

	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 system. Fill in the HA-003 and HA-004 rows.						
	When finished, export your spreadsheet as a pdf file so that a reviewer can easily see your work.						

Hazard ID	Situational Analysis						
	Operational Mode	Operational Scenario	Environmental Details	Situation Details	Other Details (optional)	Item Usage (function)	Situation Description
HA-001	OM03-Normal Drive	OS04-Highway	EN01-Rain (slippery)	SD02-High Speed		IU01-Correctly used	Normal driving on highway during rain with high speed.
HA-002	OM03-Normal Drive	OS03-Country Road	EN01-Normal Condition	SD02-High Speed		IU02-Incorrectly used	Normal driving on country roads during normal conditions with high speed (the driver is misusing the lane keeping assistance function as a fully autonomous function)
HA-003	OM03-Normal Drive	OS01-Country Road	EN03 -Fog (degraded view)	SD01-Low Speed		IU01-Correctly used	Normal driving on country roads during normal conditions with high speed (the driver is misusing the lane keeping assistance function as a fully autonomous function)
HA-004	OM03-Normal Drive	OS02-City Road	EN01-Normal Condition	SD01-Low Speed		IU01-Correctly used	Normal driving on city road during normal condition

Hazard Identification					
Function	Deviation	Deviation Details	Hazardous Event (resulting effect)	Event Details	Hazardous Event Description
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 an oscillating torque with very high torque (above limit).	EV-05-Front collision with ahead traffic	Vehicle collides with another vehicle ahead and cause injury to driver	Loss of steering
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV03-Function always activated	The lane keeping assistance function is not limited in time duration which leads to misuse as an autonomous driving function.	EV-05-Front collision with ahead traffic	Vehicle collides with another vehicle ahead and cause injury to driver	Driving on a country road with high speed and misusing the system
Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV02-Function unexpectedly activated	The LDW function is not able to detect the lane correctly.	EV-05-Front collision with ahead traffic	Vehicle collides with another vehicle ahead and cause injury to driver.	Driving on a country road with low speed and partial loss of steering.
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV01-Function not activated	The LKA function is active but fails to apply steering torque to keep vehicle in ego lane.	EV-06-Front collision with oncoming traffic	Vehicle collides with ongoing vehicle in the traffic and cause injury to driver.	Driving on a city road during normal condition and fails to keep in ego lane due to LKA function failure.

Hazardous Event Classification						Determination of ASIL and Safety Goals	
Exposure (of situation)	Rationale (for exposure)	Severity (of potential harm)	Rationale (for severity)	Controllability (of hazardous event)	Rationale (for controllability)	ASIL Determination	Safety Goal
Loss of steering	Driving on highway when it is raining occurs once a month or more often for an average driver	S3 - Life-threatening or fatal injuries	On highway speed of vehicle is expected to be high	C3-Difficult to control or uncontrollable	The malfunction was that the lane keeping warning applied too much torque in a too high frequency, the drivers lose control of steering. Because steering is lost on the wheel at high speeds, a vehicle accident would not be controllable. We will label this hazardous situation as C3	C	The oscillating steering torque from the lane departure warning function shall be limited
E2-Low probability	Driving on a country road with high speed, and misusing the system. That combination probably does not happen often, so we will label the exposure E2.	fatal injuries	The driver is traveling at high speed,	C3-Difficult to control or uncontrollable	The malfunction was that the lane keeping assistance was always on and had no time limit, so drivers could take both hands off the wheel. Because hands aren't on the wheel at high speeds, a vehicle accident would not be controllable. We will label this hazardous situation as C3.	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.
E2-Low probability	Driving on a country road with low speed under fog condition is not a high probability event for most driver.	S2-Severe and life-threatening injuries	The driver is traveling at low speed,	C3-Difficult to control or uncontrollable	The malfunction was that the LKW unexpectedly activated and vibrated the steering wheel. The drivers may lose control of steering. We will label this hazardous situation as C3.	A	The LDW function shall deactivate when the camera sensor is unable to detect road markings, and shall warn the driver of its deactivation.
E4 - High probability	Driving on a city road during normal condition is part of regular driving.	S2-Severe and life-threatening injuries	The driver is traveling during normal condition,	C1-Simply controllable	The LKA failed to function, but most driver can still able to handle the situation under normal condition. We will label this hazardous situation as C1.	A	The LKA system should check if the Electronic Power Steering ECU is functioning and give warning to driver if it stops working.