

**INSTRUCTIONS:**

Fill out the hazard analysis and risk assessment below.

HA-001 should be for the lane departure warning function as discussed in the lecture.

HA-002 should be for the lane keeping assistance function as discussed in the lecture.

Then come up with your own situations and hazards for the lane assistance function.

When finished, export your spreadsheet as a pdf file so that a reviewer can see your work.

Hazard ID			
	Operational Mode	Operational Scenario	Environmental Details
HA-001	OM03 - Normal Driving	OS04 - Highway	EN01 - Normal conditions
HA-002	OM03 - Normal Driving	OS04 - Highway	EN01 - Normal conditions
HA-003	OM03 - Normal Driving	OS03 - Country Road	EN07 - Snow (slippery road)
HA-004	OM03 - Normal Driving	OS05 - Mountain Pass	EN01 - Normal conditions

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 stance system. Fill in the HA-003 and HA-004 rows.  
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Situational Analysis			
Situation Details	Other Details (optional)	Item Usage (function)	Situation Description
SD02 - High speed	N/A	IU01 - Correctly Used	Normal driving on highway during normal conditions with high speed.
SD02 - High speed	N/A	IU02 - Incorrectly Used	Normal driving on highway during normal conditions with high speed.
SD02 - High speed	N/A	IU01 - Correctly Used	Normal driving on country roads during snow (slippery road) with high speed.
SD01 - Low speed	N/A	IU01 - Correctly Used	Normal driving on mountain pass during normal conditions with low speed.

Hazard Identification			
Function	Deviation	Deviation Details	Hazardous Event (resulting effect)
Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV10 - Actor effect is reverse	The LDW function applies the torque in the wrong direction to the steering wheel.	EV00 - Collision with other vehicle
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV03 - Function always activated	The driver is not taking control of the car and using the LKA function to let the car drive fully autonomous.	EV00 - Collision with other vehicle
Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV04 - Actor effect is too much	The LDW function applies to high torque to the steering wheel.	EV00 - Collision with other vehicle
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV02 - Function unexpectedly activated	The LKA function keeps warning and steering, however, this is due to the very winding road.	EV04 - Car comes off the road

Event Details	Hazardous Event Description	Exposure (of situation)
High haptic feedback can confuse the driver and as a consequence lose control of the vehicle..	The LDW function applies torque in the wrong direction to the steering wheel .	E2 - Low probability
The driver is not touching the steering wheel and cannot in time to changing conditions.	The LKA function is not limited in time.	E2 - Low probability
High haptic feedback is too much and the driver could oversteer and as a consequence lose control of the vehicle..	The LDW function applies torque above limit to the steering wheel .	E3 - Medium probability
Due to the high frequency of directional changes and the delayed feedback of the LKA, the driver might get confused and lose control of the vehicle.	The LKA function is unexpectedly activated.	E2 - Low probability

Hazardous Event Classification			
Rationale (for exposure)	Severity (of potential harm)	Rationale (for severity)	Controllability (of hazardous event)
This is a basic functionality error that shouldn't occur in the field as it has been tested for this condition prior to production.	S3 Life-threatening or fatal injuries	Driver is travelling at high speed.	C3 Difficult to control or uncontrollable
As the LKA function is quite simple in most situations there'll be too much interference where the driver has to take control.	S3 Life-threatening or fatal injuries	Driver is travelling at high speed.	C3 Difficult to control or uncontrollable
Drivers normally take extra caution in snowy conditions.	S3 Life-threatening or fatal injuries	Driver is travelling at high speed.	C3 Difficult to control or uncontrollable
This is a basic functionality error that shouldn't occur in the field as it has been tested for this condition prior to production.	S3 Life-threatening or fatal injuries	Coming off the road on a mountain pass might cause the vehicle to fall into a gorge.	C3 Difficult to control or uncontrollable

	Determination of ASIL and Safety Goals	
Rationale (for controllability)	ASIL Determination	Safety Goal
The driver will not expect a feedback in the wrong direction and therefore, might be very confused.	ASIL B	The LDW's applied torque direction must be in line with windowed history of previous steering directions.
The driver reacts too late and at high speed the car already travelled a fair distance before he re-gains control over the vehicle.	ASIL B	The lane keeping assistance function shall be time limited and the additional steering torque shall end after a given time interval so that the driver cannot misuse the system for autonomous driving.
The driver is busy staying aware of the snowy road conditions and might react over-sensitive to the feedback.	ASIL C	The LDW function has to use data from the stability sensors to determine road conditions and use an adaptive torque. The oscillating steering torque from the lane departure warning function shall be limited.
The driver is busy following the winding road and is not expecting	ASIL B	The LKA function has to include some kind of hysteresis so it's not over-compensating.