionse	M1e	x	x	N1e	x	x	x
FFWe	Full-width Frontal Occupant Protectione	M1e	x	x	N1e	x	x	x
FSOe	Small Overlap Frontal Occupant Protectione	M1e	x	x	x	x	x	x
HEDe	Adult Head to Windscreen Area Protectione	M1e	x	x	N1e	x	x	x
ISAe	Intelligent Speed Assistancee	M1e	M2e	M3e	N1e	N2e	N3e	x
LATe	Lateral Side-Guarde	x	x	x	x	N2e	N3e	O3e
LKAe	Lane Keeping Assiste	M1e	x	x	N1e	x	x	x
PSIe	Pole Side Impact Occupant Protectione	M1e	x	x	N1e	x	x	x
REVe	Reversing Detection or Camera Systems e	M1e	M2e	M3e	N1e	N2e	N3e	O3e
RFTe	Rear Impact Protection of the Fuel Tanke	M1e	x	x	N1e	x	x	x
RURe	Rear Underrun Protectione	x	x	x	x	N2e	N3e	O3e
S95e	Regulation 95 Side Impact Occupant Protection – Removal of Exemptionse	M1e	x	x	N1e	x	x	x
SBRe	Seat-Belt Reminderse	M1e	M2e	M3e	N1e	N2e	N3e	x
SFSe	Side impact collision protection for Far-Side occupantse	M1e	x	x	N1e	x	x	x
TPMe	Tyre Pressure Monitoring Systeme	M1e	M2e	M3e	N1e	N2e	N3e	O3e
VISe	Direct Vision and VRU detectione	x	M2e	M3e	x	N2e	N3e	x

May 2017

- BCR for each measure as part of a package

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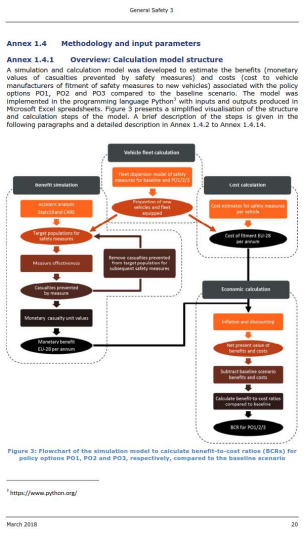
GSR-3 and 4

- Analysed different packages of measures
  - Policy options (POs)
  - PO1: State-of-the-art and widely available in the market
    - Voluntary fitment 5-90%
  - PO2: As PO1 + VRU & driver attention
  - PO3: PO2 + all remaining feasible measures



Annex 1.4 Methodology and input parameters

Annex 1.4.1 Overview: Calculation model structure

A simulation and calculation model was developed to estimate the benefits (monetary values of casualties prevented by safety measures) and costs (cost to vehicle manufacturers of fitment of safety measures to new vehicles) associated with the policy options PO1, PO2 and PO3 compared to the baseline scenario. The model was implemented in the programming language Python[1] with inputs and outputs produced in Microsoft Excel spreadsheets. Figure 3 presents a simplified visualisation of the structure and calculation steps of the model. A brief description of the steps is given in the following paragraphs and a detailed description in Annex 1.4.2 to Annex 1.4.14.

Figure 3: Flowchart of the simulation model to calculate benefit-to-cost ratios (BCRs) for policy options PO1, PO2 and PO3, respectively, compared to the baseline scenario

[1] https://www.python.org/

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List of technologies considered – Policy Option 1

Measure	Description	Applicable vehicle categories			
AEB-VEH	Autonomous emergency braking for vehicles (moving and stationary targets)	M1		N1	
AEB-PCD	Autonomous emergency braking for pedestrians and cyclists	M1		N1	
ALC	Alcohol interlock installation document	M1	M2&M3	N1	N2&N3
DDR-DAD	Drowsiness and attention detection	M1	M2&M3	N1	N2&N3
DDR-ADR	Advanced distraction recognition	M1	M2&M3	N1	N2&N3
EDR	Event data recorder	M1		N1	
ESS	Emergency stop signal	M1	M2&M3	N1	N2&N3
FFW-137	Full-width frontal occupant protection (current R137 configuration with Hybrid III ATDs)	M1		N1	
FFW-THO	Full-width frontal occupant protection (introduction of THOR-M ATDs and lower appropriate injury criteria thresholds to encourage adaptive restraints)	M1		N1	
HED-MGI	Adult head-to-windscreen impact (mandatory HIC limit in headform-to-glass impact tests; no mandatory A-pillar impact)	M1		N1	
ISA-VOL	Intelligent speed assistance (voluntary type system; can be overridden by driver and switched off for the rest of journey)	M1	M2&M3	N1	N2&N3
LKA-ELK	Lane keeping assist (emergency lane keeping system that intervenes only in case of an imminent threat such as leaving the road, or leaving the lane with oncoming traffic)	M1		N1	
PSI	Pole side impact occupant protection	M1		N1	
REV	Reversing camera system	M1	M2&M3	N1	N2&N3
TPM	Tyre pressure monitoring system		M2&M3	N1	N2&N3
VIS-DET	Front and side vulnerable road user detection and warning (no auto braking)		M2&M3		N2&N3
VIS-DIV	Minimum direct vision requirement (best-in-class approach)		M2&M3		N2&N3

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List of technologies considered – Policy Option 2

Measure	Description	Applicable vehicle categories			
AEB-VEH	Autonomous emergency braking for vehicles (moving and stationary targets)	M1		N1	
AEB-PCD	Autonomous emergency braking for pedestrians and cyclists	M1		N1	
ALC	Alcohol interlock installation document	M1	M2&M3	N1	N2&N3
DDR-DAD	Drowsiness and attention detection	M1	M2&M3	N1	N2&N3
DDR-ADR	Advanced distraction recognition	M1	M2&M3	N1	N2&N3
EDR	Event data recorder	M1		N1	
ESS	Emergency stop signal	M1	M2&M3	N1	N2&N3
FFW-137	Full-width frontal occupant protection (current R137 configuration with Hybrid III ATDs)	M1		N1	
FFW-THO	Full-width frontal occupant protection (introduction of THOR-M ATDs and lower appropriate injury criteria thresholds to encourage adaptive restraints)	M1		N1	
HED-MGI	Adult head-to-windscreen impact (mandatory HIC limit in headform-to-glass impact tests; no mandatory A-pillar impact)	M1		N1	
ISA-VOL	Intelligent speed assistance (voluntary type system; can be overridden by driver and switched off for the rest of journey)	M1	M2&M3	N1	N2&N3
LKA-ELK	Lane keeping assist (emergency lane keeping system that intervenes only in case of an imminent threat such as leaving the road, or leaving the lane with oncoming traffic)	M1		N1	
PSI	Pole side impact occupant protection	M1		N1	
REV	Reversing camera system	M1	M2&M3	N1	N2&N3
TPM	Tyre pressure monitoring system		M2&M3	N1	N2&N3
VIS-DET	Front and side vulnerable road user detection and warning (no auto braking)		M2&M3		N2&N3
VIS-DIV	Minimum direct vision requirement (best-in-class approach)		M2&M3		N2&N3

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List of technologies considered – Policy Option 3

Measure	Description	Applicable vehicle categories			
AEB-VEH	Autonomous emergency braking for vehicles (moving and stationary targets)	M1		N1	
AEB-PCD	Autonomous emergency braking for pedestrians and cyclists	M1		N1	
ALC	Alcohol interlock installation document	M1	M2&M3	N1	N2&N3
DDR-DAD	Drowsiness and attention detection	M1	M2&M3	N1	N2&N3
DDR-ADR	Advanced distraction recognition	M1	M2&M3	N1	N2&N3
EDR	Event data recorder	M1		N1	
ESS	Emergency stop signal	M1	M2&M3	N1	N2&N3
FFW-137	Full-width frontal occupant protection (current R137 configuration with Hybrid III ATDs)	M1		N1	
FFW-THO	Full-width frontal occupant protection (introduction of THOR-M ATDs and lower appropriate injury criteria thresholds to encourage adaptive restraints)	M1		N1	
HED-MGI	Adult head-to-windscreen impact (mandatory HIC limit in headform-to-glass impact tests; no mandatory A-pillar impact)	M1		N1	
ISA-VOL	Intelligent speed assistance (voluntary type system; can be overridden by driver and switched off for the rest of journey)	M1	M2&M3	N1	N2&N3
LKA-ELK	Lane keeping assist (emergency lane keeping system that intervenes only in case of an imminent threat such as leaving the road, or leaving the lane with oncoming traffic)	M1		N1	
PSI	Pole side impact occupant protection	M1		N1	
REV	Reversing camera system	M1	M2&M3	N1	N2&N3
TPM	Tyre pressure monitoring system		M2&M3	N1	N2&N3
VIS-DET	Front and side vulnerable road user detection and warning (no auto braking)		M2&M3		N2&N3
VIS-DIV	Minimum direct vision requirement (best-in-class approach)		M2&M3		N2&N3

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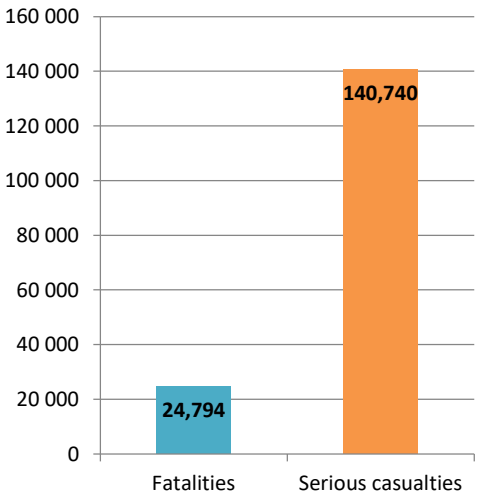
General Safety Regulation

Key Results

- Total casualty saving
  - Evaluation period 2021–2037
  - Across EU-28 compared to the baseline scenario

	All categories
Fatalities prevented	24,794
Serious casualties prevented	140,740
Slight casualties prevented	515,681



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General Safety Regulation

Key Results

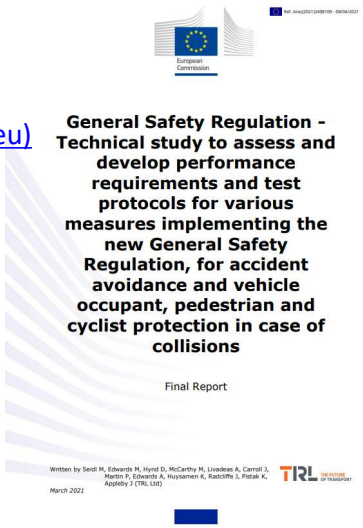
- Number of casualties prevented by safety measures
  - Evaluation period 2021–2037
  - Across EU-28 compared to the baseline scenario
  - Split by vehicle categories

	Cars	Buses	Vans	Trucks
Fatalities prevented	**21,337**	**227**	**1,283**	**1,947**
Serious casualties prevented	**126,390**	**2,410**	**6,917**	**5,023**
Slight casualties prevented	470,747	8,174	23,486	13,274

General Safety Regulation

GSR-5

- Main project completed and published in 2021
  [General Safety Regulation - Publications Office of the EU (europa.eu)]
- Continued support on certain regulations e.g. heavy vehicle EDR



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Measures covered

Code	Measure name	Vehicle categories	Date
AEB	Advanced Emergency Braking System (AEB for light duty, vehicles and pedestrians/cyclists)	M1, N1	2022
DDR	Driver Drowsiness and Attention Warning (DDAW), Advanced Driver Distraction Warning (ADDW), and Driver Availability Monitoring System (DAMS)	M1, M2, M3, N1, N2, N3	2022 2024 AV
EDR	Event Data Recorder	M1, N1 M2, M3, N2, N3	2022 2026
ELK	Emergency Lane Keeping System (ELKS)	M1, N1	2022
FFW	Frontal Full-Width Impact (implementation of THOR dummy)	M1, N1	-
HED	Pedestrian and Cyclist Enlarged Head Impact Zone	M1, N1	2024
ISA	Intelligent Speed Assistance	M1, M2, M3, N1, N2, N3	2022
REV	Reversing Detection	M1, M2, M3, N1, N2, N3	2022
TPM	Tyre Pressure Monitoring System (heavy duty)	M2, M3, N2, N3, O3, O4	2022
VIS	Direct Vision (heavy duty) Pedestrian and Cyclist Collision Warning (heavy duty) Blind Spot Information System (heavy duty)	M2, M3, N2, N3	2026 2022 2022

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General Safety Regulation

- TRL's scope of work varies between measures:

ISA TPMS

-Develop requirements and test procedures
-Trial the proposed procedures

ELKS DDAW

-Develop requirements and test procedures
-No trials

FFW HED ADDW

-Support the implementation of secondary legislation by the Commission
-Build on existing procedures or proposals where possible
-No trials

ACEA/CLEPA support

AEB VIS REV DAMS EDR

-Specific support in the context of a working group, e.g.
UN Informal Working Group

Industry involved through Informal Working Groups

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General Safety Regulation

Overview – General Safety Regulation

Modes of interaction

- TRL consulted with a variety of stakeholders, including ACEA, OEMs, CLEPA, Tier 1 suppliers, Euro NCAP, technical services, etc.
- Industry engagement in:
  - Bilateral meetings: Direct exchanges TRL <-> OEM/Tier 1 experts on an engineering level
  - Industry feedback: Technical review and feedback on TRL interim outputs through ACEA/CLEPA
  - Motor Vehicle Working Group meetings (previously 'task force meetings'): Technical exchange Commission <-> ACEA, CLEPA, and others; TRL participated where required
- The nature and extent of each of these components depended on the specific measure

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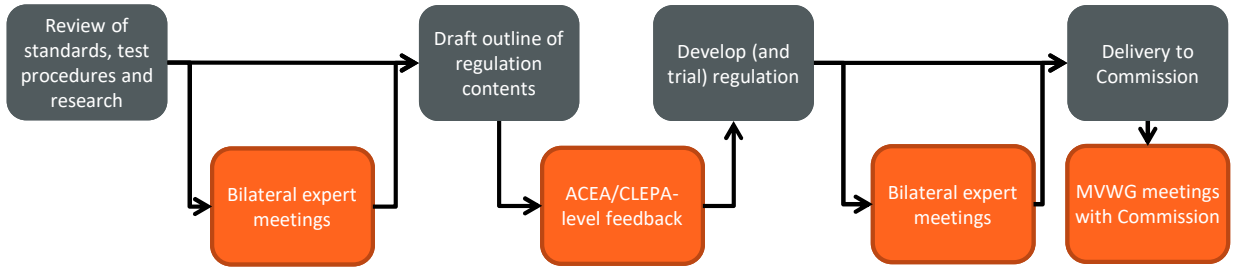
General Safety Regulation

Overview – General Safety Regulation

Stakeholder interaction across the measures



- Level of stakeholder involvement varies between measures (depending on scope of TRL's work)
- Intermediate industry consultation and 2nd round of bilateral expert meetings only for measures where TRL's task is to develop a full set of requirements and test procedures
  - DDAW, ELKS, ISA

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Conclusions

- Project finished early 2021
- Comprehensive suite of vehicle safety measures
  - Costs and benefits assessed as a package
  - Cost-effective benefits **only** achieved through **full package of measures**
- GSR measures implemented from 2022
  - Will **save 25,000 lives** and 140,000 serious injuries
- Platform for automation
  - Experience with some of the building blocks for AV technologies
  - EDR measure includes DSSAD (Data Storage System for Automated Driving)
    - Status of automated driving functions (just for ALKS to date)
  - Driver attention monitoring intended for application in AVs

The Regulations

High-level Summaries

- For general guidance only

Protection in the Event of a Collision

Car Occupants and Pedestrians

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Occupant crash protection

Overview

Full-width Frontal Impact (FFI) – UN Regulation No. 137
Offset Frontal Impact (OFI) – UN Regulation No. 94
Pole Side Impact (PSI) – UN Regulation No. 135

- Original Scope for M1 was up to 2500 kg
  - M1 category includes vehicles up to 3500 kg
- Scope updated to M1 up to 3500 kg
  - To include all M1 vehicles

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Pedestrian Windscreen Impact (PWI)

Overview

- **Source**
  - UN Regulation No. 127
  - Vehicle Category: M1, N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Head impact test designed to improve the secondary safety of pedestrians in impacts with the vehicle's windscreen
- **What it Does**
  - Mandates that the windscreen area meets the same pedestrian head injury criteria thresholds as the bonnet area already tested

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Pedestrian Windscreen Impact (PWI)

Key features

- **Scope Extension**
  - PWI extends the existing pedestrian protection regulation (bonnet top area) to also include parts of the windscreen for head impact assessment
- **Area Coverage**
  - Applies to adult and child head impacts
- **Area Exclusion**
  - A-pillars and the cowl area are not included in this extended assessment

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Pedestrian Windscreen Impact (PWI)

Testing and Validation

- **Test Area**
  - The test area includes parts of the windscreen up to an extended **wrap around distance of 2.5 metres**
- **Injury Criteria**
  - Injury criteria thresholds to be met in the windscreen area relate to head injuries
  - These are set at the same level as the criteria for the bonnet area
- **Validation Focus**
  - Ensuring the vehicle meets the mandated head injury criteria across the extended impact area

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Collision Avoidance

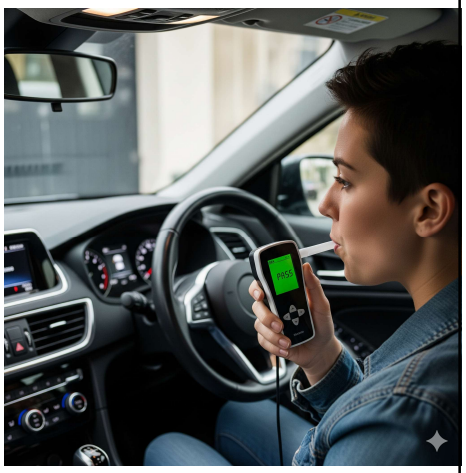
All Categories

26

Alcohol Interlock Facilitation (AIF)

Overview

- **Source**
  - Commission Delegated Regulation (EU) No. 2021/1243
  - Vehicle categories: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Facilitation of the installation of an alcohol interlock
  - An alcohol interlock is a driver assistance technology that prevents persons exceeding a set alcohol concentration limit from starting a motor vehicle
- **What it Does**
  - Specifies technical aspects to ensure the vehicle design supports the fitting of compliant alcohol interlock devices



Alcohol Interlock Facilitation (AIF)

Key Features

- **Standard Compliance**
  - AIF ensures that vehicles can be fitted with an alcohol interlock complying with European Standards EN 50436-1:2014 or EN 50436-2:2014+A1:2015
- **Installation Documentation**
  - Manufacturers must make installation facilitation information accessible. This documentation must be in the form of a standardised installation document (EN 50436-7:2016), accessible in accordance with Annex X of Regulation (EU) 2018/858
- **Interlock Operation (if installed)**
  - The interlock shall normally be in the blocking state. It un-blocks only after an acceptable breath sample
- **Intervention Scope (if installed)**
  - The interlock only intervenes in the starting process of a vehicle; it must not influence a running engine or moving vehicle

Alcohol Interlock Facilitation (AIF)

Testing and Validation

- **Documentation Requirement**
  - Manufacturers must submit installation facilitation information in the form of a standardised installation document
- **Compliance Check**
  - The vehicle design must facilitate fitting interlocks compliant with required European Standards

Automated Emergency Braking (AEB-Car, AEB-Ped, AEB-Cyc)

Overview

- **Source**
  - UN Regulation No. 152
  - Vehicle Category: M1, N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Prevent or mitigate frontal collisions with vehicles, pedestrians, and cyclists
  - Automatically apply brakes and warn the driver when a collision is imminent
  - Improve safety in urban and suburban environments
- **What it Does**
  - Automatically detects imminent frontal collisions and:
    - Warns the driver
    - Applies emergency braking

Automated Emergency Braking (AEB-Car, AEB-Ped, AEB-Cyc)

Key features

- **System characteristics**
  - Braking Force: ≥ 5.0 m/s²
  - Warning Timing: ~0.8s before braking (if feasible)
  - Driver Override: Possible via kick-down or indicators
- **Speed Range:**
  - AEB-Car: 10 to 60 km/h
  - AEB-Ped/AEB-Cyc: 20 to 60 km/h
- **Collision Avoidance:**
  - Full avoidance up to ~40 km/h
  - Speed reduction at higher speeds (e.g. 60 → 35 km/h)
- **System Status:**
  - AEB is default-on at start-up
  - System be deactivated by the driver – requires 2 deliberate actions
  - System is automatically re-instated for each journey

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Automated Emergency Braking (AEB-Car, AEB-Ped, AEB-Cyc)

Testing and Validation

- **Assessment Method**
  - System performance is assessed in **track tests** with additional audit/documentation elements
- **Test Speeds**
  - Track tests are performed at speeds up to 60 km/h, driving in a straight line
  - Soft targets (cars, child pedestrians, adult cyclists)
- **Test Targets**
  - Uses stationary and moving soft targets representing a saloon passenger car (EBV) [12]
  - Uses moving soft targets representing a child pedestrian (EBP) crossing at 5 km/h, and an adult cyclist (EBC) crossing at 15 km/h
- **Audit Requirements**
  - Documentation must ensure that **false positive interventions** are minimised in challenging scenarios (e.g. bends, junctions)

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Intelligent Speed Assistance (ISA)

Overview

- **Source**
  - Commission Delegated Regulation (EU) No. 2019/2144
  - Vehicle Category: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Driver assistance technology that warns the driver or slows the vehicle down when the speed limit is being exceeded
- **What it Does**
  - Displays the applicable speed limit (SLIF) and either warns the driver (SLWF) or automatically slows the vehicle (SCF)
  - The system can be overridden by the driver (e.g. by pressing the accelerator harder)

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Intelligent Speed Assistance (ISA)

Key features

- **Functions**
  - ISA consists of a speed limit information function (SLIF) and the manufacturer's choice of either a Speed Limit Warning Function (SLWF) or a Speed Control Function (SCF)
  - Speed limit determination focuses on explicit road signs and does not require implicit limits (e.g. street lighting rules)
- **SLWF Details**
  - Active for speeds over 20 km/h
  - Provides visual + acoustic, visual + haptic, or haptic-only warnings
  - If two modes are combined, the acoustic/haptic warning comes on after the speed limit violation persists for 3 to 6 seconds
- **SCF Details**
  - Active for speeds over 20 km/h
  - Limits vehicle speed by reducing propulsion power and driveline torque
  - Service brakes can be applied for M1 and N1 vehicles
- **Default Status & Override**
  - ISA is default-on at vehicle start
  - Can be manually deactivated
  - ISA is automatically re-instated for the next journey

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Intelligent Speed Assistance (ISA)

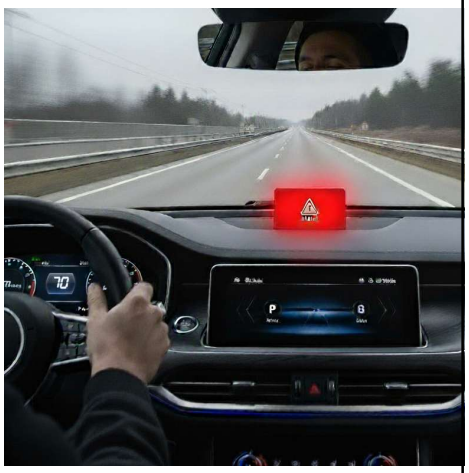
Testing and Validation

- **Speed Limit Determination Test:**
  - Capability is assessed in a track test (with documentation) and a **400 km real-world driving test**
- **Real-World Requirement:**
  - The system must correctly determine the applicable speed limit for at least **90% of the driven distance** during the 400 km test
- **Life Cycle Performance:**
  - Equivalent performance must be ensured for at least **14 years** after the vehicle manufacture date
  - If maps are used, map updates must be provided free of charge for 7 years

Driver Drowsiness and Attention Warning (DDAW)

Overview

- **Source**
  - Commission Delegated Regulation (EU) No. 2019/2144
  - Vehicle categories: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Driver assistance technology that warns the driver when driver drowsiness is detected
- **What it Does**
  - Provides a visual, acoustic, or other warning to the driver upon detecting severe drowsiness



Driver Drowsiness and Attention Warning (DDAW)

Key Features

- **Active Speed**
  - DDAW is active for vehicle speeds above 70 km/h
  - Vehicles with a maximum design speed of 70 km/h or less are exempt
- **Detection Method**
  - The system detects drowsiness by analysing driving patterns, such as the driver's steering pattern or variability in lateral lane position
  - The regulation is not prescriptive regarding the sensing technology used and may include physiological metrics
- **Warning Threshold**
  - A warning is provided when drowsiness equivalent to level 8 or above on the reference sleepiness scale (Karolinska Sleepiness Scale) is detected
- **Default Status and Override**
  - DDAW is default-on at vehicle start
  - Warnings can be manually deactivated by the driver
  - DDAW system is automatically re-instated for the next journey

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Driver Drowsiness and Attention Warning (DDAW)

Testing and Validation

- **Validation Conditions**
  - System performance must be validated during day- and night-time conditions
- **Test Environment and Participants**
  - Validation requires real-world driving or driving simulator tests involving **at least 10 human participants**
- **Approval Process**
  - The manufacturer carries out the validation tests and submits a documentation package to the technical service for approval
- **Technical Service Check**
  - The technical service performs the test based on the reported manufacturer protocol as part of the documentation assessment, and the test is passed if the system provides a warning

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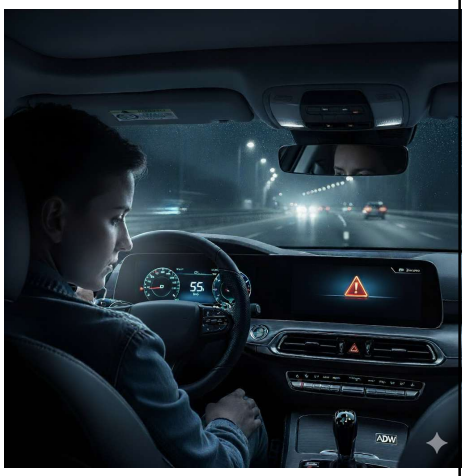
Advanced Distraction Warning (ADDW)

Overview

- **Scope**
  - Commission Delegated Regulation (EU) No. 2019/2144
  - Vehicle categories: M1, N1, M2 & M3, N2 & N3
  - Implemention: 2025 / 2027
- **What it Seeks to Achieve**
  - Driver assistance technology that alerts the driver when visual distraction is detected
- **What it Does**
  - Detects when the driver's visual attention is not directed towards the driving task by monitoring the driver's gaze direction
  - Alerts the driver with a visual signal and one further means (acoustic or haptic)



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Advanced Distraction Warning (ADDW)

Key features

- **Activation Speed**
  - Active for vehicle speeds greater than 20 km/h
- **Operating Conditions**
  - Operates effectively during day- and night-time conditions
- **Distraction Definition**
  - Distraction is defined when the driver's gaze is directed in the 'distracted zone' for 6 seconds (at speeds > 20 km/h)or 3.5 seconds (at speeds > 50 km/h)
- **Default Status and Override**
  - ADDW is default-on at vehicle start
  - Warnings or system can be manually deactivated by the driver
  - ADDW is automatically re-instated for the next journey

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Advanced Distraction Warning (ADDW)

Testing and Validation

- **Approval Basis**
  - Approval relies on reviewing technical documentation submitted by the manufacturer and testing performed by the technical service
- **Manufacturer Validation**
  - Before applying for type approval, the manufacturer must validate the system in trials
  - Validation involves human participants in a driving simulator, on a test track, or on the open road
- **Technical Service Testing**
  - The technical service performs **spot check testing** of some of the reported results
  - Testing is conducted in a test track setting or driving simulator using test drivers

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Reversing Motion Awareness (RMA)

Overview

- **Source**
  - UN Regulation No. 158
  - Vehicle Category: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Primary safety technology that aids the driver in visually observing or detecting pedestrians or cyclists behind the vehicle when reversing
- **What it Does**
  - Mandates the provision of a system to enhance rear awareness during backing events
  - If a detection system is used, it must detect objects in a defined close-proximity zone and provide warnings

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Reversing Motion Awareness (RMA)

Key features

- **Fulfilment Options**
  - RMA requirements can be fulfilled by providing the driver with vision (direct vision, mirrors, rear-view camera systems) or by awareness systems (detection system)
  - At least one must be provided
- **Vision Assessment Zone**
  - Extends 0.3 to 3.5 metres back from the vehicle's rear, across its entire width
  - Objects 0.8 metres high must be at least partially visible within this zone
- **Detection Assessment Zone**
  - Extends 0.2 to 1.0 metres back from the rear, across the entire width
- **Warning Requirement (Detection Systems)**
  - Driver must be informed by at least two modes out of acoustic, visual, and haptic

Reversing Motion Awareness (RMA)

Testing and Validation

- **Assessment Method**
  - RMA requirements are assessed by **static tests**
- **Test Objects**
  - Cylindrical test objects are used for assessment
- **Detection Validation**
  - Objects must be detected in approximately **90%** of the detection assessment zone (0.2 to 1.0 metres back)
  - If a detection system is used, the system must inform the driver using at least two modes (acoustic, visual, and haptic)

Emergency Stop Signal (ESS)

Overview

- **Source**
  - UN Regulation No. 48
  - Vehicle Category: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Primary safety technology that indicates high braking deceleration to other road users to the rear of the vehicle
- **What it Does**
  - Provides a high-frequency flashing warning signal to trailing vehicles upon detecting severe braking input or ABS cycling above a set speed threshold

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Emergency Stop Signal (ESS)

Key features

- **Activation Speed**
  - Activated automatically at driving speeds greater than 50 km/h
- **Signal Type**
  - Specified as the **simultaneous flashing of all stop or direction indicator lamps**
- **Frequency**
  - The lamps flash at a high frequency (**4 Hz**)
- **Scope**
  - The signal is given by the host vehicle and also by towed trailers

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Emergency Stop Signal (ESS)

Testing and Validation

- **Validation Criteria (M1, N1)**
  - Must activate automatically when the service brake is applied and the resulting vehicle deceleration reaches at least **6 m/s²**
- **Validation Criteria (M2, M3, N2, N3)**
  - Must activate automatically when the service brake is applied and the resulting vehicle deceleration reaches at least **4 m/s²**
- **Alternative Activation**
  - Must also activate if the anti-lock system (ABS) is fully cycling

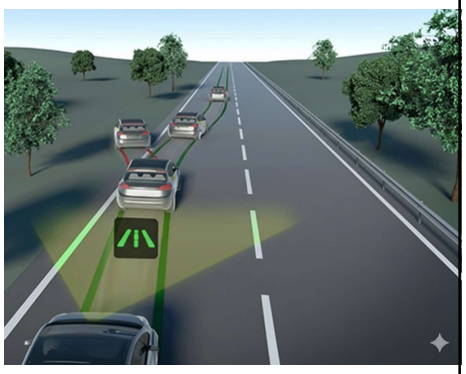
Collision Avoidance

Light Vehicle Categories

Emergency Lane Keeping System (ELKS)

Overview

- **Source**
  - Commission Implementing Regulation (EU) No. 2021/646
  - Vehicle Category: M1, N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Primary safety technology that warns the driver of unintended lane departures and corrects the vehicle's course to avoid crossing solid lane markings
- **What it Does**
  - The warning function reacts to dashed and solid lane markings
  - The corrective function reacts only to **solid lane markings**, preventing departure by more than 0.3 metres using active steering or differential braking



Emergency Lane Keeping (ELK)

Key features

- **Function Components**
  - ELK comprises a lane departure warning function and a corrective directional control function for moderate lateral departure speeds
- **Warning Function Active Speed**
  - Between 65 km/h and 130 km/h
- **Corrective Function Active Speed**
  - Between 70 km/h and 130 km/h
- **Warning Requirement**
  - When crossing a lane marking by 0.3 metres (maximum), the driver is alerted by two means (visual, acoustic, or haptic) OR an acoustic/haptic warning with spatial direction indication

Emergency Lane Keeping (ELK)

Testing and Validation

- **Approval Tests**
  - Carried out on a test track at a range of departure rates
- **Approval Process Components**
  - Includes a safety audit for electronic control functions
- **Documentation Requirement**
  - Assessment includes a documentation package, particularly focusing on the strategy used to recognise driver intended manoeuvres

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Collision Avoidance

Heavy Vehicle Categories

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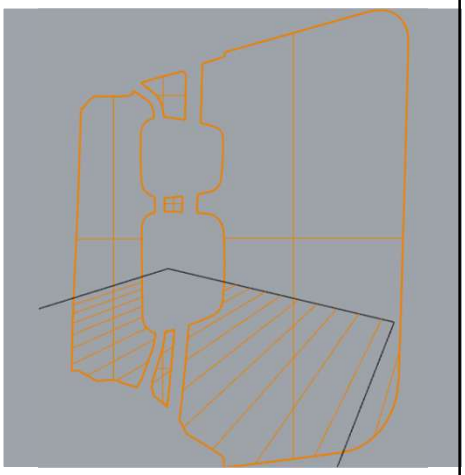
Direct Vision (DIV)

Overview

- **Source**
  - UN Regulation No. 167
  - Vehicle Cat: M2 & M3, N2 & N3
  - Implementation: 2025 / 2029
- **What it Seeks to Achieve**
  - A design requirement to ensure a minimum volume in proximity to the vehicle's front, nearside, and offside can be observed by the driver
  - This is to allow for the detection of pedestrians and cyclists
- **What it Does**
  - Sets specific volume criteria for visibility around the vehicle, based on vehicle category and criteria indicative of urban usage



Direct Vision (DIV)

Key Features

- **Vision Requirement**
  - The design requirement focuses on visibility achieved by the driver in **direct vision** (i.e. without the aid of mirrors or cameras)
- **Required Visible Volume**
  - Ensures a certain minimum volume is visible from a typical driver's seating position
  - The required volume ranges from **7.0 m³** (for seldom urban use vehicles) to **11.2 m³** (for frequent urban use vehicles)
- **Zone of Assessment**
  - The area around the vehicle taken into account extends
    - 2.0 metres to the front
    - 4.5 metres to the nearside
    - 2.0 metres to the offside
    - 1 metre to the rear
  - The height extends from ground level up to 1.6 metres

Direct Vision (DIV)

Testing and Validation

- **Assessment Method 1 (Static Physical Test)**
  - Can be performed using cameras positioned in the cab, along with grid lines and area markers outside the vehicle
- **Assessment Method 2 (Numerical Test)**
  - Can be performed using a Computer-Aided Design (CAD) model of the vehicle
- **Validation Criteria**
  - Ensures the calculated or measured visible volume meets the minimum required m^3 specified for that vehicle category

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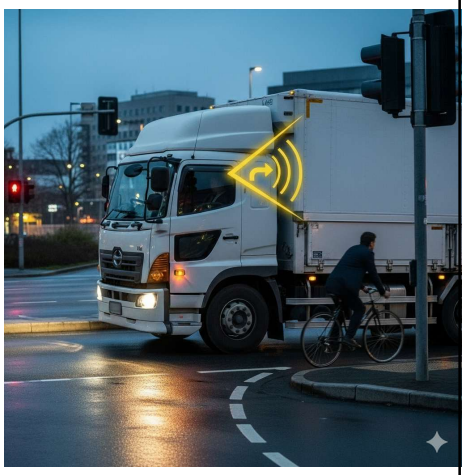
Blind Spot Information (BSI)

Overview

- **Source**
  - UN Regulation No. 151
  - Vehicle categories: M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Primary safety technology intended to inform the driver when a cyclist is close to the nearside of the vehicle
  - Warns the driver when a nearside turning collision becomes more likely
- **What it Does**
  - Provides a warning signal (visual, acoustic, or haptic) when the risk of a collision increases, e.g. due to the driver intending to turn towards the cyclist



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Blind Spot Information (BSI)

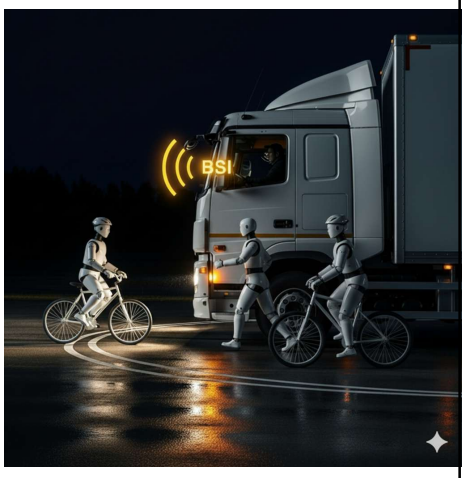
Key Features

- **Active Speed**
  - BSI is active for vehicle speeds between 0 km/h and 30 km/h
- **Operating Conditions**
  - Must operate in ambient light conditions down to 15 lux, which includes relatively low light levels
- **Information Provided:**
  - Visually informs the driver about nearby cyclists who might be endangered during a potential turn to the nearside
  - Informs about cyclists approaching the nearside at speeds between 5 km/h and 20 km/h while the vehicle is stationary
- **Default Status and Override**
  - Information and warning signals are default-on at vehicle start
  - The driver can deactivate the entire BSI or only the warning signal
  - BSI is automatically re-instated for the next journey

Blind Spot Information (BSI)

Testing and Validation

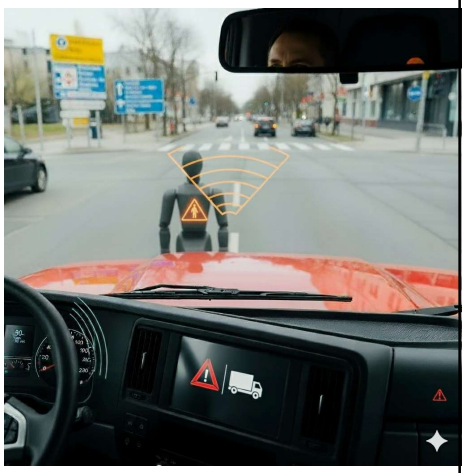
- **Assessment Method**
  - System performance is assessed in a series of dynamic and static tests
- **Test Environment**
  - Testing utilises a bicycle dummy on a test track
- **Procedure**
  - Dummy and/or vehicle are moved
  - Compliance is assessed by evaluating system information and warning behaviour based on **geometric zones of proximity**



Moving Off Information (MOI)

Overview

- **Source**
  - UN Regulation No. 159
  - Vehicle Category: M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Primary safety technology that informs the driver when a pedestrian or cyclist is in the blind spot area immediately in front of the vehicle
  - Warns when a low-speed impact or moving off collision becomes likely
- **What it Does**
  - Visually informs the driver of hazards
  - It warns the driver using **two modes** out of visual, acoustic, and haptic when the risk of a collision increases (e.g. accelerating from rest with a pedestrian directly in front)



Moving Off Information (MOI)

Key features

- **Active Speed**
  - MOI is active for vehicle speeds between 0 km/h and 10 km/h
- **Operating Conditions**
  - Must operate in ambient light conditions down to 15 lux, corresponding to relatively low light levels
- **Information Provided**
  - Visually informs the driver when the vehicle is stationary, moving off from rest in a straight line, or travelling straight ahead at low speeds
- **Default Status and Override**
  - Information and warning signals are default-on at vehicle start
  - The driver can deactivate the entire MOI or only the warning signal
  - MOI is automatically re-instated for the next journey

Moving Off Information (MOI)

Testing and Validation

- **Assessment Method**
  - System performance is assessed in a series of dynamic and static tests
- **Test Environment**
  - Testing utilises pedestrian and bicycle dummies on a test track
- **Procedure**
  - Dummy and/or vehicle are moved
  - The systems information and warning behaviour is assessed for compliance based on **geometric zones of proximity**

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Other

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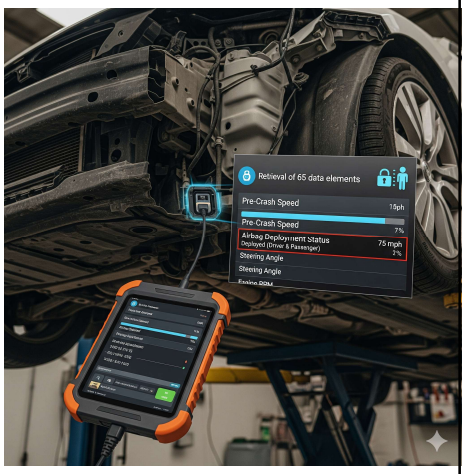
Event Data Recorder (EDR)

Overview

- **Source**
  - UN Regulation No. 160 and No. 169
  - Vehicle Category: M1, N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027 (M1, N1), 2026/2029 (M2 & M3, N2 & N3)
- **What it Seeks to Achieve**
  - Records critical, crash-related parameters before and during a collision to support accident reconstruction and research
- **What it Does**
  - Records data based on collision triggers, ensuring the recorded data is anonymised, excluding direct identifiers (like VIN) or indirect identifiers (like location or time)



Event Data Recorder (EDR)

Key Features

- **Trigger Conditions (M1, N1)**
  - Data recording must trigger when airbags or safety belt pre-tensioners deploy, the vehicle experiences collision-like deceleration levels, or an external secondary safety system (e.g. pop-up bonnet) is deployed
- **Data Elements (M1, N1)**
  - The system must capture **65 data elements** concerning the host vehicle, vehicle motion, driver inputs, safety belt status, airbag/pre-tensioner deployments, and ADAS interventions
- **Memory Capacity (M1, N1)**
  - The system needs to accommodate records of at least three events
- **Heavy Vehicle EDR (M2, M3, N2, N3)**
  - Alternative triggers (e.g. record at heavy braking or each vehicle stop)
  - Record at least 5 events
  - Recording duration extended

Event Data Recorder (EDR)

Testing and Validation

- **Data Survivability**
  - Data sets must remain retrievable after impacts corresponding to the severity level set by UN Regulation Nos. 94, 95 or 137
  - Optional Reg 100 test and geometric requirement for heavy vehicle EDR
- **Data Retrieval Access**
  - Retrieval must be possible via the vehicle's On-Board Diagnostics (OBD) port or via direct connection to the EDR
- **Manufacturer Obligation**
  - The vehicle manufacturer must provide information upon request to type-approval authorities regarding data access, retrieval, and interpretation

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Tyre Pressure Monitoring (TPM)

Overview

- **Source**
  - UN Regulation No. 141
  - Vehicle Category: N1, M2 & M3, N2 & N3
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Driver assistance technology that warns the driver of incorrect tyre pressure due to punctures or diffusion
- **What it Does**
  - Visually warns the driver when one or more tyres are underinflated
  - Distinguishes between rapid pressure loss incidents and slower diffusion underinflation

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Tyre Pressure Monitoring (TPM)

Key features

- **Activation Speed**
  - Active for vehicle speeds starting from 40 km/h (N1) or 30 km/h (M2, M3, N2, N3) up to the maximum design speed
- **Detection Threshold**
  - The detection threshold for both incident-related pressure loss (puncture) and underinflation (diffusion) is a pressure reduction by **20%**
- **Puncture Detection Time**
  - System must detect the 20% pressure reduction in a single tyre within **10 minutes driving time**
- **Diffusion Detection Time**
  - System must detect the 20% pressure reduction within **60 minutes**, even if multiple tyres are affected simultaneously

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Tyre Pressure Monitoring (TPM)

Testing and Validation

- **Approval Method**
  - The system is approved using **track tests**
- **Test Procedure**
  - Tyre pressure loss is simulated during the track tests
- **Validation Focus**
  - Observation and verification that warnings provided by the system are triggered correctly when simulating pressure loss scenarios
- **Alternative Compliance**
  - Tyre pressure refill systems and central tyre inflation systems can be fitted as an alternative to TPM

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Frontal Full-Width Impact (FFI)

Overview

- **Source**
  - UN Regulation No. 137
  - Vehicle Category: M1, N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Crash test intended to improve the secondary safety of front row occupants in frontal impacts engaging the entire width of the vehicle
- **What it Does**
  - Ensures restraint systems protect a range of occupant statures by utilising two different anthropometric test devices (ATDs)

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Frontal Full-Width Impact (FFI)

Key features

- **Test Setup**
  - Assessed in a frontal impact test against a **full-width rigid barrier**
- **Impact Speed**
  - 50 km/h
- **Occupant Restraints Focus:**
  - This test primarily challenges the capability of the occupant restraint systems (airbags, safety belts, pre-tensioners, load limiters)
- **Test Devices:**
  - Uses a 50th percentile Hybrid III male in the driver's seat and a 5th percentile Hybrid III female ATD in the front passenger position

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Frontal Full-Width Impact (FFI)

Testing and Validation

- **Test Procedure:**
  - Conducted as a 50 km/h frontal impact against a full-width rigid barrier
- **ATD Requirements:**
  - The 50th percentile Hybrid III male (driver)
  - 5th percentile Hybrid III female (front passenger)
  - ATDs must meet specific performance criteria
- **Injury Criteria Validation:**
  - Performance criteria relate to protection of the head, neck, thorax, and femur
- **Electric Vehicle Safety:**
  - Validation must ensure compliance with prescriptions to protect occupants of electric vehicles from high voltage and electrolyte leakage

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Frontal Off-Set Impact (FOI)

Overview

- **Source**
  - UN Regulation No. 94
  - Vehicle Category: N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Crash test intended to improve the secondary safety of drivers in frontal impacts with another vehicle engaging only part of the vehicle width
- **What it Does**
  - By engaging less than half the vehicle width, it aims to reduce injury risk and ensure the vehicle's structural integrity to limit compartment intrusion and keep doors closed

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Frontal Off-Set Impact (FOI)

Key features

- **Test Setup**
  - Assessed in a frontal impact with **40% overlap** against a deformable barrier
- **Impact Speed**
  - 56 km/h
- **Structural Focus**
  - This test primarily challenges the vehicle's crash absorbing structures and structural integrity
- **Test Device**
  - Uses a 50th percentile Hybrid III male ATD in the driver's seat

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Frontal Off-Set Impact (FOI)

Testing and Validation

- **Test Procedure:**
  - Conducted as a 56 km/h frontal impact with 40% overlap against a deformable barrier
- **ATD Requirement**
  - The 50th percentile Hybrid III male ATD in the driver's seat must meet specific performance criteria
- **Injury Criteria Validation**
  - Performance criteria relate to protection of the head, neck, thorax, femur, tibia, and knee
- **Structural Validation**
  - Ensures structural integrity is maintained to limit compartment intrusion and keep doors closed. Validation must also protect occupants of electric vehicles from high voltage and electrolyte leakage

Pole Side Impact (PSI)

Overview

- **Source**
  - UN Regulation No. 135
  - Vehicle Category: M1, N1
  - Implementation: 2025 / 2027
- **What it Seeks to Achieve**
  - Crash test intended to improve the secondary safety of drivers in driver-side impacts with rigid narrow objects
- **What it Does**
  - Assesses occupant protection and structural performance during an angled lateral impact

Pole Side Impact (PSI)

Key features

- **Impact Speed**
  - 32 km/h
- **Impact Object**
  - 25 cm diameter metal pole
- **Focus**
  - The positioning of the impact point aligned with the ATD specifically challenges the **driver's head protection**
- **Structural Requirement**
  - Doors, unless directly impacted, must remain latched

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Pole Side Impact (PSI)

Testing and Validation

- **Test Procedure**
  - Assessed in a 32 km/h lateral impact against a 25 cm diameter metal pole
  - The impact angle is **75 degrees**
- **ATD Requirement:**
  - The WorldSID 50th percentile adult male ATD is used
  - It is placed in the front row seat on the impacted side (typically the driver's side)
- **Injury Criteria Validation**
  - The ATD must meet performance criteria related to the protection of the head, shoulder, thorax, abdomen, and pelvis
- **Note on EV Safety**
  - The 01 Series of Amendments does not include requirements to protect occupants of electric vehicles from high voltage and electrolyte leakage

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