



VRU-Proxi-08-02

Summary of Previous GSR/ACEA Collision Landscape Analyses

February 2019

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TRL Background



TRL Background

Vision

World leader in creating the future of transport and mobility, using evidence-based solutions and innovative thinking

320

engineers, scientists, psychologists, IT experts and statisticians



Providing world-leading research, technology and software solutions for surface transport modes and the related markets of automotive, motorsport, insurance and energy

Mission

Challenge and influence our chosen markets, driving sustained reductions (ultimately to zero) in:

- Fatalities and serious injuries
- Harmful emissions
- Barriers to inclusive mobility
- Unforeseen delays
- Cost inefficiencies



1000 clients in

145 countries

the future of transport.

TRL Background...delivering impactful innovation

1950's/70's

The UK Motorway network



1969

The self-driving Citroën DS19



1997

NCAP launched



2014

TRL cycle infrastructure development



2015

Gateway driverless shuttles



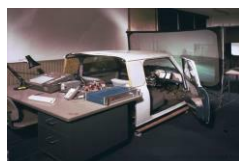
2018

London Smart Mobility Living Lab



1960s

Early simulator



1972

The magic roundabout, Swindon



1980's

Deflectometer



2012

London Summer Olympics



2016

Electric double decker bus



2017

HGV Truck Platooning



Previous Research: ACEA/GSR Background



ACEA/GSR Background

How do GSR and ACEA fit together?

AEB	SFS
AEB-PCD	RFT
LKA	ALC
ESS	EDR
ISA	TPM
DDR	VIS
SBR	RUR
F94	LAT
FFW	BFS-CNG
FSO	BFS-AFE
S95	HED
PSI	REV



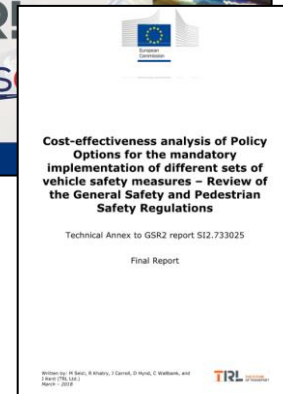
Published research
(GSR2 systematic review)

Extensive stakeholder
consultation (GSR2
report)

ACEA Accidentology
Results feed into GSR2
impact assessment



European Policy impact
assessment (GSR2
technical annex)



ACEA/GSR Background

Where do I find the GSR/ACEA reports?

- General Safety Regulation 2 report:
 - <https://publications.europa.eu/en/publication-detail/-/publication/77990533-9144-11e7-b92d-01aa75ed71a1/language-en>
- ACEA Accident Analysis report:
 - https://www.acea.be/uploads/publications/Accident_Analysis_TRL_CEESAR_2018.pdf
- TRL report for ACEA Accident Analysis:
 - <https://trl.co.uk/reports/effectiveness-estimates-proposed-amendments-eus-general-and-pedestrian-safety-regulations-0>
- Impact Assessment – Technical Annex to General Safety Regulation 2 report:
 - <https://publications.europa.eu/en/publication-detail/-/publication/ed4aff17-49c5-11e8-be1d-01aa75ed71a1/language-en>

Summary of GSR Approach



Summary of GSR Approach

Objective:

To **calculate** concrete **cost-effectiveness indicators and numbers of road casualties that could be prevented at an EU-28 level** for sets of safety measures proposed by the European Commission and considered for **mandatory implementation in new vehicles**.

Summary of GSR Approach

The specific scope of the study was defined as:

- **Geographic scope:** EU-28
- **Vehicle categories covered:** Cars (M1), Buses (M2&M3), Vans (N1), Trucks (N2&N3)
- **Evaluation period:** 2021–2037
- **Baseline scenario:** No further policy intervention in the transport sector, but voluntary improvements and effects of already implemented policies continue: Continued dispersion of mandatory vehicle safety measures into the legacy fleet and **continued voluntary uptake of the safety measures under consideration.**
- **Action scenario:** 17 safety technologies made mandatory according to Commission proposal.

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

Summary of GSR Approach

GSR Definitions of Relevant Safety Measure Functionality

VIS-DIV	VIS-DET	REV
Functionality: Improving the drivers situational awareness of VRU's in close proximity to the vehicle		
Best in class direct vision sets requirements for what the driver can see through the windscreen, side windows and any additional windows	Sensor-based detection systems for alerting the driver to VRUs that are manoeuvring round the vehicle.	Camera Monitoring Systems (CMS) for increasing the driver's field of vision while reversing.
	No automated braking	
Front and sides of the vehicle		Rear

Summary of GSR Approach

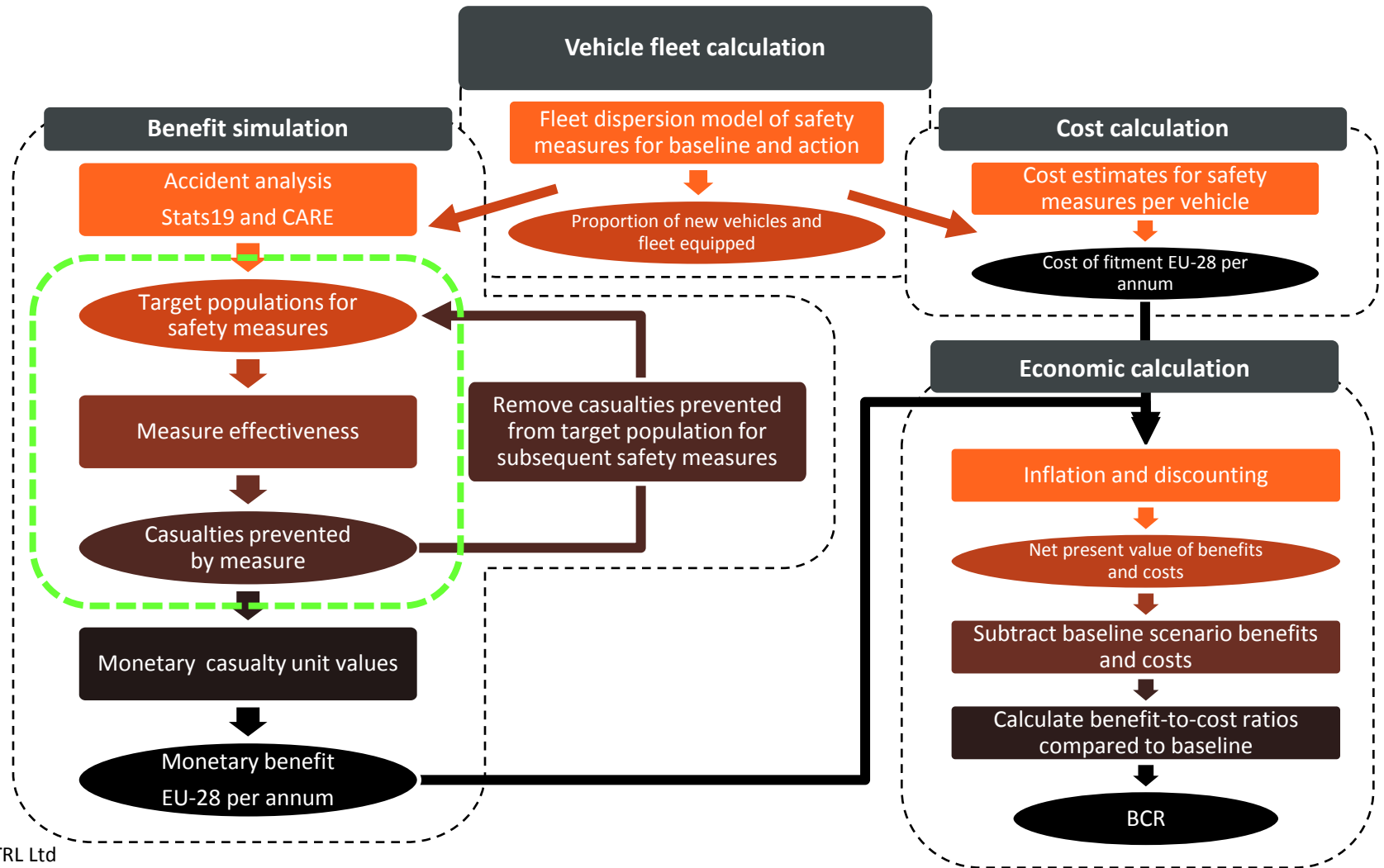
Approach of the study

- **Benefits considered:** Monetary values of casualties prevented/mitigated (fatal, serious, slight) by safety measures
- **Costs considered:** Cost to vehicle manufacturers (OEMs) of fitment of safety measures to new vehicles
- **Treatment of uncertainty:** Interval analysis and scenario analysis
- **Results:** Benefit-to-cost ratios (BCRs) and numbers of casualties prevented. All results are **in comparison to the baseline scenario.**

Summary of GSR Approach

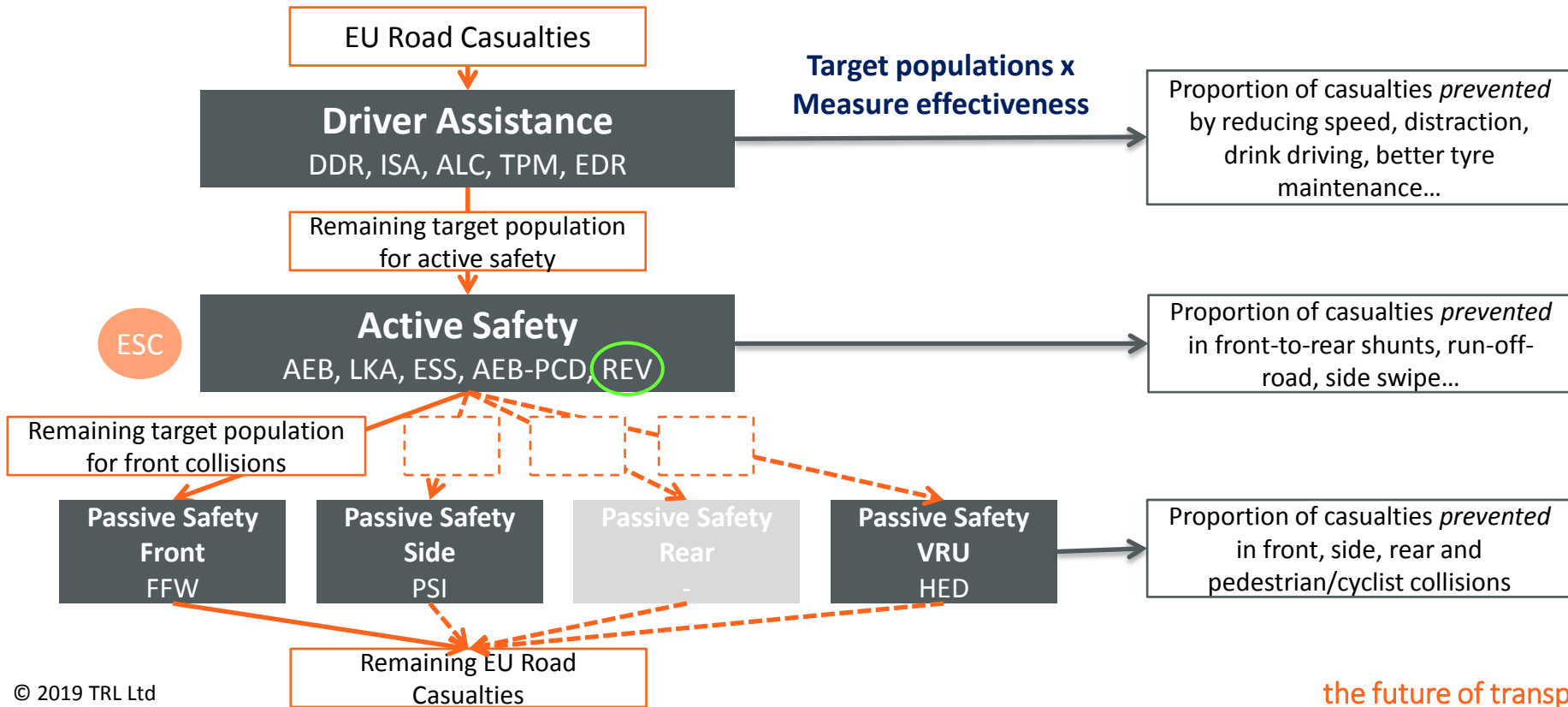
Note that the model takes into account:

- The **interactions of all measures when implemented together** (to avoid double-counting of casualties prevented by different measures)
- The **voluntary uptake of the proposed measures** expected to happen without policy intervention (baseline scenario)
- The **effects of already existing mandatory measures**, which are still dispersing into the fleet (AEBS and LDWS for trucks and buses, ESC for all categories)
- **Discounting and inflation** of monetary values



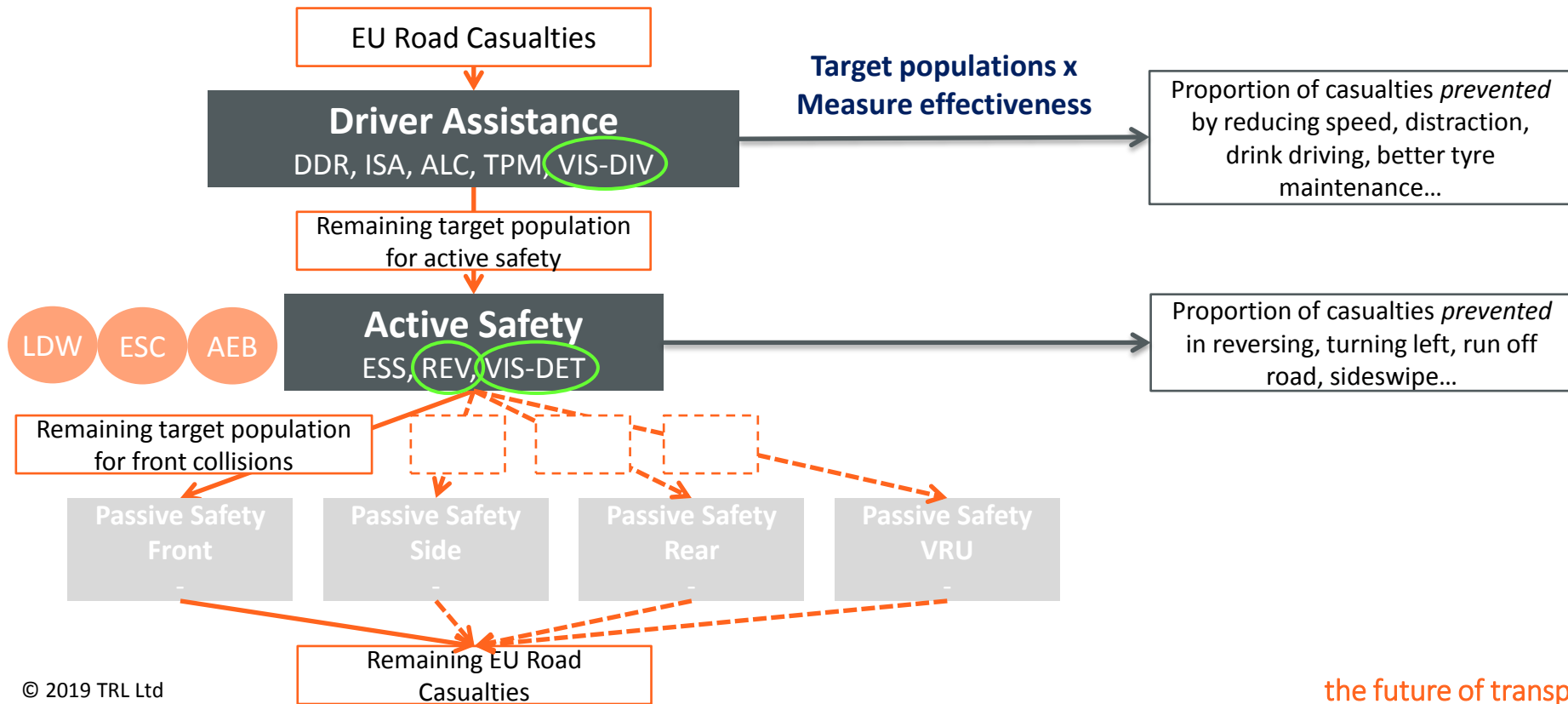
Summary of GSR Approach

Clustering of Safety Measures – Passenger Cars (M1) and Vans (N1)



Summary of GSR Approach

Clustering of Safety Measures – Buses/Coaches (M2/M3) and Trucks (N2/N3)



ACEA Analysis



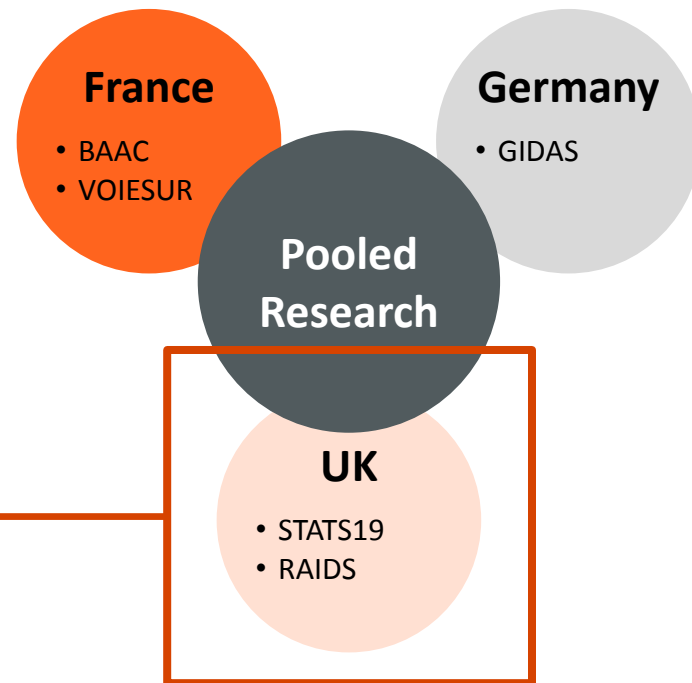
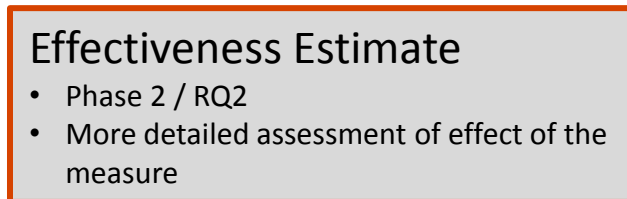
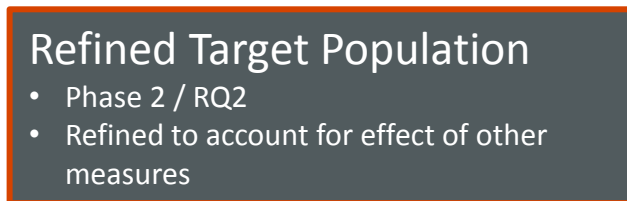
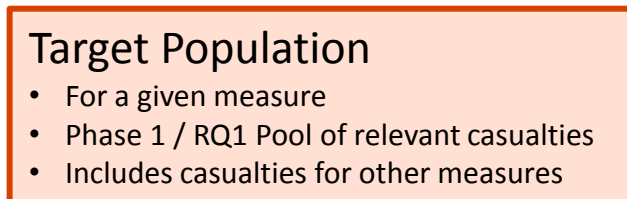
ACEA Analysis

ACEA Definitions of Relevant Safety Measure Functionality

VIS				REV
Direct Vision		Forward and Side VRU detection and cameras specifications		Reversing Detection or cameras specifications
VIS: Best-in-Class Vision	VIS: High Direct Vision	VIS: Warning	VIS: Automated Emergency Braking	
<ul style="list-style-type: none"> Remove highest chassis and adopt new cabs Improved direct vision through wind shield, passenger door and side windows Benefits dependent on driver who needs to look at right time and take correct actions Beneficial when driving ahead and turning in low speeds, in dense traffic environment 	<ul style="list-style-type: none"> Low forward position cab Much improved direct vision through wind shield and passenger door and side windows 	<ul style="list-style-type: none"> Detection and warning of VRU's ahead and at side of vehicle Benefits less dependent on driver actions Additional benefit in higher speed traffic scenarios Includes crossing pedestrians All speeds including pulling away from stationery and very low speeds 	<ul style="list-style-type: none"> Detection, warning and auto braking to avoid/mitigate collisions of VRU's ahead and at side of vehicle 	<ul style="list-style-type: none"> Sensing systems to increase driver's view or warn of persons or obstacles when reversing Preference between camera and/or detection with visual/acoustic warning to be determined

ACEA Analysis

ACEA Data Sources



ACEA Analysis

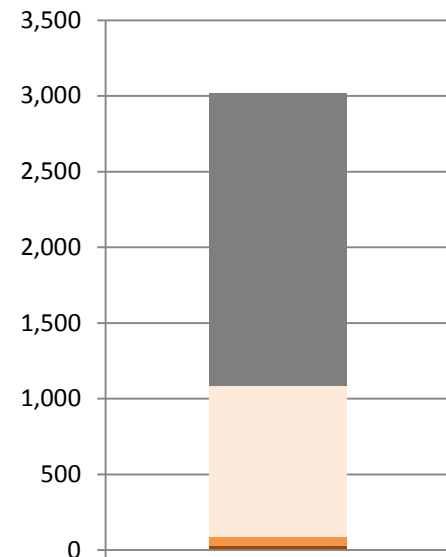
ACEA GB Target Population Estimations (5 year total)

Safety Measure	Casualty type	TP source	Vehicle type	TP casualties who benefit from measure			Total
				Fatal	Seriously injured	Slightly injured	
VIS – improved front end design for direct and indirect driver vision	Pedestrians & pedal cyclists	S19	N2	36	232	825	1,093
			N3	275	564	1,015	1,854
ISA – Intelligent Speed Assistance	All vehicle users & VRUs	S19	M1	1,470	7,691	44,078	53,239
			M2	0	27	109	136
			M3	9	18	86	113
			N1	18	190	1,551	1,759
			N2	0	14	90	104
			N3	54	68	321	443
FSO – Frontal impact Small Overlap crash test *	M1 occupants	S19+RAIDS	M1	72	855	13,175	14,102
SFS – Side impact Far Side occupant crash test *†	M1 occupants	S19+RAIDS	M1	133 - 181	896 – 1,713	10,723 -28,671	11,752 – 30,565
F94 – Frontal Impact Crash Test (removal of exemptions from Regulation 94)	M1 & N1 occupants	S19	M1	49	661	7,214	7,924
			N1	56	576	5,483	6,115
S95 – Side Impact Crash Test (removal of exemptions from Regulation 95)	M1 & N1 occupants	S19	M1	13	156	2,382	2,551
			N1	15	148	2,460	2,623
HED – Adult Head to Windscreen Area ††	Pedestrians	S19+RAIDS	M1	107 – 269	1218 – 3046	-	(1325 – 3315)
	Cyclists	S19+RAIDS	M1	18	534	-	(552)
REV – Reversing Detection <i>Note: Stats19 only includes collisions on the public highway and excludes those occurring in car parks, service yards and private workplace sites.</i>	Pedestrians & pedal cyclists	S19	N2, N3, O3+O4	7	41	136	177

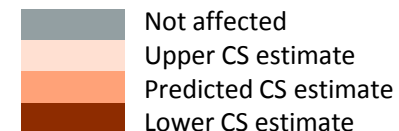
ACEA Analysis

ACEA Casualty Savings (5 year total) and Effectiveness: Best-in-Class Vision

VIS		Killed	Seriously Injured	Slightly Injured	Total Casualties
N2	TP (RQ1)	36	232	825	1,093
	CS (RQ2)	1	7	25	33
N3	TP (RQ1)	275	564	1,016	1,855
	CS (RQ2)	8	17	30	55
N _{unknown}	TP (RQ1)	1	14	56	71
	CS (RQ2)	0	0	2	2
Total	TP (RQ1)	312	810	1,897	3,019
	CS (RQ2)	9	24	57	90



VIS Best in Class

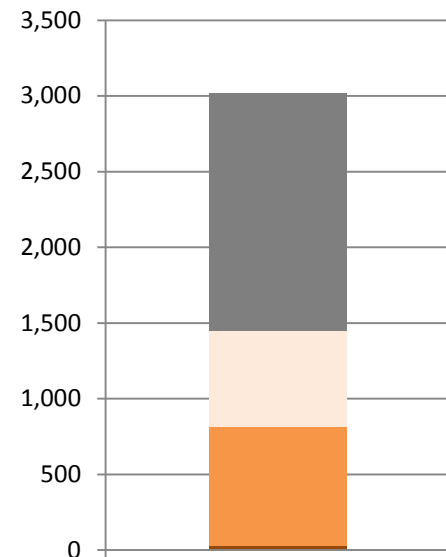


- Overall effectiveness value for requiring best-in-class vision:
 - 3% (1%-36%)
 - Based on STATS19/RAIDS data only

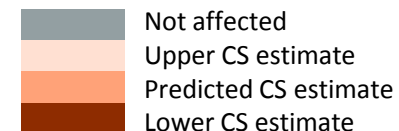
ACEA Analysis

ACEA Casualty Savings (5 year total) and Effectiveness: High Direct Vision

VIS		Killed	Seriously Injured	Slightly Injured	Total Casualties
N2	TP (RQ1)	36	232	825	1,093
	CS (RQ2)	10	63	223	296
N3	TP (RQ1)	275	564	1,016	1,855
	CS (RQ2)	74	153	274	501
N _{unknown}	TP (RQ1)	1	14	56	71
	CS (RQ2)	0	4	15	19
Total	TP (RQ1)	312	810	1,897	3,019
	CS (RQ2)	84	220	512	816



VIS High Direct Vision



- Overall effectiveness value for requiring high direct vision:
 - 27% (1%-48%)
 - Based on STATS19/RAIDS data only

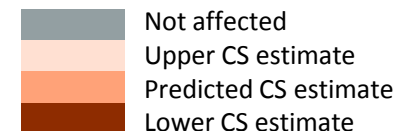
ACEA Analysis

ACEA Casualty Savings (5 year total) and Effectiveness: VRU Detection

VIS		Killed	Seriously Injured	Slightly Injured	Total Casualties
N2	TP (RQ1)	36	232	825	1,093
	CS (RQ2)	14	93	330	437
N3	TP (RQ1)	275	564	1,016	1,855
	CS (RQ2)	110	226	407	743
N _{unknown}	TP (RQ1)	1	14	56	71
	CS (RQ2)	0	5	23	28
Total	TP (RQ1)	312	810	1,897	3,019
	CS (RQ2)	124	324	760	1,208



VIS VRU Detection

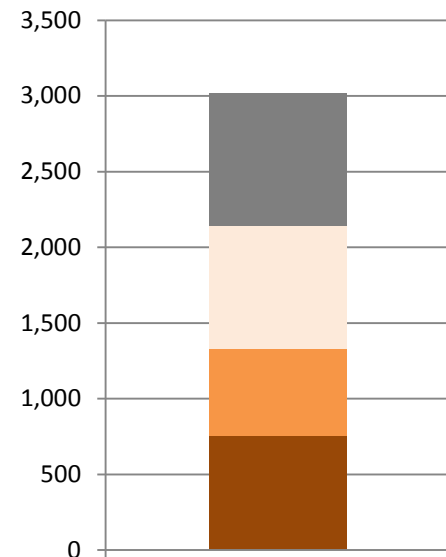


- Overall effectiveness value for requiring VRU detection:
 - 40% (6%-47%)
 - Based on STATS19/RAIDS data only

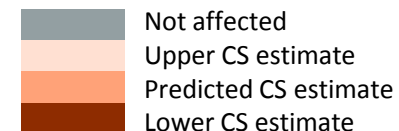
ACEA Analysis

ACEA Casualty Savings (5 year total) and Effectiveness: VRU AEB

VIS		Killed	Seriously Injured	Slightly Injured	Total Casualties
N2	TP (RQ1)	36	232	825	1,093
	CS (RQ2)	15	102	363	480
N3	TP (RQ1)	275	564	1,016	1,855
	CS (RQ2)	121	248	448	817
N _{unknown}	TP (RQ1)	1	14	56	71
	CS (RQ2)	0	7	25	32
Total	TP (RQ1)	312	810	1,897	3,019
	CS (RQ2)	136	357	836	1,329



VIS VRU AEB



- Overall effectiveness value for requiring VRU AEB:
 - 44% (25%-71%)
 - Based on STATS19/RAIDS data only

ACEA Analysis

ACEA Casualty Savings (5 year total) and Effectiveness: Reversing Detection/Camera Systems

- Overall effectiveness value for requiring reversing detection & camera systems:
 - No evaluation of the potential benefits possible as too small a sample

Summary of GSR Outcomes

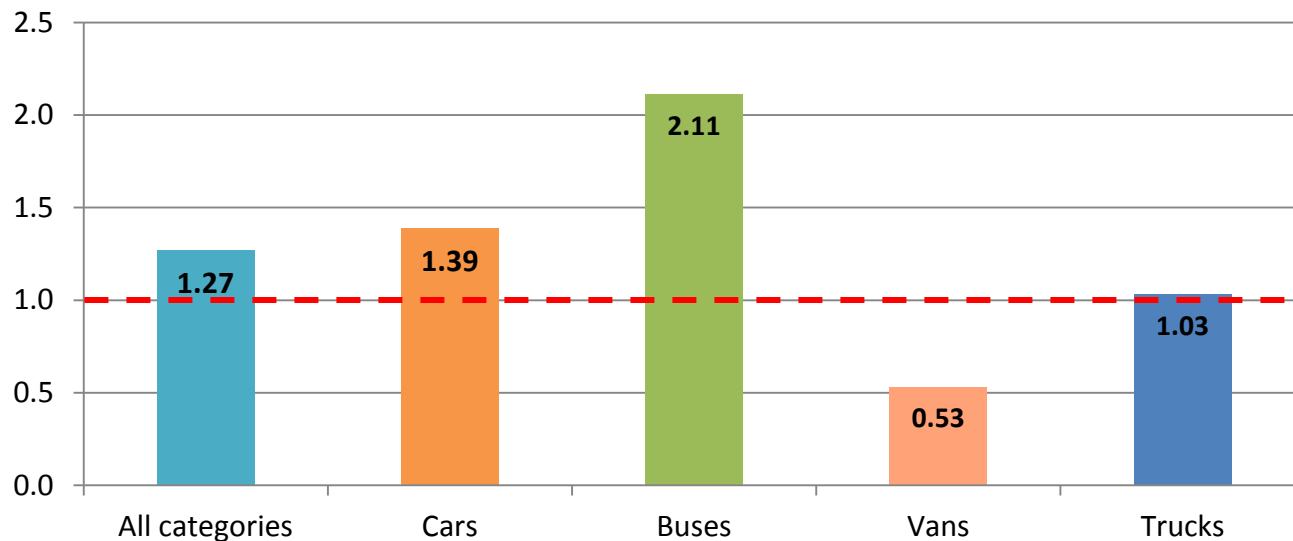


Summary of GSR Outcomes

Overall Cost-Effectiveness Outcomes

Cost-effectiveness

Benefit-to-cost ratios (BCR) of the Commission Proposal



Years: 2021–2037

EU-28

Compared to
baseline scenario

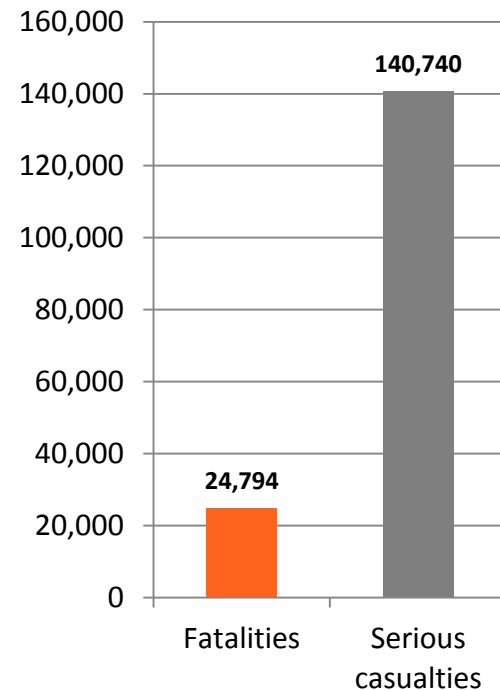
Values greater than 1 indicate that the benefits are greater than the costs

Summary of GSR Outcomes

Overall Casualty Saving Benefit Outcomes

Number of casualties prevented by the Commission Proposal split by vehicle categories over the 2021–2037 evaluation period across EU-28 compared to baseline scenario

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



Summary of GSR Outcomes

Summary of Relevant GSR Input Information

	VIS-DIV	VIS-DET	REV
Proposed Requirement	Best-in-Class DV	Front and Side Detection System	Reversing Cameras
Vehicle type	M2, M3, N2, N3		M1, M2, M3, N1, N2, N3
Target Population Description	M2/M3: Pedestrian/cyclist in front/side impact. Blind spot as a contributory factor. N2/N3: Pedestrian/cyclist in front/side impact. Adjusted to average population in France/Germany/UK		Pedestrian/cyclist collision with reversing vehicle. Adjusted for off-road collisions and populations
Other measures	No Interactions		
Potential Benefit %	M2/M3: 24% N2/N3: 3%	M2/M3: 40% N2/N3: 40%	M1/N1: 41% M2/M3/N2/N3: 33%