

**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

When finished, export your spreadsheet as a pdf file so that a reviewer can easily see you

Hazard ID	Situational Analysis			
	Operational Mode	Operational Scenario	Environmental Details	Situation Details
HA-001	OM03 - Normal driving	OS04 - Highway	EN06 - Rain (slippery road)	SD02 - High speed
HA-002	OM03 - Normal driving	OS03 - Country Road	EN01 - Normal conditions	SD02 - High speed
HA-003	OM03 - Normal driving	OS04 - Highway	EN06 - Rain (slippery road)	SD02 - High speed
HA-004	OM03 - Normal driving	OS10 - Road with construction site	EN01 - Normal conditions	SD02 - High speed

1 the HA-003 and HA-004 rows.  
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Other Details (optional)	Item Usage (function)	Situation Description	Function	Deviation
The system operates normally	IU01 - Correctly used	Normal driving on a Highway during Rain (slippery road) and Correctly used system	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 driver is misusing the LKA function as an autonomous function	IU02 - Incorrectly used	Normal driving on Country Road during Normal conditions with High speed and Incorrectly used system	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV03 - Function always activated
The system operates normally	IU01 - Correctly used	Normal driving on a Highway during Rain (slippery road) and Correctly used system	Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV05 - Actor effect is too less
On the Road with construction site the Camera subsystem can confuse the lane lines	IU01 - Correctly used	Normal driving on a Road with a construction site with High speed and Correctly used system	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV03 - Function always activated

Hazard Identification		
Deviation Details	Hazardous Event (resulting effect)	Event Details
The LDW function applies an oscillating torque with very high torque (above limit)	EV00 - Collision with other vehicle	High haptic feedback can affect driver's ability to steer as intended. The driver could lose control of the vehicle and collide with another vehicle or with road infrastructure
The LKA function is always activated applying the steering torque in order to stay in the ego lane	EV00 - Collision with other vehicle	Misusing the LKA function makes potential for vehicle collision
The LDW function applies an oscillating torque with very low torque (below limit)	EV00 - Collision with other vehicle	Low haptic feedback can limit driver's ability to respond to the lane departure. The driver could miss or respond to late to the lane departure and collide with another vehicle or with road infrastructure
The LKA function is always activated regardless the Operational Scenario	EV-04 - Front collision with obstacle	The LKA function degrades on a Road with construction site and vehicle can collide with obstacle

			Hazard
Hazardous Event Description	Exposure (of situation)	Rationale (for exposure)	Severity (of potential harm)
The LDW function applies too high an oscillating torque to the steering wheel (above limit)	E3 - Medium probability	Highway driving during Rain (slippery road)	S3 - Life-threatening or fatal injuries
The driver was misusing the LKA function by taking both hands off the wheel and incorrectly treating the car as a fully autonomous vehicle.	E2 - Low probability	The combination of driving on Country Road and misusing the function is not happening too often	S3 - Life-threatening or fatal injuries
The LDW function applies too low an oscillating torque to the steering wheel (below limit)	E3 - Medium probability	Highway driving during Rain (slippery road)	S3 - Life-threatening or fatal injuries
On the Road with a construction site the lane lines can be missing or confusing, the LKA function degrades and vehicle can collide with obstacle	E2 - Low probability	Driving on Road with construction site is not happening too often	S3 - Life-threatening or fatal injuries

### Hazardous Event Classification

Rationale (for severity)	Controllability (of hazardous event)	Rationale (for controllability)
On the Highway the driver was travelling at high speed (> 40 km/h)	C3 - Difficult to control or uncontrollable	When the LDW function causes an excessive vibration of the steering wheel, most drivers would have difficulty controlling the vehicle
On the Highway the driver was travelling at high speed (>40 km/h)	C3 - Difficult to control or uncontrollable	The malfunction was that the LKA function 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.
On the Highway the driver was travelling at high speed (> 40 km/h)	C3 - Difficult to control or uncontrollable	When the LDW function applies not enough vibration of the steering wheel, most drivers would have difficulty to respond in time to the vehicle lane departure
It could be construction on Highway with speed limit 80 km/h and the driver was travelling at high speed (>40 km/h)	C3 - Difficult to control or uncontrollable	It is difficult to control the vehicle when driving in on Road with construction site at high speed.

Determination of ASIL and Safety Goals	
ASIL Determination	Safety Goal
C	The oscillating steering torque from the LDW function shall be limited
B	The LKA function shall be time limited and additional steering torque shall end after given time interval so that the driver could not misuse the system for autonomous driving
C	The oscillating steering torque from the LDW function shall be high enough for the driver to respond
B	The Lane Assistance system shall be deactivated when driving on Road with construction site