

<div><div>INSTRUCTIONS:</div><div>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.</div></div>													

Hazardous Event Classification						Determination of ASIL and Safety Goals	
Exposure (of situation)	Rationale (for exposure)	Severity (of potential harm)	Controllability (for severity)	Controllability (of hazardous event)	Rationale (for controllability)	ASIL Determination	Safety Goal
E4 - High probability	night driving in the city is a regular activity	S1 - Light and moderate injuries	In city traffic, speed of vehicle is expected to be low	C0 - Controllable in general	At city speed, most drivers will be able to control the situation by applying brakes and there is additional illumination on city roads	QM	Total Loss of Beam Shall Be Prevented
E4 - High probability	night driving in the city on completely unilluminated roads while it is snowing is rare	S3 - Life-threatening or fatal injuries	On country roads speed of vehicle is expected to be high	C1 - Simply controllable	Since there is usually no other form of illumination to be expected on country road, it will be difficult for the average driver to control the vehicle in such a	B	Total loss of low beam shall be prevented
E2 - Low probability	High driving is part of regular driving, however, heavy snow occurs a few times a year	S3 - Life-threatening or fatal injuries	On highway speed of vehicle is expected to be high	C2 - Normally controllable	When driving on highway with low beam, it can be expected that there are other vehicles and there is some form of illumination on road and hence >90% drivers are able to brake and control the vehicle. And also use other forms of warning (e.g. hazard lights) to signal malfunction	A	Total loss of low beam shall be prevented
E4 - High probability	country driving is part of regular driving	S3 - Life-threatening or fatal injuries	On country roads speed of vehicle is expected to be high	C1 - Simply controllable	Since there is usually no other form of illumination to be expected on country road, it will be difficult for the average driver to control the vehicle in such a situation	B	Total loss of low beam shall be prevented











[illegible]























Hazard & Risk Analysis Definitions

Operational Mode			
ID	Mode	Remarks	Reference
OM01	Parked	Car is parked, ignition is off	OM01 - Parked
OM02	Ignition on	Car is parked, ignition is on	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)	Being towed by another car	OM07 - Towing (passive)
OM08	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			
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 (forseeable)	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	Glacier (slippery road)	road attribute	EN08 - Glacier (slippery road)
EN09	N/A	not applicable or not relevant	EN09 - 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 drivers	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								
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			
			S0	S1	S2	S3
	C1	E1	QM	QM	QM	QM
		E2	QM	QM	QM	QM
		E3	QM	QM	QM	A
		E4	QM	QM	A	B
	C2	E1	QM	QM	QM	QM
		E2	QM	QM	QM	A
		E3	QM	QM	A	B
		E4	QM	A	B	C
	C3	E1	QM	QM	QM	A
		E2	QM	QM	A	B
		E3	QM	A	B	C
		E4	QM	B	C	D