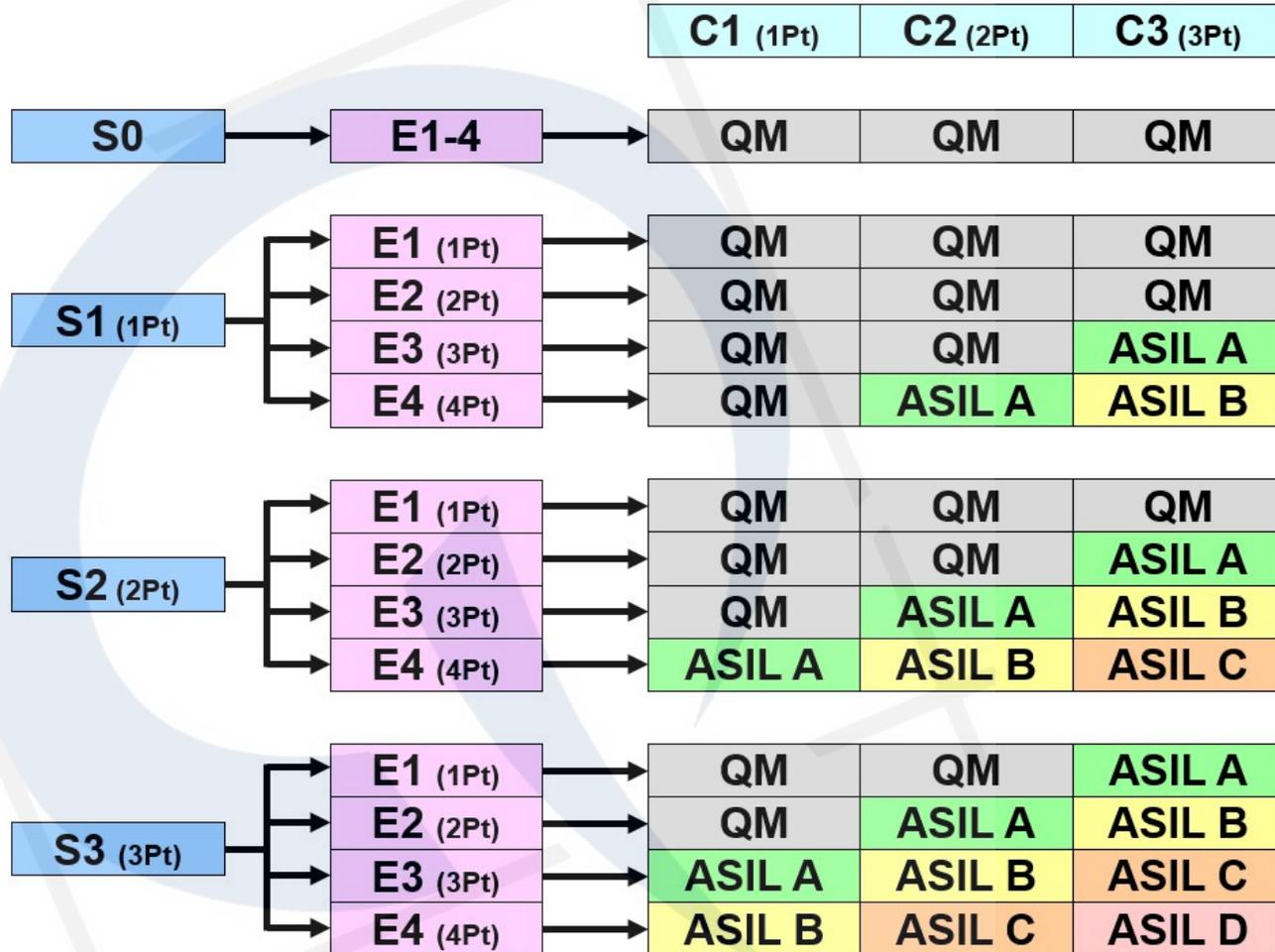


Severity	
S0	No injuries (<i>not hurted</i>)
S1	Light and moderate injuries (<i>arm hurted</i>)
S2	Severe and life-threatening injuries (survival probable – (<i>arm detached</i>))
S3	Life-threatening injuries (survival uncertain), fatal injuries (<i>head detached</i>)

Exposure (Duration + Frequency)	
E0	Incredible
E1	Very low probability
E2	Low probability
E3	Medium probability
E4	High probability

Controllability	
C0	Controllable in general
C1	Simply controllable
C2	Normally controllable
C3	Difficult to control or uncontrollable



S0 or E0 or C0 → always QM

Description of Severity

SO	S1	S2	S3
AIS 0 and less than 10% probability of AIS 1-6; or damage that cannot be classified safety-related	More than 10% probability of AIS 1-6 (and not S2 or S3)	More than 10% probability of AIS 3-6 (and not S3)	More than 10% probability of AIS 5-6
Bumps with roadside infrastructure Pushing over roadside post, fence, etc. Light grazing damage Damage entering / exiting parking space Leaving the road without collision or rollover	Side impact with a narrow stationary object, e.g. passenger car crashing into a tree (impact to passenger cell) with very low speed Rear / front collision with another passenger car with very low speed Front collision (e.g. rear-ending another vehicle, semi-trailer, etc.) without passenger compartment deformation	Side impact with a narrow stationary object, e.g. crashing into a tree (impact to passenger cell) with low speed Side collision with a passenger car (e.g. intrudes upon passenger compartment) with low speed Rear / front collision with another passenger car with low speed Pedestrian / bicycle accident while turning (city intersection and streets)	Side impact with a narrow stationary object, e.g. crashing into a tree (impact to passenger cell) with medium speed Side collision with a passenger car (e.g. intrudes upon passenger compartment) with medium speed Rear / front collision with another passenger car with medium speed Pedestrian/bicycle accident (e.g. 2-lane road) Front collision (e.g. rear-ending another vehicle, semi-truck, etc.) with passenger compartment deformation

Source: ISO 26262-3:2018, Table B.1 - Examples of severity classification

Severity: Description of AIS stages

AIS 0: no injuries

AIS 1: light injuries such as skin-deep wounds, muscle pains, whiplash, etc.

AIS 2: moderate injuries such as deep flesh wounds, concussion with up to 15 minutes of unconsciousness, uncomplicated long bone fractures, uncomplicated rib fractures, etc.

Description of Exposure (Duration)



E1	E2	E3	E4
Not specified	<1% of average operating time	1% to 10% of average operating time	>10% of average operating time
Vehicle during jump start In repair garage Driving downhill with engine off (mountain pass)	Country road intersection Highway exit ramp Snow and ice on road Slippery leaves on road Trailer attached Roof rack attached Vehicle being refuelled Driving in reverse Overtaking Parking (with trailer attached)	One-way street (city street) Wet road Vehicle on a hill (hill hold) Heavy traffic (stop and go)	Highway Country road Accelerating Decelerating Stopping at traffic light (city street) Lane change (highway)

Source: ISO 26262-3:2018, Table B.2 — Classes of probability of exposure regarding duration in operational situations

Severity: Description of AIS stages (AIS := Abbreviated Injury Scale)

AIS 3: severe but not life-threatening injuries such as skull fractures without brain injury, spinal dislocations below the fourth cervical vertebra without damage to the spinal cord, more than one fractured rib without paradoxical breathing, etc.

AIS 4: severe injuries (life-threatening, survival probable) such as concussion with or without skull fractures with up to 12 hours of unconsciousness, paradoxical breathing

AIS 5: critical injuries (life-threatening, survival uncertain) such as spinal fractures below the fourth cervical vertebra with damage to the spinal cord, intestinal tears, cardiac tears, more than 12 hours of unconsciousness including intracranial bleeding

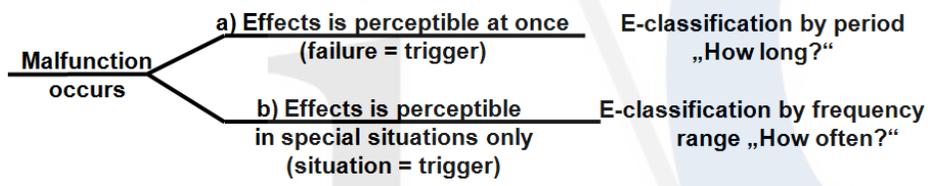
AIS 6: extremely critical or fatal injuries such as fractures of the cervical vertebrae above the third cervical vertebra with damage to the spinal cord, extremely critical open wounds of body cavities (thoracic and abdominal cavities), etc.

Source: ISO 26262-3:2018, B.2.2 - Description of AIS stages

Description of Exposure (Frequency)

E1	E2	E3	E4
Occurs less often than once a year for the great majority of drivers	Occurs a few times a year for the great majority of drivers	Occurs once a month or more often for an average driver	Occurs during almost every drive on average
Stopped, requiring engine restart (at railway crossing) Vehicle being towed	Mountain pass with unsecured steep slope Snow and ice on road Roof rack attached Evasive manoeuvre, deviating from desired path	Wet road Vehicle being refuelled Vehicle on a hill (hill hold) Overtaking	Shifting transmission gears Executing a turn (steering) Using indicators Driving in reverse

Source: ISO 26262-3:2018, Table B.3 - Classes of probability of exposure regarding frequency in operational situations



Speed-Definitions	Speed-Range
very low speed	maximum 15 kph - Definition according to ISO 26262, part 10, page 11
low speed	16 kph - 50 kph [i-Q own definition, to fill up gap in standard]
medium speed	51 kph - 90 kph - Definition according to: ISO 26262, part 10, page 12
high speed	> 90 kph [i-Q own definition, to complete standard]

Description of Controllability

CO	C1	C2	C3
Controllable in general	More than 99% of the average drivers or other traffic participants are able to avoid harm	Between 90% and 99% of the average drivers or other traffic participants are able to avoid harm	Less than 90% of the average drivers or other traffic participants are able, to avoid harm
Situations that are considered distracting: Unexpected radio volume increase Warning message – fuel low Unavailability of a driver assisting system that does not effect the safe operation of the vehicle	Unintended closing of the window while driving Blocked steering column when accelerating from standstill	Failure of ABS during emergency braking Propulsion failure at high lateral acceleration Inadvertent opening bus door while driving with passenger standing in doorway	Failure of brakes Faulty driver airbag release when travelling at high speed Excessive trailer swing during braking potential for jackknifing Function with high automation where driver is not in the loop

NOTE 1: For C2, a feasible test scenario in accordance with RESPONSE 3 (see Bibliography [4]) is accepted as adequate: "Practical testing experience revealed that a number of 20 valid data sets per scenario can supply a basic indication of validity". If each of the 20 data sets complies with the pass-criteria for the test, a level of controllability of 85% (with a level of confidence of 95% which is generally accepted for human factors tests) can be proven. This is appropriate evidence of the rationale for a C2-estimate.

NOTE 2: For C1 a test to provide a rationale that 99% of the drivers "pass" the test in a certain traffic scenario might not be feasible because a huge number of test subjects would be necessary as the appropriate evidence for such a rationale. Decision can be based on expert judgment.

NOTE 3: As no controllability is assumed for category C3, it is not relevant to have appropriate evidence of the rationale for such a classification.

NOTE 4: The informative example in Table B.6 can be applied to passenger cars and T&B vehicles, but are considered on a case-by-case basis.

Source: ISO 26262-3:2018, Table B.6 - Examples of possibly controllable hazardous events by the driver or by the persons potentially at risk

Description of Exposure for T&B (Duration)

Description of Exposure (Frequency)



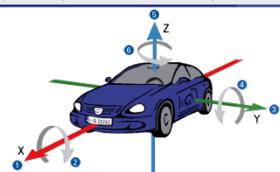
		Class of probability of exposure in operational situations (see Table 2)			
		E1	E2	E3	E4
Description		Very low probability	Low probability	Medium probability	High probability
Duration (% of average operating time)		Not specified	<1% of average operating time	1% to 10% of average operating time	>10% of average operating time
Examples for	Driving in reverse		LH, CB, CO, IB	DI, VO	
	overtaking another truck or bus with small speed difference (with lane change to oncoming lane)	LH, DI, VO, CO, IB			
	driving with trailer attached			DI, CO, IB	LH, VO
	semi-trailer tractor without trailer attached (on public road)		LH, DI, VO		
	driving on construction site (vehicle is driving directly on construction site, not only for delivering goods to construction site)	LH	DI		VO
	steep slope	LH, CB	DI, CO, IB	VO	
	standing at a bus stop			CO	CB, IB
	Entering / driving off from bus stop		CO	CB, IB	
	NOTE The informative examples in Table B.2 can be applied to T&B, but are considered on a case by case basis. For situations occurring in both, Table B.2 and Table B.4, Table B.4 is considered more appropriate for T&B				
- long haul (LH), for long distance transporting goods;		- distribution (DI), for distributing goods;			
- vocational (VO), for performing specific work functions, e.g. dumper truck, concrete mixer, dustcart;		- city bus (CB), for urban and suburban use;			
		- interurban bus (IB), for interurban transport; and			
		- coach (CO), for long distance journeys.			
Source: ISO 26262-3:2018, Table B.4 - Classes of probability of exposure regarding duration in operational situations for T&B					

		Class of probability of exposure in operational situations (see Table 2)				
		E1	E2	E3	E4	
Description		Very low probability	Low probability	Medium probability	High probability	
Frequency of situation		Occurs less often than once a year for the great majority of drivers	Occurs a few times a year for the great majority of Drivers	Occurs once a month or more often for an average Driver	Occurs during almost every drive on average	
Examples for	Driving in reverse			CB	LH, DI, VO, CB, IB	
	overtaking another truck or bus with small speed difference (with lane change to oncoming lane)			LH, DI, VO, CO, IB		
	driving with trailer attached			DI, CO, IB	LH, VO	
	semi-trailer tractor without trailer attached (on public road)		DI, VO	LH		
	driving on construction site (vehicle is driving directly on construction site, not only for delivering goods to construction site)	LH	DI		VO	
	steep slope	LH, CB	DI, CO, IB		VO	
	standing at / entering / driving off a bus stop				CB, CO, IB	
	NOTE The informative examples in Table B.3 can be applied to T&B, but are considered on a case by case basis. For situations occurring in both, Table B.3 and Table B.5, Table B.5 is considered more appropriate for T&B					
	- long haul (LH), for long distance transporting goods;		- distribution (DI), for distributing goods;			
- vocational (VO), for performing specific work functions, e.g. dumper truck, concrete mixer, dustcart;		- city bus (CB), for urban and suburban use;				
		- interurban bus (IB), for interurban transport; and				
		- coach (CO), for long distance journeys.				
Source: ISO 26262-3:2018, Table B.5 - Classes of probability of exposure regarding frequency in operational situations for T&B						

Vehicle Situations – Examples for HARA



Common Situations	
Direction of Driving	turn
	straight ahead
	uphill
	downhill / pass
	standstill
	driving backwards
Acceleration	slightly accelerating
	strongly accelerating
	coasting with running engine
	coasting with engine OFF, ignition ON
	coasting with engine OFF, ignition OFF
	constant speed
Deceleration	partial braking
	full brake application
	automatic brake
	application of parking brake (emergency brake)
Traffic	platoon
	opposing traffic
	traffic jam
	urban traffic
Parking	Parking with strong tilt (transport on a ship, double carport, carpark, ...)
	Parking at a slope (downhill)
	Parking at a slope (uphill)
	getting into a parking lot



Common Situations	
Special Driving Situations	circular path
	steep turn
	bridge
	tunnel
	racing circuit
	crest [Berggipfel]
	wash tunnel, carwash
	lateral inclination
	jerky [ruckartig] steering (steering angle sensor step / staggered)
	elk test
	chassis dynamometer test bench
	automatic gearbox emergency program
	engine emergency program
	engine failure (coasting to standstill) ignition ON
	car / trailer combination
	driving with roof rack
	towing vehicle away, ignition and engine ON
	towing rope
	tow bar
	on a ferry / motor rail train
	on a rotary disc in car park
	common work in a garage
	diagnosis interface operation
	getting started with a battery jumper cable
	seasonal operation (e.g. for six months)
u-turn using the hand brake	

Common Situations	
Velocity	low velocity
	high velocity
	parking / switching
	highway
	country road
Environmental Conditions	
Temperature	heat
	coldness
	change of temperature
	room temperature
	heat emission
	Irradiation [Einstrahlung]
refrigeration, cooling	
Air	high mountains
	Dead See
Humi.	tropics
	desert
Dirtiness Condit.	desert sand
	dust
	salt spray
	agriculture
droppings	droppings
	friction factor
Lane Characteristics	low μ
	high μ
	μ split
	chess board (alternating friction)
	rough / breakneck road
	Potholes [Schlaglöcher]
	bumpy road
	cobble stone pavement

Environmental Conditions	
Lane Characteristics	summit
	railroad crossing
	aquaplaning
	single damages
	off road
	mud
	wet grassland
	snow
	transversal slope
	interconnection
passing a creek	
boulders, gravel, sand	boulders, gravel, sand
	bedrock
	racing circuit
	take off due to curbs
Visibility & Weather Conditions	fog
	night
	day
	thunderbolt
	storm
	rain
	hail
sun	
Crash Situation	blinding
	ultraviolet radiation
	heating of passenger compartment
	rear collision
	frontal collision
	lateral collision
	rollover
fire brigade at work	

Driver's Activities	
Pedal Activities	braking pedal slightly pressed
	braking pedal strongly pressed
	releasing brake pedal
	braking pedal not pressed
	braking pedal touched
	accelerator pedal slightly pressed
	accelerator pedal strongly pressed
	releasing accelerator pedal
	accelerator pedal not pressed
	accelerator pedal touched
clutch pedal pressed completely	
clutch pedal slightly pressed	clutch pedal slightly pressed
	clutch pedal slipped (no complete release)
	clutch pedal released
	clutch pedal not pressed
clutch pedal touched	clutch pedal touched
	hand brake lever operated
Hand	EPB control element operated
	Miscellaneous Situations & Criteria
children seat on front passenger seat	
animals in passenger compartment	
driver enters vehicle without opening the door (convertible)	
driver leaves vehicle without opening the door (convertible)	
humidity in passenger compartment	