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Hazard II				Situational Ar	nalysis						Hazard Identification					Haza	rdous Event Classific	ition		Determi	ination of ASIL and Safety Goals
	Operational Mode	Operational Scenario	Environmental Details	Situation Details	Other Details (optional)	Item Usage (function)	Situation Description	Function	Deviation	Deviation Details	Hazardous Event (resulting effect)	Event Details	Hazardous Event Description	(of situation)	Rationale (for exposure)	Severity (of potential harm)	Rationale (for severity)	Controllability (of hazardous event)	Rationale (for controllability)	ASIL Determination	Safety Goal
HA-001	OM03 - Normal driving	OS04 - Highway	EN01 - Normal condit	SD02 - High speed	Driver rubbernecking + gripping steering wheel loosely	IL01 - Correctly used	Normal driving on a Highway during normal condition	Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV04 - Actor effect is too much	Oscillating steering torque applied exceeds the limit.		Lateral collision with vehicle on either left or right side.		E2 - Low probability	Probability of nubbernecking is very low when driving on highway. When this event happens the duration is small.	S3 - Life-threatening or tatal injuries	greater impact during the collision	uncontrollable	If LWD applies torque in one direction, driver might react and appy torque in the opposite direction. This behavior can repeat and will cause car to swerve badly.	С	The oscillating steering torque from LDW should be limited.
HA-002	OM03 - Normal driving	OS03 - Country Road	EN01 - Normal condit	SD02 - High speed		IL02 - Incorrectly used	Normal driving on a Country road during normal condition.	active in order to stay in ego lane	DV03 - Function always activated		EV00 - Collision with other vehicle	Lateral collision with vehicle on either left or right side.		probability	Since its risky to abuse LKA feature, driver wont be doing it quite often. Probability of this event happening is low.	S3 - Life-threatening or fatal injuries	High speed will have greater impact during the collision	uncontrollable	Since driver is depending on the LKA for the direction, direction can change if road condition change for example, curve ahead.	В	Time duration of LKA should be time limited to prevent the misuse of LKA as an autonomous driving.
HA-003	OM03 - Normal driving	OS01 - Any road	1040)	SD01 - Low speed	Night time + reflection of light on the road	IL02 - Incorrectly used	Normal driving on any Road during rain	Lane Departure Warring (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV02 - Function unexpectedly activated	Oscillating steering torque applied unnecessarily.	During rain, reflection of headlights from oncoming cars on the road can cause camera to detect land lines incorrectly and activate LDW feature	sinal art of right state.		probability	Occurrence of this event is happening less frequent so probability is low.	S2 - Severe and life- threatening injuries	During rain, normally people don't drive fast, so impact could be less severe.		Traffic condition in the surroundings can change the outcome. Driver maybe able to control the car or maybe not. So picked the higher controllability.	С	LDW shouldn't be activated if its raining. Driver should remain in the control of the car.
HA-004	OM03 - Normal driving	OS04 - Highway	EN05 - Cross-wind (lateral force)	SD02 - High speed		IL01 - Correctly used	Normal driving on a Highway during crosswinds	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV02 - Function unexpectedly activated	Steering torque applied could be counter intutive.	Combination of crosswind and steering torque could cause car to swerve badly.	Lateral collision with vehicle on either left or right side.	Driver loses control of vehicle	E2 - Low probability	Occurrence of this event is happening less frequent so probability is low.	S2 - Severe and life- threatening injuries	High speed will have greater impact during the collision		Traffic condition in the surroundings can change the outcome. Driver maybe able to control the car or maybe not. So picked the higher controllability.		If LKA is getting activated frequently during short time span, LKA should deactivate itself and let driver control the car.

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## **Hazard & Risk Analysis Definitions**

Operational Mode

ID	Mode	Remarks	Reference
OM01			OM01 - Parked
OM02			OM02 - Ignition on
OM03	Normal driving	Car is driving	OM03 - Normal driving
OM04	Backward driving	Car is driving	OM04 - Backward driving
OM05	Degraded driving	Limp home mode	OM05 - Degraded driving
OM06	Towing (active)	Towing another car	OM06 - Towing (active)
OM07	Towing (passive)	Beeing towed by another car	OM07 - Towing (passive)
80MO	Service	Vehicle is in repair garage	OM08 - Service
OM09	N/A	not applicable or not relevant	OM09 - N/A

Operational Scenario

ID	Scenario	Remarks	Reference
OS01	Any Road	road type	OS01 - Any Road
OS02	City Road	road type	OS02 - City Road
OS03	Country Road	road type	OS03 - Country Road
OS04	Highway	road type	OS04 - Highway
OS05	Mountain Pass	road type	OS05 - Mountain Pass
OS06	Off Road	road type	OS06 - Off Road
OS07	Road with gradient	road attribute	OS07 - Road with gradient
OS08	Road with bump	road attribute	OS08 - Road with bump
OS09	Road tunnel	road attribute	OS09 - Road tunnel
OS10	Road with construction site	road attribute	OS10 - Road with construction site
OS11	N/A	not applicable or not relevant	OS11 - N/A

Situation Details

Oituation i	Sciulis		
ID	Scenario	Remarks	Reference
SD01	Low speed	driving attribute	SD01 - Low speed
SD02	High speed	driving attribute	SD02 - High speed
SD03	Normal acceleration	driving attribute	SD03 - Normal acceleration
SD04	High acceleration	driving attribute	SD04 - High acceleration
SD05	Normal braking	driving attribute	SD05 - Normal braking
SD06	High braking	driving attribute	SD06 - High braking
SD07	N/A	not applicable or not relevant	SD07 - N/A

Item Usage

ID	Mode	Remarks	Reference
IU01	Correctly used	Intended usage	IU01 - Correctly used
IU02	Incorrectly used	Unintended usage (foreseeable)	IU02 - Incorrectly used
IU03	N/A	not applicable or not relevant	IU03 - N/A

## **Environmental Details**

ID	Scenario	Remarks	Reference
EN01	Normal conditions	weather attribute	EN01 - Normal conditions
EN02	Sun blares (degraded view)	weather attribute	EN02 - Sun blares (degraded view)
EN03	Fog (degraded view)	weather attribute	EN03 - Fog (degraded view)
EN04	Snowfall (degraded view)	weather attribute	EN04 - Snowfall (degraded view)
EN05	Cross-wind (lateral force)	weather attribute	EN05 - Cross-wind (lateral force)
EN06	Rain (slippery road)	road attribute	EN06 - Rain (slippery road)
EN07	Snow (slippery road)	road attribute	EN07 - Snow (slippery road)
EN08	Glace (slippery road)	road attribute	EN08 - Glace (slippery road)
EN09	N/A	not applicable or not relevant	EN09 - N/A

## Deviation

ID	Deviation (Guideword)	Remarks	Reference
DV01	Function not activated	Activation error	DV01 - Function not activated
DV02	Function unexpectedly activated	Activation error	DV02 - Function unexpectedly activated
DV03	Function always activated	Activation error	DV03 - Function always activated
DV04	Actor effect is too much	Quantitative error	DV04 - Actor effect is too much
DV05	Actor effect is too less	Quantitative error	DV05 - Actor effect is too less
DV06	Actor action too early	Timing error	DV06 - Actor action too early
DV07	Actor action too late	Timing error	DV07 - Actor action too late
DV08	Actor action before	Sequence error	DV08 - Actor action before
DV09	Actor action after	Sequence error	DV09 - Actor action after
DV10	Actor effect is reverse	Logical error	DV10 - Actor effect is reverse
DV11	Actor effect is wrong	Logical error	DV11 - Actor effect is wrong
DV12	Sensor sensitivity is too high	Quantitative error	DV12 - Sensor sensitivity is too high
DV13	Sensor sensitivity is too low	Quantitative error	DV13 - Sensor sensitivity is too low
DV14	Sensor detection too early	Timing error	DV14 - Sensor detection too early
DV15	Sensor detection too late	Timing error	DV15 - Sensor detection too late
DV16	Sensor detection before	Sequence error	DV16 - Sensor detection before
DV17	Sensor detection after	Sequence error	DV17 - Sensor detection after
DV18	Sensor detection is reverse	Logical error	DV18 - Sensor detection is reverse
DV19	Sensor detection is wrong	Logical error	DV19 - Sensor detection is wrong
DV20	N/A	not applicable or not relevant	DV20 - N/A

Hazardous Events (possibe effects)

ID	Hazardous Event	Remarks	Reference
EV-07	None		EV-07 - None
EV-06	Front collision with oncoming traffic		EV-06 - Front collision with oncoming traffic
EV-05	Front collision with ahead traffic		EV-05 - Front collision with ahead traffic
EV-04	Front collision with obstacle		EV-04 - Front collision with obstacle
EV-03	Rear collision with trailing traffic		EV-03 - Rear collision with trailing traffic
EV-02	Side collision with other traffic		EV-02 - Side collision with other traffic
EV-01	Side collision with obstacle		EV-01 - Side collision with obstacle
EV00	Collision with other vehicle		EV00 - Collision with other vehicle
EV01	Collision with train		EV01 - Collision with train
EV02	Collision with pedestrian		EV02 - Collision with pedestrian
EV03	Car spins out of control		EV03 - Car spins out of control
EV04	Car comes off the road		EV04 - Car comes off the road
EV05	Car catches file		EV05 - Car catches file
EV06	N/A		EV06 - N/A

Exposure

ID	Description	Duration (of situation)	Frequency (of situation)	Reference
E0	Incredible			E0 - Incredible
E1	Very low probability	Not specified	Occurs less often than once a year for the great majority of driv	E1 - Very low probability
E2	Low probability	<1 % of average operating time	Occurs a few times a year for the great majority of drivers	E2 - Low probability
E3	Medium probability	1 % to 10 % of average operating time	Occurs once a month or more often for an average driver	E3 - Medium probability
E4	High probability	>10 % of average operating time	Occurs during almost every drive on average	E4 - High probability

Severit

Severity				
ID	Description	Remarks	Probability of Injuries	Reference
S0	No injuries	No injuries	AIS 0 and less than 10 % probability of AIS 1-6	S0 - No injuries
S1	Light and moderate injuries	Light and moderate injuries	More than 10 % probability of AIS 1-6 (and not S2 or S3)	S1 - Light and moderate injuries
S2	Severe and life-threatening injuries	Severe and life-threatening injuries (survival probable)	More than 10 % probability of AIS 3-6 (and not S3)	S2 - Severe and life-threatening injuries
S3	Life-threatening or fatal injuries	Life-threatening injuries (survival uncertain), fatal injuries	More than 10 % probability of AIS 5-6	S3 - Life-threatening or fatal injuries

Controllability

ID	Description	Remarks	Reference					
C0	Controllable in general	Controllable in general	C0 - Controllable in general					
C1	Simply controllable	99 % or more of all drivers or other traffic participants are usually able to avoid harm	C1 - Simply controllable					
C2	Normally controllable	90 % or more of all drivers or other traffic participants are usually able to avoid harm	C2 - Normally controllable					
C3	Difficult to control or uncontrollable	Less than 90 % of all drivers or other traffic participants are usually able, or barely able, to avoid harm	C3 - Difficult to control or uncontrollable					

Controllability	Exposure	Severity			
Controllability	Exposure	S0	S1	S2	S3
	E1	QM	QM	QM	QM
C1	E2	QM	QM	QM	QM
01	E3	QM	QM	QM	Α
	E4	QM	QM	Α	В
	E1	QM	QM	QM	QM
C2	E2	QM	QM	QM	Α
02	E3	QM	QM	Α	В
	E4	QM	Α	В	С
	E1	QM	QM	QM	Α
C3	E2	QM	QM	Α	В
03	E3	QM	Α	В	С
	E4	QM	В	С	D