

ReliablE in-Vehicle pErception and decisioN-making in complex environmenTal conditionS

Grant Agreement Number: 101069614

D.2.3 Vehicle System Hazard Analysis & Risk Assessment

Document Identification				
Status	Final	Due Date	31/08/2023	
Version	1.0	Submission Date	31/08/2023	
Related WP	WP2	Document Reference	D2.3	
Related Deliverable(s)	D.2.1, D2.2	Dissemination Level	PU	
Lead Participant	APTIV	Document Type:	R	
Contributors	All Task 2.4 partners	Lead Authors	Yogesh Ganesh, APTIV	
		Reviewers	Anastasia Bolovinou, ICCS	
			Siddartha Kashgir, WMG	



Funded by the European Union This project has received funding under grant agreement No 101069614. It is funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Commission. Neither the European Union nor the granting authority can be held responsible for them.



Author(s)		
First Name	Last Name	Partner
Yogesh	Ganesh	APTIV
Mariat	James Elizebeth	WMG
Bill	Roungas	ICCS
Anthony	Ohazulike	HIT-FR
Alireza	Ahrabian	HIT-UK
Dariu	Gavrila	TUD

Document History			
Version	Date	Modified by	Modification reason
0.1	14/03/2023	APTIV	Initial version.
0.2	02/05/2023	APTIV	Added control structure
0.3	17/07/2023	APTIV	Finalizing HARA report
0.4	09/08/2023	APTIV	Complete D2.3 report
0.5	25/08/2023	APTIV	Integrating review comments
1.0	31/08/2023	ICCS	Final Approval



Quality Control		
Role	Who (Partner's short name)	Approval Date
Deliverable Leader	Yogesh Ganesh (APTIV)	30/08/2023
Quality manager	Panagiotis Lytrivis (ICCS)	31/08/2023
Project Coordinator	Angelos Amditis (ICCS)	31/08/2023



Executive Summary

The "D2.3: Vehicle system hazard analysis & risk assessment" deliverable is a public report of the EVENTS project, dealing with the risks and potential hazards associated with each use case by performing a Risk Assessment and Hazard Analysis (HARA) process. The approach taken in this work proposes a hybrid scheme that integrates STPA analysis with classical HARA.

The safety analysis findings are then used to formulate safety goals that are required to be met, in order for each vehicle system to operate safely within its ODD.

Work on Task 2.4 is based on the use case specification including ODD definition (mainly level of automation, road types and required infrastructure), the expected use-case exposure as well as the system architecture provided by the previous tasks.

Acceptance criteria, which are used to measure/assure safety of the intended function (SOTIF) of an autonomous vehicle or advanced driver assistance system (ADAS), are provided for the European roads. These initial performance goals will feed the development work of WP3 (Perception and self-assessment) and WP4 (On-board decision-making for fail-safe automated vehicle motion), where a list of reasonably quantified SOTIF events will be provided based on simulation testing, which in turn will feed the work on vehicle system safety compliance verification on Task T5.3.



Table of Contents

Ех	Executive Summary4		
1.	Intr	oduction	9
2.	Me	thodology	10
	2.1	Method 1: Hazard and Operability Study	10
	2.2	Method 2: Systems-Theoretic Process Analysis (STPA)	
	2.3	Integrating STPA steps into ISO26262	
3.	lter	n Definition: System scope and definition.	13
	3.1	Initial Inputs for HARA	13
	3.2	STPA Step 1: Define Purpose	14
	3.1	STPA Step 2: Model Control Structure	15
4.	Veł	iicle Level Hazard analysis	17
	4.1	Functional Decomposition of CAV.	
	4.2	Functions list with applicable HAZOP Guidewords	
	4.3	Experiments for hazard analysis	19
	Table	4 : Location and surface condition table	19
	Table	5 : Weather and traffic condition table	20
	4.4	Vehicle Operating Modes	20
	4.5	STPA Step 3: Identify Unsafe Control Actions (UCA's)	20
5.	Risl	Assessment – ASIL Rating	22
	5.1	Safety goals derived from HARA	22
	5.2	Assigning Control Actions to ADS Functions	23
6.	Safe	ety Analysis	24
	6.1	STPA Step 4: Identify Causal Factors	24
	6.2	Requirements derived from STPA Analysis	25
7.	Fun	ctional Safety Concept & Requirements	26
	7.1	Activation / Deactivation Functional Safety Concepts	
	7.2	HMI Status Functional Safety Concept	
	7.3	Longitudinal Control Functional Safety Concept	27
	7.4	Lateral Control Functional Safety Concept	29
	7.5	Take Over Request & Safe Stop Functional Safety Concept	29
	7.6	Usage of STPA derived requirements & FSC in EVENTS	30
8.	Acc	eptance Criteria for SOTIF based on Mileage Strategy	31



9. Conclusions	33
References	34
Annex 1: Model Control Structure	35
Annex 2: STPA Spte 3	36
Annex 3: Hazon-based HARA	46
Annex 4: STPA Step 4	54
Annex 5: Safety Requirements	.122

List of Tables

Table 1: Identified Losses	15
Table 2: Vehicle level hazard table	15
Table 3: Applicable HAZOP Guidewords for ADS functions	18
Table 4: Location and surface condition table	19
Table 5: Weather and traffic condition table	20
Table 6: Vehicle operating mode table	20
Table 7: Safety goal summary	22
Table 8: Mapping Control Actions to ADS Functions table	23
Table 9: Failure criticality to safe state transition table	30
Table 10: Acceptance Criteria Calculation	32

List of Figures

Figure 1: HAZOP Steps	10
Figure 2: STPA Steps	11
Figure 3: STPA in ISO26262 Context	12
Figure 4: Item Context Diagram	13
Figure 5: EVENTS system architecture diagram	. 14
Figure 6: Model Control Structure (a larger image is shown in Annex 1)	16
Figure 7: The STPA Step 3	. 17
Figure 8: CAV Functional Decomposition	17
Figure 9: UCA Guideword	21
Figure 10: The Automotive Safety Integrity Level (ASIL)	22
Figure 11: The STPA Step 4	. 24
Figure 12: The Functional Safety Concept & Requirements	26
Figure 13: Activation/Deactivation Safety Concept	26
Figure 14: HMI Safety concept	27
Figure 15: Longitudinal & Lateral Control Functional Safety Concept	28
Figure 16: EXP6 high-level Full Stack Architecture and Interfaces	30



Abbreviations & Acronyms

Abbreviation / acronym	Description
ACC	Adaptive Cruise Control
AD(F)	Autonomous Driving (Function)
ADS	Autonomous Driving System
AI	Artificial Intelligence
AL	Alert Limit
AV	Automated Vehicle
BP	Behavioural Planner
СА	Consortium Agreement
САМ	Cooperative Awareness Message
CAV	Connected Automated Vehicle
СРМ	Collective Perception Messages
DDT	Dynamic Driving Task
DENM	Decentralized Environmental Notification Message
DM	Decision Making
EC	European Commission
EXPs	Experiments
FIS	Fuzzy Inference System
FoV	Field of View
FSC	Functional Safety Concept
FTP	Fail-degraded Trajectory Planning
GA	Grant Agreement
IR	Integrity Risk
ISO	International Organization for Standardization
I/O	Input(s) / Output(s)
Lidar	Light Detection and Ranging
MDP	Markov Decision Process
МРС	Model Predictive Control
MRM	Minimum Risk Manoeuvre



Abbreviation / acronym	Description
МОР	Moving Object Prediction
МОТ	Multi-Object Tracking
ODD	Operational Design Domain
PE	Position Error
PL	Protection Level
РР	Perception Platform
RADAR	RAdio Detecting And Ranging
REQs	Requirements
RL	Reinforcement Learning
SAE	Society of Automotive Engineers
SMD	Safety-mode Decision
SPaT message	Signal Phase and Timing message
SPECs	Specifications
TOR	Take Over Request
ТР	Trajectory Planner
TSs	Target Scenarios
UCs	Use Cases
VRU	Vulnerable Road User
WP	Work Package



1. Introduction

Assuring safety is important in autonomous vehicles. The safety related to autonomous vehicles can be primarily viewed from two perspectives [6]: the functional safety (FuSa) and the safety of the intended functionality (SOTIF). While FuSa ensures the system has an acceptable risk with respect to malfunctions of electrical and electronic components, SOTIF ensures the system has an acceptable risk with respect to functional insufficiencies and performance limitations. SOTIF also considers expected system misuse, touching on cybersecurity aspects; however, such aspects are considered out of the project focus and will not be covered by this work.

With the growing complexity of automotive systems and the integration of advanced technologies, ensuring functional safety is of utmost importance. ISO 26262 [1], the international standard for functional safety in the automotive industry, provides a structured framework to address these safety challenges. In ISO 26262, the concept of *HARA* (Hazard Analysis and Risk Assessment) is introduced for system safety assessment during the concept phase of the system. HARA is an integral part of the functional safety process since it serves as the foundation for identifying potential hazards and assessing their associated risks. It involves a rigorous examination of potential failure modes, their causes, and the severity of their consequences on vehicle occupants, other road users, and the environment. Once HARA is completed, functional safety requirements are created and all the findings are aggregated into a functional safety concept. Works that augment HARA with scenario-based analysis or replace HARA with alternatives more suitable for AD systems have recently appeared [7].



2. Methodology

This project combines two analysis methods, namely HAZOP and STPA to generate a list of hazards and based on this, the safety analysis results.

2.1 Method 1: Hazard and Operability Study

HAZOP (Hazard and Operability Study) is a systematic and structured approach used in industries such as chemical, petrochemical, and manufacturing to identify potential hazards and operability issues in processes, systems, and equipment. The classical HAZOP approach has several advantages:

- 1. Comprehensive Hazard Identification
- 2. Structured and Systematic
- 3. Team Collaboration
- 4. Risk Assessment
- 5. Early Identification of Hazards

Figure 1 illustrates the analytical steps of the HAZOP study.



Figure 1: HAZOP Steps



This study applies the HAZOP study steps shown in Figure 1 as follows:

- 1. Define the system of study and the scope of the analysis.
- 2. List all the functions that the system components are designed to perform.
- 3. For each of the identified functions, apply a set of guidewords [8] that describe the various ways in which the function may deviate from its design intent.
- 4. Identified malfunctions from relevant guideword for each function is then analyzed with applicable scenarios to document the context of malfunction.
- 5. Severity, Exposure, Controllability [9] is then analyzed for step 4.
- 6. Top level Safety goals are derived to be fulfilled by the system design.

2.2 Method 2: Systems-Theoretic Process Analysis (STPA)

The STPA is a top-down system engineering approach to system safety that guides safety managers and analysts in the identification of a migration toward states of higher *risk* [11] and addresses more types of hazards and treats safety as a dynamic control problem rather than an individual component failure. STPA also addresses types of hazardous causes in the absence of failure [12]. In STPA, the system is modelled as a dynamic control structure, where proper controls and communications in the system ensure the desired outcome for emergent properties, such as safety. In the STPA framework, a system will not enter a hazardous state unless an unsafe control action is issued by a controller, or a control action needed to maintain safety is not issued. The STPA steps are shown in Figure 2.





2.3 Integrating STPA steps into ISO26262

The absence of a risk assessment phase in the STPA analysis method represents a notable omission, as this step plays a crucial role in determining the safety integrity allocation on system elements. In Figure 3, the procedures for incorporating STPA into the ISO26262 [REF ISO] process methodology are presented.



Figure 3: STPA in ISO26262 Context

By merging the traditional HAZOP process with STPA, we have enhanced our safety analysis approach, making it more tailored for Connected and Autonomous Vehicles (CAVs).



3. Item Definition: System scope and definition.

The System Scope refers to defining the boundaries and extent of the automotive safety system under consideration. This involves specifying the components, functions, and interfaces that are within the scope of the safety assessment.







3.1 Initial Inputs for HARA

Analysis Assumptions on CAV

- Autonomy vehicle level L3 system (Driver hands off).
- ODD as defined to include all experiments for the EVENTS Use Cases 1, 2 & 3 [14] [15].



- Vehicle equipped with automatic gear, wiper and headlights.
- Autonomous mode intended for forward motion only.

Analysis Assumptions on Driver

- Driver with valid driving license.
- Driver shall remain attentive and able to take back control in time when requested by the Autonomy Function.



Figure 5: EVENTS system architecture diagram

3.2 STPA Step 1: Define Purpose

Purpose: Identify Losses

An approach to identifying losses involves:

- 1. Identify the stakeholders, e.g. Users, producers, customers, operators, etc.
- 2. Stakeholders identify their "stake" in the system. What do they value? For example, human life, fleet of useable aircraft, electrical power generation, transportation, etc. What are their goals? For example, maintain a fleet of useable aircraft, provide transportation, provide medical treatment, provide electrical power generation, etc.
- 3. Translate each value or goal into a loss.

Identified list of losses:

L-1: Loss of life or injury to people



L-2: Loss or damage to vehicle

L-3: Loss or damage to objects outside the vehicle

*The focus of this safety analysis will be to cover loss of life or injury to driver, passenger or pedestrians and other losses have been excluded.

Losses	
L-1	Loss of life or injury to driver, passengers, or pedestrians

Table 1: Identified Losses

A hazard is a system state or set of conditions that, together with a set of worst-case environmental conditions, will lead to a loss.

Vehicle- Level		Link to
Hazards:	Hazard Description	Losses
	CAV fails to maintain minimum separation with or	
H-1	collides with vulnerable road users.	L-1
	CAV fails to maintain minimum separation with or	
H-2	collides laterally with static/dynamic objects.	L-1
	CAV fails to maintain minimum separation with or	
H-3	collides longitudinally with static/dynamic objects.	L-1
H-4	CAV fails to follow traffic signs / rules.	L-1
H-5	CAV enters an uncontrolled state.	L-1
<u>-</u>	Note: Vulnerable road users can include pedestrians,	
	cyclists, horse riders, motorcyclists and people using	
	mobility scooters.	

Table 2: Vehicle level hazard table.

3.1 STPA Step 2: Model Control Structure

The control structure represents how the system is controlled or managed. It includes the controllers, operators, and automated control elements that influence the system's behavior. In Figure 6, the RED downward arrows represent the control actions and the BLUE upward arrows indicate the feedback signals. The UCA (unsafe control action) Guideword is applied to each control action and relevant hazard is documented in STPA Step 3.





Figure 6: Model Control Structure (a larger image is shown in Annex 1)



4. Vehicle Level Hazard analysis

Vehicle Level Hazard Analysis involves systematically identifying potential safety risks in a vehicle's design and operation, assessing the severity and probability of these hazards, and implementing measures to mitigate them. This process helps ensure that vehicles are engineered with a strong focus on safety, reducing the risk of accidents and enhancing overall road safety. This activity is performed at a vehicle level and the top-level safety goals are derived. The subsystems will inherit the relevant safety goals and ASIL targets.



Figure 7: The STPA Step 3

4.1 Functional Decomposition of CAV.

Functional decomposition of a Level 3 (CAV) autonomous system involves breaking down the system's capabilities and functions into distinct components that work together to enable the vehicle to operate autonomously.



Figure 8: CAV Functional Decomposition



4.2 Functions list with applicable HAZOP Guidewords

		HAZOP Guide Word								
	ADS Function List	No /Loss /Missing	Incorrect	Unintended	Insufficient					
1	ADS Activation	х	x	х	Not Applicable					
2	ADS De-activation	x	x	х	Not Applicable					
3	ADS Lateral Control	x	x	х	x					
4	ADS Longitudinal Control (Acceleration & Braking)	x	x	x	x					
5	ADS Take Over Request (CAV initiated)	x	x	x	Not Applicable					
6	ADS Minimum Risk Maneuver	x	x	x	Not Applicable					
7	ADS Status (Active/Inactive)	x	x	Not Applicable	Not Applicable					

ADS – Autonomous Driving System

Table 3: Applicable HAZOP Guidewords for ADS functions.



4.3 Experiments for hazard analysis.

The list of experiments provides Locations, Road & Weather conditions and Traffic and people considerations [14] and its relevant combinations, which are included in the HARA analysis. Namely, the EVENTS experiments are:

EXP1: Interaction with VRUs under complex urban environment. (HARA Analysis on Urban roads with VRU's and adverse weather conditions)

EXP2: Re-establish platoon formation after splitting due to roundabout. (HARA Analysis on Urban roads)

EXP3: Self-assessment and reliability of perception data with complementary V2X data in complex urban environments. (HARA Analysis on Urban roads)

EXP4: Decision making for motion planning when faced with roadworks, unmarked lanes and narrow roads with assistance from perception self-assessment. (HARA Analysis on Urban roads & Highway with Missing lane information and Construction zone)

EXP5: Decision making for motion planning when entering a jammed highway. <u>(HARA</u> <u>Analysis on Highways with varying traffic conditions)</u>

EXP6: Small object detection at a far range in adverse weather conditions. (HARA Analysis on Highways with Static Objects in lane)

EXP7: Localization/perception self-assessment and other vehicles' behaviour prediction under adverse weather or adverse road conditions. (HARA Analysis on Urban and highway roads with adverse weather conditions)

	ocation	Surface Condition			
Road type	Road layout	Surface condition			
Highway (max- 130kmph)	Two way driving non-divided with VRU's	Normal road condition (Mu > 0.8)			
Urban roads (max- 50kmph)	Highway with several lanes	Low Mu (<0.4)			
	Missing lanes				

The consolidated list to perform HARA for all experiments is tabulated below.

Table 4: Location and surface condition table



Weather	Traffic and p	eople
Conditions	Traffic Condition	Static Objects
Normal condition	No Traffic - Free Drive	No Obstruction in Lane
Rain	Slow moving traffic < 10kmph	Obstruction in Lane
Snow	Traffic Standstill	
Dense Fog		

Table 5: Weather and traffic condition table

4.4 Vehicle Operating Modes

CAV Mode	Description	Driving Authority
Manual Mode	Driver performing dynamic driving task.	Driver
Autonomy Active ADS	CAV performing dynamic driving task.	CAV
Take Over Request	CAV performs dynamic driving for short duration until driver takes over.	CAV -> Driver
Minimum Risk Maneuver	CAV performs stop in lane maneuver with gradual deceleration in the absence of driver take over.	CAV

Table 6: Vehicle operating mode table

4.5 STPA Step 3: Identify Unsafe Control Actions (UCA's)

From the control structure each down arrow coloured in RED is a control action. The UCAs (Unsafe Control Actions) which are control actions that, in a particular context and worst-case environment, will lead to a hazard are documented in STPA Step-3.





Figure 9: UCA Guideword

The detailed STPA Step 3 can be found in Annex 2.



5. Risk Assessment – ASIL Rating

Risk Assessment is a quantitative assessment of the risk associated with each hazard. Risk is typically calculated as the product of the likelihood (probability) of an event and the severity (consequences) of that event. ISO 26262 [1] defines a specific Automotive Safety Integrity Level (ASIL) scale (ASIL A, B, C, or D) to categorize the risk level.



Figure 10: The Automotive Safety Integrity Level (ASIL)

The detailed HAZOP-based HARA can be found in Annex 3.

No	Safety Goal	ASIL	Responsible Function
1	Ensure ADS status is correctly reported to the driver	D	ADS Status (Active/Inactive)
2	Prevent control not given back to the driver when requested	D	ADS Take Over Request (Driver Take Over)
3	Prevent ADS use outside of ODD	D	ADS Activation / De-ADS Activation
4	Prevent insufficient/ unintended steering.	D	ADS Lateral Control
5	Prevent unintended braking.	С	ADS Longitudinal Control (Acceleration & Braking)
6	Prevent loss or insufficient braking.	D	ADS Longitudinal Control (Acceleration & Braking)
7	Prevent unintended acceleration.	D	ADS Longitudinal Control (Acceleration & Braking)
8	Always activate brake lights when brakes are activated.	С	Vehicle Body/Chassis domain
9	Ensure safe stop in case of no driver take over	D	ADS Minimum Risk Maneuver

5.1 Safety goals derived from HARA

Table 7: Safety goal summary



5.2 Assigning Control Actions to ADS Functions

Control Action	From	То	Responsible Function			
HMIEnableAD	_					
HMIDisableAD	Driver	AutonomousDrive Controller	ADS Status			
DriverBrakeRequest	_	VahieleMatien	ADS Take Over Request			
DriverSteerRequest	Driver	Controller	(Manual Drive / Driver			
DriverThrottleRequest			Override)			
ADSBrakeRequest			ADS Longitudnal Control (Acceleration & Braking)			
ADSSteerRequest	Controller	Controller	ADS Lateral Control			
ADSThrottleRequest	Controller	Controller	ADS Longitudnal Control (Acceleration & Braking)			
BrakeRequest	VahioloMaticz					
SteerRequest	Controller	VehicleActuators	- General Body domain			
ThrottleRequest	controller					

Table 8: Mapping Control Actions to ADS Functions table



6. Safety Analysis

After the unsafe control actions have been identified, the next step is to identify loss scenarios. Two types of loss scenarios must be considered:

- a. Why would Unsafe Control Actions occur?
- b. Why would control actions be improperly executed or not executed, leading to hazards?

Enfol	u Anaberia	
Functional FMEA	STPA Step 4	STPA Step 4: Identify Causal Factors



There are four general reasons why a controller might provide (or not provide) a control action that is unsafe:

- Failures involving the controller (for physical controllers).
- Inadequate control algorithm.
- Unsafe control input (from another controller).
- Inadequate process model.
- Hazards can be caused by UCAs, but they can also be caused without a UCA if control actions are improperly executed or not executed. To create these scenarios, we must consider factors that affect the control path as well as factors that affect the controlled process.

The identification of Causal Factor type, Requirements to Prevent & Detect the Causal Factors is documented below.

6.1 STPA Step 4: Identify Causal Factors

The STPA Step 4 can be found in Annex 4.



6.2 Requirements derived from STPA Analysis

STPA being a systematic approach considers safety as an emergent problem and analyses the complex interactions within the social-technical systems. This kind of approach is suitable for SOTIF issues **Error! Reference source not found.**.

In STPA Step 4, we have analyzed known limitations of system components to derive causal scenarios from those limitations that could potentially result in vehicle-level hazards. The Causal Factor analysis which also contains SOTIF triggering events has been grouped into ODD, Driver, Sensors, V2X, Self-Assessment, HMI, AutomousDriveController, MAPS, VehicleMotionController and can be found in Annex 5.

Also, in Annex 5, the Mitigation strategies for these triggering events such as design decision (mechanism for the detection of incorrect/erroneous inputs) and functional limitation (notification to the driver) have been identified.



7. Functional Safety Concept & Requirements

The Functional Safety Concept (FSC) is a crucial aspect of ISO 26262 [1]. The FSC provides a high-level overview of how functional safety will be achieved in a particular system or component. Six FSCs are considered in this report and are analyzed through a simplified system diagram and a list of safety requirements.



Figure 12: The Functional Safety Concept & Requirements

7.1 Activation / Deactivation Functional Safety Concepts

The Activation / Deactivation Functional Safety Concept addresses SG-03 (Prevent ADS use outside of ODD). When ADS is in Available Mode, it keeps evaluating constantly the ODD and ego vehicle condition and road type. With the help of Figure 13, a list of requirements has been defined as follows:





- The ODD Determination block shall prevent the operation of ADS outside its ODD by using information provided by various vehicle sub-systems.
- Map info shall provide Country and Road type information.



• Sensing and Perception shall provide Traffic Signs, Lane situations, Road Situations, Traffic Situations and Extreme Weather conditions.

7.2 HMI Status Functional Safety Concept

The Activation/HMI Status Functional Safety Concept addresses SG-01 (Ensure ADS status is correctly reported to the driver). With the help of Figure 14, a list of requirements has been defined as follows:



Figure 14: HMI Safety concept

- ADS shall compute the correct ADS activation status.
- Failure: avoid setting ADS active when ADS is not active.
- HMI & Infotainment shall indicate to the driver ADS active only when "ADS ACTIVE" is set by ADS System.
- Recommend to use a graphical visualization and / or a textual description

7.3 Longitudinal Control Functional Safety Concept

The Longitudinal Control Functional Safety Concept addresses SG-5, SG-6, SG-7 covering unintended braking on system limit, loss or insufficient braking, and unintended acceleration while ADS is operating.





Figure 15: Longitudinal & Lateral Control Functional Safety Concept

The safety integrity of the longitudinal control request is provided by ADS System with 2 independent channels (Primary and Secondary Trajectory generation). Two operational modes are considered:

- 1. Nominal Mode
- Primary longitudinal Request is ASIL B(D).
- Secondary longitudinal Request is ASIL B(D).
- Sufficient independence between Primary trajectory generation and Secondary. trajectory generation shall be demonstrated.
- Trajectory Validator and selection (between both) is ASIL D. When ADS is Active Control, it shall detect safety relevant obstacle and provide its correct attributes (Position, Long/Lat Speed, Long/Lat Accel,).
- In case of conflict between both trajectory, Initiate TOR apply predefined deceleration profile and maintain the lateral control. Where conflict is assumed to be:
 - One trajectory requesting deceleration and second requesting acceleration.
 - Both trajectories requesting different deceleration values. The conflict thresholds need to be tuned.



2. Fault Handling Mode

- On detection of fault impacting the Primary Longitudinal Control Request Integrity with respect to No/insufficient deceleration, Primary channel shall initiate a Take Over Request.
- On detection of fault impacting the Secondary Longitudinal Control Request Integrity with respect to No/insufficient deceleration, Secondary channel shall initiate a Take Over Request.

7.4 Lateral Control Functional Safety Concept

The Lateral Control Functional Safety Concept addresses SG-04 (Prevent insufficient/ unintended steering). The safety integrity of the lateral control request is provided by ADS System with 2 independent channel trajectories. To ensure the sufficient independence between both trajectories, 2 different sources are used for the perception of Ego Lanes:

- Source 1: Camera.
- Source 2: LIDAR / Surround Camera AND Predicted trajectory Lane based on Surrounding Object as lead Vehicle, Adjacent Vehicles, Road Boundaries (Barriers, Edges).

ASIL D: Deviation of more than 50 cm with high yaw rate change (In Annex 3 - ADS Lateral Control).

ASIL B: Deviation of more than 50 cm with low yaw rate change (In Annex 3 - ADS Lateral Control).

In case of conflict between Primary and Secondary trajectories, Initiate TOR apply predefined deceleration profile and maintain the lateral control (Last known best values). Primary & Secondary Channel shall detect Lane markings with Source 1 (Camera) and Source 2 and provide its correct attributes.

Fault magnitude: inaccuracy of +/-50 cm.

7.5 Take Over Request & Safe Stop Functional Safety Concept

Take over request is initiated by the CAV when it can no longer perform the required DDT (Dynamic driving task). Take Over Request FSC addresses SG-2 (Prevent control not given back to the driver when requested) and SG-9 (Ensure safe stop in case of no driver take over). Driver actions on steering and braking has the highest priority over ADS request. Transition to safe stop shall be performed depending on failure category as described in *Table 9*.



Initial Operating Mode	Failure Categories	ADS capabilities after Failure	Transition to safe state
Available / Standby	Any Failure	-	Feature Disabled
		Vehicle is able to	
		maintain follow Lead	Comfort Handover-
		vehicle/Lane	Handover period of 30s
		(including collision	and to stop the vehicle
Active Control	Low critical failures	mitigation)	within 15sec.
		Vehicle is able to	Emergency Deceleration
Active Control	High critical failures	stop-in-Lane Only	to stop in lane

 Table 9: Failure criticality to safe state transition table

7.6 Usage of STPA derived requirements & FSC in EVENTS

This section explains, using an example, the methodology for usage of derived safety concept and the STPA requirements for the individual experiments.

EVENTS module owners shall select the applicable safety concept from Section 6 that is relevant for their experiment. For example, in EXP6 *(Small object detection at a far range in adverse weather conditions)*, as illustrated in Figure 11, the focus is only on Sensing & Perception and Decision/Motion Planning.



Figure 16: EXP6 high-level Full Stack Architecture and Interfaces

EXP6 shall apply the Longitudinal & Lateral Control Functional Safety Concepts and the requirements from STPA analysis (Section 6.2) from Sensors & Perception, AutomousDriveController, and MAPS.



8. Acceptance Criteria for SOTIF based on Mileage Strategy

Acceptance criteria are the most important metrics used to measure/assure safety of the intended function (SOTIF) of an autonomous vehicle or advanced driver assistance system (ADAS) [16]. Mileage refers to the distance a vehicle can cover using one gallon or liter of fuel or per one charge cycle. Considering a car's operating speed and mileage, there is a limited amount of time or distance it can travel in a given year. Within this mileage strategy [10], we utilize this time or distance to establish Acceptance Criteria values.

Factors to Consider for calculating Acceptance Criteria with Mileage Strategy:

Average Vehicle Speed: In the context of the mileage strategy, it is crucial to monitor the average speed of a vehicle during its Operation Design Domain (ODD). This is because urban, rural, and highway mileages can vary significantly for vehicles. Furthermore, when a vehicle operates at a low average speed within its ODD, there's a limit to the number of miles it can cover even with extended hours of operation. This information helps us assess whether we require more test fleet vehicles or simply need to adjust the planned timeline for mileage accumulation.

Crash Data: Similar to the operational lifetime strategy, obtaining crash data for the mileage strategy may not always be straightforward. Instead, we may need to estimate the number of crashes by considering the ODD or the expected average accidents per km within the ODD. This estimation is essential for calculating Acceptance Criteria (AC) [2][3][4][5].

ODD Factors: Just like in other strategies, ODD factors are significant in the context of the mileage strategy. Regardless of the total potential achievable mileage by the vehicles, insufficient coverage of the intended ODD factors could compromise Safety of the Intended Function (SOTIF) assurance.

Table 10 can be used to calculate the Acceptance criteria based on the mileage strategy.



Annual distance travelled by car for the EU (kms)	Total passenger car on road (EU)	Average Injuries + fatalities per year (EU 2017- 2021)	Passenger cars Injuries + fatalities per year (EU)	VRU's Injuries + fatalities per year (EU) (Pedestrians + Motorcycle + Bicycle)	Passenger cars (Injuries + fatalities) Incidents/km	VRU (Injuries + fatalities) Incidents/km	
11.300	246.000.000						
	Number of Fatalities	21.500	9.589	9.245	3,45E-09	3,32578E-09	
	Number of Injuries	1.200.000	535.200	516.000	1,92532E-07	1,85625E-07	
	Total	1.221.500	544.789	525.245	1,96E-07	1,89E-07	
	Rural roads accounted for	r 52.5 % of the fata	lities	1,81E-09			
	Urban roads accounted for	or 38.7 % of the fata	alities	1,33E-09			
	Motorways accounted for	r 8.8 % of the fatali	ties	3,04E-10			
Average number							
of kilometers							
between							
incidents	5.102.525,9	Kms					

Table 10: Acceptance Criteria Calculation

With the current crash data, the incident/km for Passenger cars is 1.96E-07 and Pedestrians is 1.89E-07. The L3 System developed shall be at least 10 times safer than human performance and the SOTIF acceptance Criteria shall be <u>1.96E-08</u>.

Note: Applying acceptance criteria as defined above to the EVENTS experimental context (simulations and field tests) and subsystems will be investigated further during the evaluation phase (WP6).



9. Conclusions

In conclusion, the completion of the D2.3 deliverable represents a significant milestone in ensuring the safety and reliability of our autonomous driving system. By employing both classical Hazard and Operability (HAZOP) analysis and the System-Theoretic Process Analysis (STPA) approach, one of the notable achievements of this deliverable is the clear definition of safety goals and safety requirements. These are essential components for guiding the development and evaluation of our autonomous driving system.

The tabulation of safety requirements into distinct categories, including ODD (Operational Design Domain), Sensors, Driver Interaction, and AVstack (Autonomous Drive Controller), provides a structured framework for addressing specific safety concerns within each area. Furthermore, the Functional Safety Concept (FSC) outlined in this deliverable illustrates how we intend to achieve system-level safety, by outlining the strategies and measures to mitigate identified risks.

In the future, our steps will involve these safety concept and safety requirements to be accepted by experiment leaders and implemented during the implementation phase of the project (WP5).



References

- ISO. 26262-2:2018 Road vehicles Functional safety Part 2: Management of functional safety, 2018.
- [2] <u>https://road-safety.transport.ec.europa.eu/system/files/2023-03/ERSO annual report 20220509.pdf</u>.
- [3] <u>https://ec.europa.eu/eurostat/statistics-</u> <u>explained/index.php?title=Road accident fatalities -</u> <u>statistics by type of vehicle&oldid=583880</u>.
- [4] <u>https://ec.europa.eu/eurostat/statistics-</u> <u>explained/index.php?title=Passenger_mobility_statistics#Urban_trips.</u>
- [5] <u>https://www.odyssee-mure.eu/publications/efficiency-by-sector/transport/distance-travelled-by-car.html#:~:text=Sectoral%20Profile%20%2D%20Transport&text=Large%20discrepancy%20of%20the%20average,km%2Fyear%20for%20the%20EU.</u>
- [6] <u>https://jsystemsafety.com/index.php/jss/article/view/6</u>.
- [7] <u>https://warg.org/fredrik/publ/ssiv2020/QRN_Approach.pdf</u>.
- [8] https://pqri.org/wp-content/uploads/2015/08/pdf/HAZOP Training Guide.pdf.
- [9] <u>https://www.i-q.de/iso-26262/fusi-asil-klassifikationen</u>.
- [10] https://www.sae.org/publications/technical-papers/content/2023-01-0582/.
- [11] <u>https://dspace.mit.edu/handle/1721.1/124172</u>.
- [12]<u>https://www.researchgate.net/publication/314797280 Using STPA in Compliance</u> <u>with ISO 26262 for Developing a Safe Architecture for Fully Automated Vehic</u> <u>les</u>.
- [13] Becker, C., Brewer, J. C., & Yount, L. (2020). Safety of the intended functionality of lane-centering and lane-changing maneuvers of a generic level 3 highway chauffeur system (No. DOT HS 812 879). United States. National Highway Traffic Safety Administration. Electronic System Safety Research Division.
- [14] EVENTS Deliverable D2.1: User and system requirements for selected use cases (2023).
- [15] EVENTS Deliverable D2.2: Full Stack Architecture & Interfaces (2023).
- [16] Madala, K., Erdos, D., Krishnamoorthy, J., Wang, Z., Gonzalez, C. A., Shivkumar, A., & Chang, M. (2023). Strategies to Define Reasonable Acceptance Criteria and Validation Targets for SOTIF Assurance (No. 2023-01-0582). SAE Technical Paper.



Annex 1: Model Control Structure





Annex 2: STPA Step 3

Control Action	From	то		Not provided		Pr	rovided Incorre	ctly	Pro	vided but Not Ne	eded	Provided too Early		Provided too Late		Provided too Long		ng	Stopped Providing too Soon				
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
HMIEnableA D	Driver	Autonomous DriveControll er	UCA-1.1.1	HMIEnableAD not provided when the CAV is approaching a significant obstacle or a VRU in its path, the driver intends to activate ADS and has stopped performing the DDT. Note: The Driver may assume that they have already provided it, but the request may not have been actually sent/received by the AutonomousDr iveController	H-1,3,5	UCA-1.2.1	HMIEnableA D Provided Incorrectly when CAV16 DDD (Eg: heavy snow/rain, poor lighting/poor visibility, a significant object has been detected but not classified and collision is imminent 1 and Driver has stopped performing the DDT.	H-2,3,5							UCA-1.5.1	HMIEnableA D Provided too late when the CAV is approaching a significant obstacle or VRU in its path, the driver intends to activate ADS and has stopped performing the DDT.	H-1,3,5		N/A - Discrete signal/comm and.			N/A -Discrete signal/command.	
			UCA-1.1.2	HMIEnableAD not provided when the CAV is operating on a motorway, another vehicle is cutting into CAV path, the driver intends and has stopped performing the DDT.	H-3,5	UCA-1.2.2	HMIEnableA D Provided Incorrectly when there is a severe ADS/CAV failure and the driver has stopped performing the DDT.	H-S														- Signary continuation	
HMIDisableA D	Driver	Autonomous DriveControll er	UCA-2.1.1 UCA-2.1.2	HMIDisableAD not provided when the ADS is enabled, Driver is not able to perform the DDT, the CAV is getting close to a significant obstacle or VRU in its path HMIDisableAD not provided	H-1,3,5 H-1,5	-			UCA-2.3.1	Driver provides HMIDisableAD enabled, the CAV is within its ODD, there are static obstacles, dynamic obstacles and VRUs in the close vicinity of the CAV and the Driver is not performing the DDT.	H-1,2,3,5				UCA-2.5.1	HMIDisableA provided too late when the ADS is enabled, Driver is not able to perform the DDT, the CAV is getting close to a significant obstacle or VRU in its path	H-1,3,5		N/A - Discrete signal/comm and.			N/A -Discrete signal/command.	


Control Action	From	то		Not provided		Pro	ovided Incorre	ctly	Prov	vided but Not Ne	eded	Pr	ovided too Ea	rly	Р	rovided too La	te	Pi	rovided too Lo	ng	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
DriverBrakeB	Driver	VehicleMoti	UCA-3.1.1	Driver does not provide DriverBrakeReq uest when ADS is disabled and the CAV is about to collide with a significant obstacle or a VRU in its path.	H-1,3										UCA-3.5.1	Driver provides DriverBrakeR equest too late when ADS is disabled and the CAV is about to collide with a significant obstacle or a VRU in its path.	H-1,3						
			UCA-3.1.2	Driver does not provide DriverBrakeReq uest when ADS is disabled and the CAV is approaching a red traffic light signal.	H-4										UCA-3.5.2	Driver provides DriverBrakeR equest too late when ADS is enabled, there is a takeover request and a load is falling from a truck ahead.	н-3						
DriverSteerR equest	Driver	VehicleMoti onController	UCA-4.1.1	Driver does not provide DriverSteerReq uest when ADS is disabled at Night in cold and wet weather (rain)and CAV is in a situation where steering is required (e.g. maneuvering a roundabout, bend/curve).	H-2,3				UCA-4.3.1	Driver provides DriverSteerReq uest when ADS is disabled and there are vehicles beside the CAV in the CAV in digacent lanes or CAV is close to the central reservation	H-2				UCA-4.5.1	Driver provides DriverSteerR equest too late when ADS is disabled, a VRU suddenly appears, moving towards the QAV, there are no obstacles on the adjacent lane and maximum deceleration is insufficient to avoid a collision with the VRU.	н-3						



Control Action	From	то		Not provided		Pr	ovided Incorre	ctly	Pro	vided but Not Ne	eded	Р	rovided too Ea	rly	F	Provided too La	ite	Р	rovided too Lo	ong	Stop	pped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
DriverThrott eRequest	Driver	VehicleMoti onController				UCA-5.2.1	Driver provides incorrect DriverThrottl eRequest when ADS is disabled and the CAV is in a situation where optimal	н-2,3	UCA-5.3.1	Driver provides DriverThrottleR equest when ADS is enabled and the CAV is approaching an obstacle in its path. Note: The driver override in this case may lead to collision	H-3												
						-	optimal acceleration is needed(moving down a slope and there are leading vehicles in the path.)		UCA-5.3.2	Driver provides DriverThrottleR equest when ADS is disabled and the current speed is above the maximum limit for the current zone/road	H-4												
			UCA-6.1.1	AutonomousDr veController does not ADSBrakeRequ est during Night time when the CAV is operating on a motorway /jammed highway ramp/dense urban road,ADS is enabled,weath er conditions enabled,weath er conditions ce on road) and the CAV is approaching a significant obstacle/VRU in its path.	H-1,3	UCA-6.2.1	Autonomous DriveControll er provides insufficient ADSBrakeRe quest when ADS is enabled , the CAV is approaching a significant obstacle or a VRU in its path and there is an imminent collision risk.	H-1,3							UCA-6.5.1	Autonomous DriveControll er provides ADSSTAkeRe quest too late when ADS is enabled, the CAV is operating on a motorway /jammed highway ramp/dense urban road, at Night, weather conditions are adversel rain/snow/fo gr/ice on road) and there is a significant obstacle (eg: parked vehicle, decelerating lead vehicle, road works, blocked lane etc.) or a VLU	H-1,3				UCA-6.7.1	AutonomousDriv econtroller stops providing ADSBrakeReques t too soon during the Night time when the CAV is operating on a motorway /highway/dense urban road, ADS is enabled, weather conditions are adverse(rain/snow/fog/ic e on the road), the CAV is approaching a significant obstacle//NR in its path and an imminent collision risk prevails.	H-1,2,3



Control Action	From	то		Not provided		Pi	ovided Incorre	ctly	Pro	vided but Not Ne	eded	F	Provided too Ea	rly	F	rovided too L	ate	P	rovided too Lo	ong	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
			UCA-6.1.2	AutonomousDri veController does not provide ADSBrakeRequ est when ADS is enabled, the CAV is approaching a roundabout, there are no lead vehicles and there are vehicles approaching from the right.	H-2,4	UCA-6.2.2	Autonomous DriveControll er provides insufficient ADStrakete quest when ADS is enabled and the current speed of the CAV is too high to navigate around an approaching sharp bend (narrow curve radii).	H-2,3							UCA-6.5.2	Autonomous DriveControl er provides ADSBrakeRe quest too late when ADS is enabled, the CAV is approaching a roundabout, there are no lead vehicles and there are vehicles approaching from the right	H-2,3,4				UCA-6.7.2	AutonomousDriv eController stops providing AD5BrakeReques t too soon when AD5 is enabled and the current vehicle speed is still high for the situation (Eg: manoeuvering a sharp bend/ turn, approaching a decelerating lead vehicle, etc.)	H-2,3,4
ADSBrakeRc quest	Autonomeus DriveControll er	VehicleMoti onController	UCA-6.1.3	AutonomousDri veController does not provide ADSBrakeRequ enabled, the CAV is operating on a motorway /highway/dens e urban road, there is a malfunction/re duction of accuracy of the Localization, and the CAV is approaching a significant obstacle/VRU in its path.	H-1,3				UCA-6.3.1	AutonomousDri veController provides ADSBrakeReque st when ADS is enabled, there are vehicles following the CAV closely behind and there are no obstacles ahead. <i>Note: This may</i> <i>lead to a rear</i> <i>obstacle</i> <i>collision.</i>	H-3				UCA-6.5.3	Autonomous DriveControl er provides ADSBrakeRe quest too late when ADS is enabled and CAV is approaching a red traffic light.	H-3,4						



Control Action	From	то		Not provided		Pi	rovided Incorre	ectly	Prov	vided but Not Ne	eded	Pi	ovided too Ea	irly	Р	rovided too La	ite	Р	rovided too La	ing	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
			UCA-6.1.4	AutonomousDri veController does not provide ADSBrakeRequ est when ADS is enabled, there is a reduction in accuracy of perception and the CAV is approaching a slow speed zone(eg. due to road works or road traffic accidents with the presence of emergency vehicles).	H-3,4	UCA-6.2.3	Autonomous DriveControl er provides excessive ADSstrakeR e anabled, there are moving vehicles ahead of the CAV and other vehicles following closely behind. Note: This may lead to a rear obstacle collision	H-3							UCA-6.5.4	Autonomous DriveControll er provides ADSBrakeRe quest too late when ADS is enabled and the CAV is approaching a sharp turn/bend/c urve.	H-2,3				UCA-6.7.3	AutonomousDriv eController stops providing ADSBrakeReques t too soon when ADS is in a degraded mode performing a MRM, there are significant obstacles/VRUs in the path of the CAV, and a safe stopping location has not been reached.	H-1,2,3
			UCA-6.1.5	AutonomousDri veController does not provide ADSBrakeRequ est when ADS is enabled, there are obstacles around the CAV, the Driver is not available/attent ive and there is no response to the takeover request issued upon exit of ODD.	H-5,2,3										UCA-6.5.5	Autonomous DriveControll er provides ADSBrakeRe quest too late when ADS is enabled, there are obstacles around the CAV, and there is no response to the takeover request issued upon exit of ODD.	H-5,2,3						



Control	From	то		Not provided		Pi	ovided Incorre	ctly	Pro	vided but Not Ne	eded	Р	rovided too Ea	rly	P	rovided too L	ate	Р	ovided too Lo	ng	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
			UCA-7.1.1	AutonomousDri does not provide ADSSteerReque st when ADS is enabled, there is a significant obstacle(eg: parked vehicle, blocked lane, road works or special vehicles) or a suddenly appearing VRU in the lane of the CAV and adjacent lanes are available /free of obstacles	H-1,3,4	UCA-7.2.1	Autonomous DriveControll er provides incorrect ADSsterReq enabled, weather conditions are adverse (heavy conditions are adverse (heavy road), the CAV is maneuvering a sharp turn/bend/c urv and to close to the border.	H-2,3							UCA-7.5.1	Autonomous DriveControl er provides ADSSteerRec uest too late when ADS is enabled, there is a significant obstacle(eg: parked vehicle, blocked lane road works), or a VRU in the lane of the CAV and adjacent lanes are available /free of obstacles	H-1,3		Autopagoous		UCA-7.7.1	AutonomousDriv eController stops providing ADSSteerRequest too soon when ADS is enabled, there is a significant obstacle(eg: parked vehicle, blocked lane, road works) or a VRU in the lane of the CAV, adjacent lanes are available /free of obstacles and an imminent collision risk prevails.	H-1,2,3
ADSSteerReq uest	Autonomous DriveControll er	VehicleMoti onController	UCA-7.1.2	AutonomousDri veController does not provide abBed, the CAV is maneuvering a sharp turn/bend/curv e and is too close to the border.	H-2,3	UCA-7.2.2	Autonomous DriveControll er provides incorrect ADSSteerReq uest when ADS is enabled, there is a VRU(cyclist/horser rider/mobilit y scooter user) in the lane of travel of the CAV and the CAV is performing an overtake maneuver.	H-2	UCA-7.3.1	AutonomousDri veController provides ADSSteerReque st (lane change) when ADS is enabled, there is an insignificant(ov erdriveable) obstacle(eg:leaf , mud) in the CAV path and there are vehicles in adjacent lanes.	H-2				UCA-7.5.2	Autonomous DriveControl er provides ADSSteeRec uest too late suddenly appears, moving towards the path of the CAV, there	н-3	UCA-7.6.1	Additional and a prive Controll er provides ADSSteerReq uest too long when ADS is enabled, weather conditions are adverse (heavy rain/snow/fo g/ice on the road), the CAV is maneuvering a sharp turn/bend/c urve and is too close to the border.	H-2	UCA-7.7.2	AutonomousDriv eController stops providing ADSSteerRequest too soon when ADS is enabled, the CAV is continuing to	H-2,3
			UCA-7.1.3	AutonomousDri veController does not provide ADSSteerReque st when ADS is enabled and the CAV is merging onto the main road from a ramp.	H-2,3	UCA-7.2.3	Autonomous DriveControll er provides incorrect(exc essive) ADSSteerReq uest when ADS is enabled, lane markings are faded/absen t and there are obstacles adjacent to the CAV.	H-2								obstacles obstac						maneuver a sharp turn/bend/curve.	



Control	From	то		Not provided		Pr	ovided Incorre	ctly	Pro	vided but Not Ne	eded	Р	ovided too Ea	arly	1	Provided too L	ate	P	rovided too Lo	ing	Stop	pped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
				AutonomousPiri		UCA-8.2.1	Autonomous DriveControll er provides incorrect(Exe ADSThrottle Request when ADS is enabled, wea ther conditions are adverse(rain/snow/fo gr/ice on road) and there are lead vehicles on the CAV path.	н-3	UCA-8.3.1	AutonomousDri veController provides ADSThrottleReq uest when the CAV is operating on a motorway / jammed highway ramp/dense urban road, ADS is enabled, and the CAV is approaching a significant obstacle(eg: stationary vehicle, blocked lane of travel, decelerating lead vehicle, vehicle cutting in etc.)/or a VRU in its path.	H-1,3					Autonomous DriveControl er provides ADSThrottle Request too late when ADS is enabled the							
ADSThrottle Request	Autonomous DriveControll er	VehicleMoti	UCA-8.1.1	Autonindustry veController does not provide ADSThrottleRe quest when the CAV is operating on a highway/motor way, ADS is in a degraded mode performing a degraded mode performing a MRM to move to a safe stopping location and there are vehicles approaching from behind.	H-3	UCA-8.2.2	Autonomous DriveControll er provides incorrect(texe essive) ADSThrottle Request when ADS is enabled and the CAV current speed is the maximum allowed for the zone of operation.	H-4	UCA-8.3.2	AutonomousDri veController provides ADSThrottleReq uest when ADS is enabled, the CAV is approaching a red traffic light or a pedestrian crossing and there are VRUs crossing the road	H-1,3,4				UCA-8.5.1	CAV has entered a higher speed zone, the current vehicle speed is far below the maximum speed for the current zone of operation, there are no obstacles ahead of the CAV and there are accelerating vehicles	H-3,4	UCA-8.6.1	Autonomous DriveControll er provides ADSThrottle Request too long when ADS is enabled and the CAV is manœuverin g a bend/sharp curve or around a static obstacle in its path.	H-2,3			



Action	From	То		Not provided		Pr	ovided Incorre	ctly	Pro	vided but Not Ne	eded	Pi	rovided too Ea	rly	F	Provided too La	ite	Р	rovided too Lo	ong	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
						UCA-8.2.3	Autonomous DriveControll er provides incorrect(ins) ADSThrottle Request when ADS is enabled, the CAV current speed is far below the current speed is far below the current to peration and there are vehicles approaching from behind. Note: This may lead to rear-end collision	H-3,4	UCA-8.3.3	AutonomousDri veController provides ADSThrottleReq uest when the CAV is approaching a slower speed zone and there are obstacles(eg: decelerating vehicles) ahead	H-4,3					approaching from behind. Note: This may lead to rear-end collision							
BrakeReque t	s VehicleMoti onController	VehicleActua tors	UCA-9.1.1	VehicleMotionC ontroller does not provide BrakeRequest when ADS is enabled, Autonomous Drive Controller has issued a brake request and the CAV is and the CAV is in a situation where deceleration is required(appro aching a slow speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.).	H-1,2,3,4	UCA-9.2.1	VehicleMoti onController provides incorrect BrakeReques t when Driver has provided an override and the CAV is in a situation where deceleration is required(app roaching a slow speed zone, navigating a slow speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.).	H-1,2,3,4,5	UCA-9.3.1	VehicleMotionC ontroller provides incorrect BrakeRequest when ADS is enabled, no brake request has been issued by the Autonomous Drive Controller or the Driver, there are no obstacles or VRUs ahead of the CAV and there are vehicles following closely behind.	H-3				UCA-9.5.1	VehicleMoti onController provides BrakeReques too late when ADS is enabled, Autonomous Drive Controller has issued a brake a brake a brake a brake the CAV is in the CAV is in a situation where deceleration is required(app roaching a slow speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacie or a VRU, performing a	H-1,2,3,4				UCA-9.7.1	VehicleMotionCo ntroller stops providing BrakeRequest too soon when ADS is enabled, Autonomous Drive Controller has issued a brake request and the CAV continues to be in a situation where deceleration is required(approac Jone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.)	H-1,2,3,4



Control Action	From	то		Not provided		Pr	ovided Incorre	ctly	Prov	vided but Not Ne	eded	Pi	ovided too Ea	rly	Р	rovided too La	ate	Р	rovided too Lo	ong	Stop	ped Providing too	Soon
ALLON .			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
SteerReques t	VehicleMoti onController	VehicleActua tors	UCA-10.1.1	VehicleMotionC ontroller does not provide SteerRequest when ADS is enabled, Autonomous Drive Controller has issued a steer request and the CAV is steer request and the CAV is parked vehicle, blocked lane, road works, or VRU in the lane of the CAV, maneuvering a sharp turn/bend/curv e, performing a MRM etc.)	H-1,2,3	UCA-10.2.1	VehicleMoti onController provides incorrect t when Driver has provided an override and the CAV is in a situation where steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or V RU in the lane of the CAV, maneuvering a sharp turn/bend/c urve etc.)	H-1,2,3,5	UCA-10.3.1	VehicleMotionC ontroller provides SteerRequest when ADS is enabled, no steer request has been issued by the Autonomous Drive Controller, or the Driver, and there are vehicles or VRUs in adjacent lanes.	H-1,2				UCA-10.5.1	VehicleMoti onController provides SteerReques too late when ADS is enabled, Autonomous Drive Controller Autonomous Drive Controller request and the CAV is in a situation where steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or VRU in the lane of the CAV and adjacent lanes are free; maneuvering a sharp turm/bendpt, urn, bendpt, a sharp turm/bendpt, urn, bendpt, a performine a	H-1,2,3	UCA-10.6.1	VehicleMoti onController provides SteerReques too long when ADS is enabled, Autonomous Drive Controller has issued a steer request, weather conditions are adverse(hea vy rain,snow,fo g or ice on road) and the CAV is maneuvering a sharp turry,bend/c urve, performing a MRM etc	H-2	UCA-10.7.1	VehicleMotionCo ntroller stops providing SteerRequest too soon when ADS is sued a steer request and the cAV is still in a situation where steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or VRU in the lane of the CAV, maneuvering a sharp turn/bend/curve, pMRM etc.)	H-1,2,3
ThrottleRequ est	J VehicleMoti onController	VehicleActua tors	UCA-11.1.1	VehicleMotionC ontroller does not provide Throttle Request when ADS is enabled, Autonomous Drive Controller has issued a throttle request and there are vehicles approaching from behind.	H-3	UCA-11.2.1	VehicleMoti onController provides an incorrect Throttle Request(exc essive) when essive) when essive) when essive) when an override, weather conditions are adverse(rain/snow/fo g/ice on the road), the CAV is very close to the road border and there are lead vehicles on the CAV path.	H-2,3	UCA-11.3.1	VehicleMotionC ontroller provides t when ADS is enabled, no throttle request has been issued by the Autonomous Drive Controller or the Driver, and the CAV is approaching an obstacle(eg: stationary vehicle, blocked lane of travel, decelerating lead vehicle, vehicle cutting in, etc.]/or a VRU or red traffic light sign in its path.	H-1,3,4				UCA-11.5.1	VehicleMoti onController provides ThrottleRequest to late when ADS is anabled, Autonomous Drive Controller has issued a throttle request, there are no obstacles ahead of the CAV and there are vehicles following closely behind.	н-3				UCA-11.7.1	VehicleMotionCo ntroller stops providing ThrottleRequest too soon when ADS is enabled and providing ADSThrottleRequ est, there are wold of the CAV and there are vehicle following closely behind.	H-3



Control Action	From	то		Not provided		Pri	ovided Incorre	ctly	Pro	vided but Not Ne	eded	Р	Provided too Ea	rly	Р	rovided too La	ate	Р	rovided too Lo	ing	Stop	ped Providing too	Soon
			ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards	ID	Description	Hazards
DynamicPath VerificationR esponse Note: Requiremen ts on Dynamic Path Verification around an obstacle are limited. Hence the scope of UCAs is also limited.	Remote Operator	Autonomous DriveControll er	UCA-12.1.1	RemoteOperat or does not provide DynamicPathVe rificationRespo nse when a DynamicPathVe rificationReque st has been received and verified and the CAV is approaching a significant obstacle in its path.	н-3	UCA-12.2.1	RemoteOper ator provides DynamicPath VerificationR esponse incorrectly when a DynamicPath VerificationR equest has been received but not verified incorrectly and the CAV is approaching a significant obstacle in its path.	H-3				UCA-12.4.1	RemoteOper ator provides DynamicPath VerificationR esponse too early when a DynamicPath VerificationR equest has been received but not verified and the CAV is approaching a significant obstacle in its path.	H-3	UCA-12.5.1	RemoteOper ator provides DynamicPatt VerificationR esponse too late when a DynamicPatt VerificationR equest has been received and the CAV is approaching a significant obstacle in its path.	н-3		N/A - Discrete signal/comm and.			N/A -Discrete signal/command.	



Annex 3: HAZOP-based HARA

	Location	Surface Condition	Weather Conditions	Itom Ucago	Traffic and p	people	Malfunctioning Behaviour
Road type	Road layout	Surface Condition	weather conditions	Item Osage	Traffic Condition	Static Objects	
Highway (max- 130kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	Manual Mode	No Traffic - Free Drive	No Obstruction in Lane	No ADS Activation
Urban roads (max- 50kmph)	Highway with several lanes	Low Mu (<0.4)	Rain	Autonomy Active ADS	Slow moving traffic < 10kmph	Obstruction in Lane	Unintended ADS Activation
	Missing lanes		Snow	Take Over Request - MRM	Traffic Standstill		No ADS Deactivation (outside ODD)
	Construction zone		Dense Fog				Unintended ADS Deactivation
				•			Incorrect ADS Lateral Control
							Loss of ADS Lateral Control
							Unintended Accelaration
							(ADS Longitudnal Control)
							No Accelaration
							(ADS Longitudnal Control)
							Unintended Deceleration
							(ADS Longitudnal Control)
							Insufficient deceleration
							(ADS Longitudnal Control)
							No deceleration
							(ADS Longitudnal Control)
							No ADS Take Over Request
							Unintended ADS Take Over Request
							No ADS Minium Risk Manuve Trigger
							Unintended
							ADS Minium Risk Manuver Trigger
							No ADS Display Status
							Incorrect ADS Display Status

CAV Mode	Description	Driving Authority
Manual Mode	Driver performing dynamic driving task.	Driver
Autonomy Active ADS	CAV performing dynamic driving task.	CAV
Take Over Request	CAV performs dynamic driving until driver takes over.	CAV
Minium Risk Manuver	CAV performs dynamic driving until driver takes over.	CAV



	No ADS Activation												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severity Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	Manual Mode	Any	E4	Manual Driving - E4	SO	No Severity in case of No ADS Activation	C1	Driver Still in control	Not Safety Relevant	Driver requests ADS Activation from manual drive mode, No Activation of ADS and driver still in control.

	Incorrect ADS Activati	on											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	Manual Mode	Any	E4	Manual Driving - E4 outside ODD	53	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	СЗ	Ego Driver not in control loop when ADS is activated.	D	Driver requests ADS Activation from manual drive mode outside ODD (Operating Design Domain), ADS is Activated . Risk of collison when ADS Activated outside of ODD.

	No ADS De-Activation	n											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	\$3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	СЗ	Ego Driver not in control loop when ADS is activated. Driver not able to De-activate the ADS Feature	D	Driver requests ADS De-Activation from ADSActive mode , Driver not able to take back vehicle control

	Incorrect ADS De-Activa	tion											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	50	No Severity in case of Incorrect ADS Activation with Take over Request	C1	Driver can take back control in the TOR time , or MRM will be performed.	QM	Driver takes back control in TOR time.
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	No Take Over Request , Driver not in control of vehicle when ADS is De- activated	D	Drivier not aware of ADS De-Activation.

	No /Loss/too low - ADS Later	al Control											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	D	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	SO	Due to collision delta speed (<10 kmph) ,No injuries in Highway scenario	C3	Ego Driver not in control loop when ADS is activated.	Not Safety Relevant	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	в	Driver not in control loop when ADS is
Highway (max- 130kmph)	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	в	Loss of lateral control results in path deviation resulting in collion with adjacent
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	\$1	Due to collision delta speed (<10 kmph) , light injuries for VRU	C3	Ego Driver not in control loop when ADS is activated.	В	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	SO	vehicle speed 0kmph.	C3	Ego Driver not in control loop when ADS is activated.	Not Safety Relevant	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	S3	Due to collision with VRU with urban driving speed.	C3	Ego Driver not in control loop when ADS is activated.	D	

Incorrect ADS Lateral Control (too high)



Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	D	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	S0	Due to collision delta speed (<10 kmph) ,No injuries in Highway scenario	C3	Ego Driver not in control loop when ADS is activated.	Not Safety Relevant	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	в	Driver not in control loop when ADS is
Highway (max- 130kmph)	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	в	Active , too high lateral control results in EGO vehicle moving out of EGO lane.
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	S1	Due to collision delta speed (<10 kmph) , light injuries for VRU	C3	Ego Driver not in control loop when ADS is activated.	в	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	50	vehicle speed 0kmph.	C3	Ego Driver not in control loop when ADS is activated.	Not Safety Relevant	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	S3	Due to collision with VRU with urban driving speed.	C3	Ego Driver not in control loop when ADS is activated.	D	

	Unintended ADS Lateral C	ontrol											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	Manual Mode	Any	E4	Manual driving - E4	53	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	Lateral control from ADS when not in ADS Active mode. Driver Lateral Overide	D	Unintended Lateral control by ADS in Manual driving mode , Driver loses lateral control resulting in collision.

1	No/Loss of ADS Longitudnal Contro	l (Acceleration)											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	\$3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	SO	Due to collision delta speed (<10 kmph) ,No injuries in Highway scenario	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	\$3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	
Highway (max- 130kmph)	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	\$3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	EGO vehicle slows down and stops in case of Loss of longitudnal control.
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	S1	Due to collision delta speed (<10 kmph) , light injuries for VRU	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	so	vehicle speed 0kmph.	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	SO	Vehicle stops in the event of loss of acceleration.	C1	When EGO vehicle slows down, Rear car driver has control to overcome this scenario.	QM	

L	Jnintended ADS Longitudnal Contro	ol (Acceleration)											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	D	



Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	S1	Due to collision delta speed (> 20 kmph) incase of unintended acceleration,Light injuries in Highway scenario	C3	Ego Driver not in control loop when ADS is activated.	В	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	S3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	В	Unintended Acceleration when ADS is
High+D71+A68:N74+A68:P74+ A6+A71:M72	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	\$3	Due to collision delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	В	on Highway and Collision with VRU in Urban.
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	S1	Due to collision delta speed (<10 kmph) , light injuries for VRU	C3	Ego Driver not in control loop when ADS is activated.	В	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	52	Due to collision delta speed (>15 kmph), incase of unintended acceleration with VRU	C3	Ego Driver not in control loop when ADS is activated.	с	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	S3	Due to collision with VRU with urban driving speed.	C3	Ego Driver not in control loop when ADS is activated.	D	

	No/Loss of ADS Longitudnal Cont	trol (Braking)											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	S3	No or insufficient braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	D	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	SO	No or insufficient braking resulting in collision with delta speed (<10 kmph) ,No injuries in Highway scenario	C3	Ego Driver not in control loop when ADS is activated.	Not Safety Relevant	
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	s3	No or insufficient braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	В	
Highway (max- 130kmph)	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	S3	No or insufficient braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated.	В	No or insufficient braking from EGO vehicle resulting in collision with lead vehicle or with VRU in urban scenarios.
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	\$1	No or insufficient braking resulting in collision with delta speed (<10 kmph) , light injuries for VRU	C3	Ego Driver not in control loop when ADS is activated.	В	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	51	No or insufficient braking resulting in collision with delta speed while vehicle roll over (<10 kmph) , light injuries for VRU	C3	Ego Driver not in control loop when ADS is activated.	В	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	53	No or insufficient braking resulting in collision with VRU with urban driving speed.	C3	Ego Driver not in control loop when ADS is activated.	D	

	Unintended ADS Longitudnal Con	trol (Braking)											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	No Traffic - Free Drive	E4	ADS Driving exposure- E4	53	Unintended braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C2	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	C	



Highway (max- 130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure in traffic scenario- E4	SO	Unintended braking resulting in collision with delta speed (<10 kmph) ,No injuries in Highway scenario	C2	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	Not Safety Relevant	
Highway (max-130kmph)	Highway with several lanes	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Obstruction in Lane	E2	Obstruction in highway lane - E2	S3	Unintended braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C2	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	В	
Highway (max- 130kmph)	Highway with several lanes	Low Mu (<0.4)	Snow	ADS Active	No Traffic - Free Drive	E2	Lo Mu Exposure - E2	S3	Unintended braking resulting in collision with delta speed (> 60 Kph) , a S3 level can be expected.	C3	Ego Driver not in control loop when ADS is activated. Unintended braking cause driver to lose control of the vehicle.	В	Unintended braking from EGO vehicle resulting in collision with rear vehicle on highway.
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Slow movinf traffic < 10kmph	E4	ADS Driving exposure- E4	S1	Unintended brakingg resulting in collision with delta speed (<10 kmph) , light injuries for VRU	C1	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	QM	
Urban roads (max- S0kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Traffic Standstill	E4	ADS Driving exposure in traffic scenario- E4	S1	Unintended braking resulting in collision with delta speed while vehicle roll over (<10 kmph) , light injuries for VRU	C1	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	QM	
Urban roads (max- 50kmph)	Two way driving non divided with VRU's	Normal road condition (Mu > 0.8)	Normal condition	ADS Active	Urban Driving condition with light traffic.	E4	ADS Driving exposure in traffic scenario- E4	S1	Unintended braking resulting in collision with VRU with urban driving speed.	C1	Ego Driver not in control loop when ADS is activated. Brake Light Activated. Rear Driver responds to EGO vehicle deceleration	QM	

	No ADS Take Over Request												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	ADS is activated. Driver not aware of ADS De- activated when no Take over request is issued.	D	No ADS Take over request is issued and ADS is de-activted , The Ego is not in control.

	Unintended ADS Take Over Request												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	co	ADS is activated. Issues unintended Take over requst. Driver annoyance.	QM	If no driver take over , vehicle performs MRM.

©EVENTS Consortium 2022-2025

Incorrect ADS Take Over Request



Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	СЗ	Control not given back to the driver when requested	D	Driver not able to take back control of the ego vehicle.

	NO ADS Minium Risk Man	nuver											
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	No Driver take over. Driver not in control.	D	ADS shall ensure safe stop in case of no driver take over.

	Unintended ADS Minium Risk Manuver												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S2	Collision with delta speed < 60kmph on highway and < 30kmph with VRU in urban scenario	co	ADS System making safe stop when not intended , Driver can override to take back control. Or Ego performs a safe stop	QM	Driver not able to take back control of the ego vehicle.

	No ADS Status reported to driver												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	Driver not aware of current ADS State when loss of ADS status occurs.	D	Loss of ADS Status on a active hands free drive is safety critical , driver shall always be aware and notified of the correct and ADS State

	Incorrect ADS Status reported to driver												
Road type	Road layout	Surface Condition	Weather Conditions	Item Usage	Traffic Condition	Exposure	Exposure Comment	Severity	Severit Comment	Controlability	Controlability Comment	ASIL Rating	Comment
Any	Any	Any	Any	ADS Active	Any	E4	ADS Driving - E4	S3	Collision with delta speed > 60kmph on highway and > 30kmph with VRU in urban scenario	C3	Driver not aware of current ADS State	D	Driver performs hands off after ADS Status is confirmed. Correct ADS state information is critical for transition from Manual drive to hands free driving.



Safety Goal	ASIL	Responsible Functions
Ensure ADS status is correctly reported	D	ADS Status
to the driver	D	(Active/Inactive)
Prevent control not given back to the	D	ADS Take Over Request
driver when requested	D	ADS Take Over Request
Prevent ADS use outside of ODD	D	ADS Activation / De-ADS Activation
Prevent insufficient/ unintended steerin	D	ADS Lateral Control
Prevent unintended braking on system	C	ADS Longitudinal Control (Accoloration & Braking)
limit.	C	
Prevent loss or insufficient braking.	D	ADS Longitudnal Control (Acceleration & Braking)
Prevent unintended acceleration.	D	ADS Longitudnal Control (Acceleration & Braking)
Always activate brake lights when	C	Conoral Dady domain
brakes are activated.	L	- General Body domain
Ensure safe stop in case of no driver	D	ADS Minimum Bick Manauvar
take over	U	

	Hazards
H1	Collision with stationary obstacle out of lane
H2	Collision with vulnerable road user
H3	Longitudinal collision with adjacent lanes objects
H4	Longitudinal collision with following vehicle
Н5	Longitudinal collision with leading vehicle
H6	Reduced controllability of the vehicle by the driver
H7	Side collision with adjacent lanes objects
H8	Side collision with motorcycle
Н9	ADS not able to cope with environment around



	ASIL Determination Table											
Sougrity Class	Brobability Class		Controllability Class	•								
Sevency class	Probability class	C1	C2	C3								
	E1	QM	QM	QM								
S1	E2	QM	QM	QM								
31	E3	QM	QM	A								
	E4	QM	A	В								
	E1	QM	QM	QM								
52	E2	QM	QM	A								
32	E3	QM	A	В								
	E4	A	В	С								
53	E1	QM	QM	A								
	E2	QM	A	В								
	E3	A	В	С								
	E4	В	С	D								

Severity Evaluation Table										
	50	S1	S2	\$3						
Front/ Rear	0-4	4-20	20-40	40-60						
Side	0-2	2-8	8-16	16-40						
	No Injuries	Light & Moderate Injuries	Severe and Life-	Life Threatening Injuries (Survival						
			threatening Injuries,	Uncertain), Fatal Injuries						
			Survival Probable							

CONTROLLABILITY RANKING										
Class	CO	C1	C2	C3						
ISO 26262 Reference	Controllable in general	Simply controllable	Normally controllable	Difficult to control or uncontrollable						
Reference Description	Full ability to maintain intended driving path	99% or more of all drivers or other traffic participants are usually able to avoid a specified harm - Ability to brake & steer to slow or stop vehicle	90% or more of all drivers or other traffic participants are usually able to avoid a specified harm	Less than 90% of all drivers or other traffic participants are usually able, or barely able, to avoid a specified harm						

EXPOSURE RANKING									
Class	E0	E1	E2	E3	E4				
ISO 26262 Reference	Incredible	Very low probability	Low probability	Medium probability	High probability				
Reference Description	Not Specified	Situations that occur less often than once a year for the majority of drivers	< 1% of average operating time or situations that occur a few times a year for the great majority of drivers	1% - 10% of average operating time or situations that occur once a month or more often for an average driver	> 10% of average operating time or situations that occur during almost every drive cycle on average				



Annex 4: STPA Step 4

UCA No.	UCA	Link to Hazards	What the Process Model Believes	Process Model Believes because	Causal Factor	СҒ Туре	Requirement to Prevent the CF	Requirement to Detect the CF
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
				AutonomousDriveController believes so because it followed the control algorithm to provide brake request mousDriveController believes as provided ADSBrakeRequest	AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was not sent out. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSBrakeRequest was sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, BrakeRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that it has provided ADSBrakeRequest		ADSBrakeRequest was sent by AutonomousDriveController, but due to the maffunctioning actuator (VehicleMotionController), BrakeRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
					The brake request calculated by the AutonomousDriveController is overwritten by the empty/faulty brake request from the Driver(unintended output) and hence incorrect/empty BrakeRequest(0Nm) is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.
				AutonomousDriveController	ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
					Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
					believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
			AutonomousDriveController believes that there is no need to provide ADSBrakeRequest	AutonomousDriveController believes so because it followed the control algorithm to not provide brake request	The control algorithm that determines when to send ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
	AutonomousDriveController does not provide ADSBrakeRequest during Night time when the CAV is operating on a motorway				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
operating on /jammed hig UCA-6.1.1 urban road, enabled,wea are adverse (rain/snow/fr and the CAV significant ok path.	/jammed highway ramp/dense urban road, ADS is enabled,weather conditions are adverse (rain/snow/fog/ice on road)	H-1,3			Due to performance limitations of Sensors(owing to adverse weather and time of day), incorrect feedback signals(GPSData,PointCloud, RadarData,RawImage, etc) were sent.	PerformanceLimitations	The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility or occlusions.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notify the Driver about this.
	and the CAV is approaching a significant obstacle/VRU in its path.	ce on road) pproaching a cle/VRU in its	/ t t	AutonomousDriveController believes so because it was referring to the feedback signals from Sensors	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				to determine the presence/position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors



		-		The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) accurately, it shall notify the Driver.	
		AutonomousDriveController believes		The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).	
		that there are no obstacles/VRUs in the CAV path	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued	
				Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps	
				The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.	
				The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).	
			AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued	
			believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Objectuata was never serit/incorrectly serit. sent notification to communication errors between V2X & nonmousDriveController, feedback signal from the (V2XObjectData) was never received/incorrectly Quality and integrity of the communication There shares the communication in the communicati			
				The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.	
				The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.	
				AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was not sent out. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver	
			AutonomousDriveController believes so because it followed the control algorithm to provide brake	ADSBrakeRequest was sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, BrakeRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators	
	req AutonomousDriveController believes that it has provided ADSBrakeRequest	iequest	ADSBrakeRequest was sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), BrakeRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued		
			The brake request calculated by theAutonomousDriveController is overwritten by the empty/faulty brake request from the Driver(unintended output) and hence incorrect/empty BrakeRequest(IONm) is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.		
			ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.		
			AutonomousDriveController	Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued	



				believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
		riveController de uest when ADS is	AutonomousDriveController believes that there is no need to provide ADSBrakeRequest	AutonomousDriveController believes so because it followed the control algorithm to not provide brake request	The control algorithm that determines when to send ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	If AutonomousDriveController is unable to determine when ADSBrakeRequest must be issued, it shall notify the Driver.
	AutonomousDriveController does not provide ADSBrakeRequest when ADS is				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
UCA-6.1.2	enabled , the CAV is approaching a roundabout, there are no lead vehicles and there are vehicles approaching	H-2,4			Due to occlusions(tall grass or other obstructions)inaccurate feedback signals were sent from the Sensors	PerformanceLimitations	The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility, occlusions, etc.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notify the Driver about this.
	from the right.			AutonomousDriveController believes so because it was referring to the feedback signals from Sensors	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				to determine the presence/position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes that there are no vehicles approaching from the right.		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
					Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
				AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonmousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.



				Autonomous DriveController	AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was not sent out. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				believes so because it followed the control algorithm to provide brake request	ADSBrakeRequest was sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, BrakeRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that it has provided ADSBrakeRequest		ADSBrakeRequest was sent by AutonomousDriveController, but due to the maffunctioning actuator (VehicleMotionController), BrakeRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
				AutonomousDriveController	ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
					Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
				believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
			AutonomousDriveController believes that there is no need to provide ADSBrakeRequest	AutonomousDriveController believes so because it followed the control algorithm to not provide brake request	The control algorithm that determines when to send ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
					The SelfAssessmentStatus feedback issued by Self- Assessment is incorrect.	Inadequate Feedback	The SelfAssessmentStatus shall reflect the actual status of the self assessment of the ADS system	There shall be a mechanism to detect incorrect/inadequately updated SelfAssessmentStatus and appropriate notifications issued
					The PerceptionReliabilityScore feedback issued by Self- Assessment is incorrect.	Inadequate Feedback	PerceptionReliabilityScore shall accurately indicate how reliable the perception system is.	There shall be a mechanism to detect incorrect/inadequately updated PerceptionReliabilityScore and appropriate notifications issued
					Correct feedback signals were issued by Self- Assessment, but due to communication errors between Self-Assessment and AutonomousDriveController, the feedback signals were incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Self-Assessment shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Self- Assessment
					SelfAssessmentStatus feedback was correctly received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing SelfAssessmentStatus adequately to determine the status of Perception and Localisation	If AutonomousDriveController is unable to process SelfAssessmentStatus, it shall notify the Driver.
	AutonomousDriveController does not provide ADSBrakeRequest when ADS is enabled, the CAV is operating on a motorway /highway/dense urban road, there is a H-1			Autonomous DriveController	PerceptionReliabilityScore feedback was correctly received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing PerceptionReliabilityScore adequately to determine how reliable the perception system is	If AutonomousDriveController is unable to process PerceptionReliabilityScore , it shall notify the Driver.
			AutonomousDriveController believes that there is no malfunction or reduction of accuracy of the Perception t	believes so because it was referring to the feedback signals from Self- Assessment to determine the status	The ObjectDetectionCheck feedback from Perception&Localization is incorrect	Inadequate Feedback	The ObjectDetectionCheck shall indicate accurately how well(range) objects can be detected,classified and tracked.	There shall be a mechanism to detect incorrect/inadequately updated ObjectDetectionCheck
			or Localization	of Perception and Localisation.	The LocalizationCheck feedback from Perception&Localization is incorrect	Inadequate Feedback	The LocalizationCheck shall indicate how accurately vehicle position can be localised	There shall be a mechanism to detect incorrect/inadequately updated LocalizationCheck
UCA-6.1.3		ense urban road, H-1,3	3		The ObjectTrackingCheck feedback from Perception&Localization is incorrect.	Inadequate Feedback	The ObjectTrackingCheck shall indicate accurately how well(range) objects can be detected and tracked.	There shall be a mechanism to detect incorrect/inadequately updated ObjectTrackingCheck
	malfunction/reduction of accuracy of the Perception&Localization, and				The SensorVisibility feedback from Sensors is incorrect	Inadequate Feedback	The SensorVisibility shall provide an estimate of sensor effective visibility	There shall be a mechanism to detect incorrect/inadequately updated SensorVisibility



	the CAV is approaching a significant obstacle/VRU in its path.				The SensorObstruction feedback from Sensors is incorrect.	Inadequate Feedback	The SensorObstruction shall provide an estimate of amount of sensor obstruction	There shall be a mechanism to detect incorrect/inadequately updated SensorObstruction
					Self-Assessment correctly received all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,Localiz ationCheck & ObjectTrackingCheck), but incorrectly processed them.	Flawed Control Algorithm	Self assessment shall process all feedback signals from Sensors(Sensor/sibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,L ocalizationCheck & ObjectTrackingCheck) to determine how reliable the perception and localisation systems are	If AutonomousDriveController is unable to process all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,L ocalizationCheck & ObjectTrackingCheck) to generate a reliability score, it shall notify the Driver.
					Self-Assessment correctly received all feedback signals from Sensors(SensorVisbillity&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck & ObjectTrackingCheck) but wasu unable to process them correctly due to its malfunctions.	Malfunctioning Sensor	Self-Assessment shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Self-Assessment and appropriate notifications must be issued to the Driver
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
					Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			that there are no obstacles/VRUs in the CAV path	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Map (Mappinage). The quality of the Maps shall be guaranteed to nsure that accurate Mapimage feedback signal s sent There shall be a mechanism malfunctions of the Maps ar notifications issued Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed. There shall be a mechanism the communication channel AutonomousDriveController	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
				AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
			believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X	
				T c p	The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.



				AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was not sent out. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController an appropriate notifications must be issued to the Driver
			AutonomousDriveController believes so because it followed the control algorithm to provide brake request	ADSBrakeRequest was sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, BrakeRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
		AutonomousDriveController believes that it has provided ADSBrakeRequest		ADSBrakeRequest was sent by AutonomousDriveController, but due to the maffunctioning actuator (VehicleMotionController), BrakeRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
				The brake request calculated by theAutonomousDriveController is overwritten by the empty/faulty brake request from the Driver(unintended output) and hence incorrect/empty BrakeRequest(ONm) is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.
				ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
			AutonomousDriveController	Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
			believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
				Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
		AutonomousDriveController believes that there is no need to provide ADSBrakeRequest	AutonomousDriveController believes so because it followed the control algorithm to not provide brake request	The control algorithm that determines when to send ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
			AutonomousDriveController	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
			to the feedback signals from Sensors to determine the presence / position of objects (such as speed limit signs)around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				The feedback signals from the Sensors (GPSData, PointCloud, RadarObata, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the speed limits for the roads/zones.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc accurately, it shall notify the Driver.
				The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
AutonomousDriveController does not provide ADSBrakeRequest when ADS is		AutonomousDriveController does not		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
ADSBrakeRequest when ADS is enabled, there is a reduction in accuracy of perception and localization and the CAV is approaching a slow speed zone(eg. due to road works or	H-3,4	believe that it is approaching a slow speed zone.	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (Mapimage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps

UCA-6.1.4



	road traffic accidents with the presence of emergency vehicles).				The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV provided	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
				AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The SelfAssessmentStatus feedback from Self- Assessment was incorrect.	Inadequate Feedback	The SelfAssessmentStatus shall reflect the actual status of the self assessment of the ADS system	There shall be a mechanism to detect incorrect/inadequately updated SelfAssessmentStatus and appropriate notifications issued
					The PerceptionReliabilityScore feedback from Self- Assessment was incorrect.	Inadequate Feedback	PerceptionReliabilityScore shall accurately indicate how reliable the perception system is.	There shall be a mechanism to detect incorrect/inadequately updated PerceptionReliabilityScore and appropriate notifications issued
					Correct feedback signals were issued, but due to a communication error between Self-Assessment and Autonomous Drive Controller, the feedback signals were not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Self-Assessment shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Self- Assessment
					SelfAssessmentStatus feedback was correctly received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing SelfAssessmentStatus adequately to determine the status of Perception and Localisation	If AutonomousDriveController is unable to process SelfAssessmentStatus, it shall notify the Driver.
			AutonomousDriveController believes	AutonomousDriveController believes so because it was referring	PerceptionReliabilityScore feedback was correctly received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing PerceptionReliabilityScore adequately to determine how reliable the perception system is	If AutonomousDriveController is unable to process PerceptionReliabilityScore , it shall notify the Driver.
			that there are no accuracy issues with perception and localisation	Assessment to determine the accuracy of perception and localization	The ObjectDetectionCheck feedback from Perception&Localization is incorrect	Inadequate Feedback	The ObjectDetectionCheck shall indicate accurately how well(range) objects can be detected,classified and tracked.	There shall be a mechanism to detect incorrect/inadequately updated ObjectDetectionCheck
					The ObjectTrackingCheck feedback from Perception&Localization is incorrect.	Inadequate Feedback	The ObjectTrackingCheck shall indicate accurately how well(range) objects can be detected and tracked.	There shall be a mechanism to detect incorrect/inadequately updated ObjectTrackingCheck
					The SensorVisibility feedback from Sensors is incorrect	Inadequate Feedback	The SensorVisibility shall provide an estimate of sensor effective visibility	There shall be a mechanism to detect incorrect/inadequately updated SensorVisibility
					The SensorObstruction feedback from Sensors is incorrect.	Inadequate Feedback	The SensorObstruction shall provide an estimate of amount of sensor obstruction	There shall be a mechanism to detect incorrect/inadequately updated SensorObstruction
					Self-Assessment correctly received all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck & ObjectTrackingCheck), but incorrectly processed them.	Flawed Control Algorithm	Self assessment shall process all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,L ocalizationCheck & ObjectTrackingCheck) to determine how reliable the perception and localisation systems are	If AutonomousDriveController is unable to process all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,L ocalizationCheck & ObjectTrackingCheck) to generate a reliability score, it shall notify the Driver.
			S fr P C C	Self-Assessment correctly received all feedback signals from Sensors(Sensorvisbiliity&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck & ObjectTrackingCheck) but was unable to process them correctly due to its malfunctions.	Malfunctioning Sensor	Self-Assessment shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Self-Assessment and appropriate notifications must be issued to the Driver	
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.



			Aut. beli com	AutoomousDebuControllar	AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was not sent out. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				believes so because it followed the control algorithm to provide brake request	ADSBrakeRequest was sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, BrakeRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that it has provided ADSBrakeRequest		ADSBrakeRequest was sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), BrakeRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
					ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
				AutonomousDriveController	Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
				believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
			AutonomousDriveController believes that there is no need to provide ADSBrakeRequest when the CAV exits its ODD	AutonomousDriveController believes so because it followed the control algorithm to not provide brake request when the CAV exits its ODD	The control algorithm that determines when to send ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	AutonomousDriveController				Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
UCA-6.1.5	ADSTrakeRequest when ADS is enabled, there are obstacles around the CAV, the Driver is not available/attentive and there is no response to the takeover request issued upon exit of ODD.	H-5,2,3		The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequately to determine the presence and relative position/speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawimage, etc) accurately, it shall notify the Driver.	
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
		ti P	that there are no obstacles in the CAV / path t	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.



					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
				AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The DriverOverrideStatus feedback from VehicleMotionController was incorrect.	Inadequate Feedback	The DriverOverrideStatus shall indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrect/erroneous DriverOverrideStatus
				AutonomousDriveController believes so because it was referring to the DriverOverrideStatus feedback from the VehicleMotionController to	Correct DriverOverrideStatus feedback signal was issued, but due to a communication error between VehicleMotionController and Autonomous Drive Controller, the signal was not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and VehicleMotionController
			AutonomousDriveController believes that the Driver is attentive/available and has taken over control of the DDT.	determine whether the Driver was controlling the CAV.	DriverOverrideStatus feedback was correctly received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing DriverOverrideStatus to determine whether the Driver is in control of the DDT	If AutonomousDriveController is unable to process DriverOverrideStatus, it shall notify the Driver.
				AutonomousDriveController believes so because there is no feedback to the AutonomousDriveController on the	A feedback signal on Driver Availability is missing in the design. Note : This would need to include a Driver availability recognition system including internal cameras to monitor driver attentiveness.	Missing Feedback	There shall be a feedback to inform the AutonomousDriverController whether the Driver is attentiive and available to take over DDT.	AutonomousDriveController shall be able to identify the driver availability status from other sources.
				Driver presence or attentiveness.	A feedback signal on Driver seat belt status is missing in the design.	Missing Feedback	There shall be a feedback to inform the AutonomousDriverController of the Driver Seat belt status	AutonomousDriveController shall be able to identify the driver Seat belt status from other sources.
				AutonomousDriveController believes that because it was following the control algorithm to	The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
					AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSBrakeRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuors, incorrect BrakeRequest was received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes		ADSBrakeRequest was correctly sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), BrakeRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
	col	that the brake request provided was correct.		VehicleMotionController received the correct brake request from AutonomousDriveController, but it was overwritten by the faulty/unintentional brake request from the Driver.	Conflicted Control	The Vehicle Motion Controller shall be able to identify false/unintended requests from the Driver and prioritise the requests from the AutonomousDriveController over these erroneous requests.	If the requests from the Autonomous Drive Controller have been overridden by the false/unintended inputs from the Driver, the Autonomous Drive Controller shall be notified about it.	
				ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.	
			C V AutonomousDriveController	Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued	



				believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
	AutonomousDriveController				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
UCA-6.2.1	provides insufficient ADSBrakeRequest when ADS is enabled , the CAV is approaching a significant	H-1,3			Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	obstacle or a VRU in its path and there is an imminent collision risk.			AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The classification of objects may be incorrect, for eg: a significant object may be classified as insignificant or the relative position and speed of dynamic obstacles/VRUs may be inaccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) to detect, classify objects accurately and track them	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawlmage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes AutonomousDriveController believes Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent. Malfunctioning Sensor The quality of the Mag ensure that accurate M is sent AutonomousDriveController believes AutonomousDriveController Due to communication errors between Maps & Due to communication errors between Maps & Lot feedback signal from Maps to determine the CAV position AutonomousDriveController, the feedback seever cereview of incorrectly received by the AutonomousDriveController. Quality and integrity of the Map equation on mousDriveController.		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
				Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps			
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
			AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X	
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The relative position and speed of dynamic obstacles/VRUs calculated by the AutonomousDriveController may be inaccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XDbjetData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.



					AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				AutonomousDriveController believes that because it was following the control algorithm to provide brake request.	ADSBrakeRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController VehicleActuators, incorrect BrakeRequest was received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes		ADSBrakeRequest was correctly sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), BrakeRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
			that the brake request provided was correct.		VehicleMotionController received the correct brake request from AutonomousDriveController, but it was overwritten by the faulty/unintentional brake request from the Driver.	Conflicted Control	The Vehicle Motion Controller shall be able to identify false/unintended requests from the Driver and prioritise the requests from the AutonomousDriveController over these erroneous requests.	If the requests from the Autonomous Drive Controller have been overridden by the false/unintended inputs from the Driver, the Autonomous Drive Controller shall be notified about it.
				AutonomousDriveController	ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	lect the There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals. Actuators There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued There shall be a mechanism to detect faults in
1					Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
	AutonomousDriveController			believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
UCA-6.2.2	ADSBrakeRequest when ADS is enabled and the current speed of the CAV is too high to	es insufficient ackeRequest when ADS is ed and the current speed te around an aching sharp bend w curve radii). H-2,3 H-	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.				
	navigate around an approaching sharp bend (narrow curve radii).				The IMUData feedback from Sensors is incorrect.	Inadequate Feedback	The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData
					The WheelSpeed feedback from Sensors is incorrect.	Inadequate Feedback	The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed
					Correct feedback signals (IMUData & WheelSpeed) were issued by Sensors, but due to a communication error between Sensors and Autonomous Drive Controller, the signals were not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine vehicle speed	Correct feedback signals (IMUData & WheelSpeed) were received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing IMUData & WheelSpeed to determine the actual vehicle speed	If AutonomousDriveController is unable to process IMUData & WheelSpeed, it shall notify the Driver
					Sensors are malfunctioning, hence feedback signals (IMUData & WheelSpeed) were never sent/incorrectly sent.	Malfunctioning Sensor	Sensors shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Sensors and appropriate notifications must be issued to the Driver
			AutonomousDriveController believes that the current speed of the CAV is		The 6DOFPosition&Orientation feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6DOFPosition&Orientation
			appropriate for the situation.		The WheelRotations feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			A b t d	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the road curvature	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps



					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The control algorithm that sends ADSBrakeRequest is incorrect,	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSBrakeRequest when required	If AutonomousDriveController is unable to issue ADSBrakeRequest when required, it shall notify the Driver.
				Autonomous DriveController	AutonomousDriveController is malfunctioning, hence, ADSGrakeRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				Automotionsorrecontroller believes that because it was following the control algorithm to provide brake request.	ADSBrakeRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuots, incorrect BrakeRequest was received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that the brake request provided was correct.		ADSBrakeRequest was correctly sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), BrakeRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
					ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
		н-3	3 AutonomousDriveController believes that there are no vehicles following closely behind	AutonomousDriveController believes so because it was referring to ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
					Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
1104-6 2 3	provides excessive ADSBrakeRequest when ADS is enabled, there are moving vehicles abead of the CAV and				Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, Rawlmage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
ULA-6.2.3 vehicles a other veh behind. <i>Note: Thi</i> <i>obstacle i</i>	other vehicles following closely behind. Note: This may lead to a rear obstacle collision				Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps



					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The relative position and speed of dynamic obstacles/VRUs calculated by the AutonomousDriveController may be inaccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjetData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSBrakeRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSBrakeRequest must be issued	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
		:DriveController SbrakeRequest	AutonomousDriveController believes that it has not provided ADSBrakeRequest A	AutonomousDriveController believes that because it was following the control algorithm to not provide brake request.	AutonomousDriveController is malfunctioning, hence, ADSBrakeRequest was fault-issued. Note: Malfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSBrakeRequest was not sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), BrakeRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to ADSRrakeStatus feedback to determine the status of the brake request implementation	ADSBrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The ADSBrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSBrakeStatus signals.
					Correct BrakeStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSBrakeStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
					Correct BrakeStatus feedback is sent by VehiclActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSBrakeStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSBrakeStatus adequately	If AutonomousDriveController is unable to process ADSBrakeStatus, it shall notify the Driver.
				AutonomousDriveController	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
AutonomousDriveController provides ADSBrakeRequest when ADS is enabled, there are vehicles following the CAV closely behind and there are no obstacles ahead. Note: This may lead to a rear	AutonomousDriveController provides ADSBrakeRequest				Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	bled, there wing the CAV nd there are ad. ead to a rear	b t t	believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors	



				1				,
	obstacle collision.				The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, Radarbata, RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController helieves		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			CAV.	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (Mapimage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The relative position and speed of dynamic obstacles/VRUs calculated by the AutonomousDriveController may be inaccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
			AutonomousDriveController believes that it has provided ADSBrakeRequest at the right time A b b f f f	AutonomousDriveController believes that because it was following the control algorithm to provide ADSBrakeRequest	The specified control algorithm that calculates when to issue ADSBrakeRequest is flawed.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue brake request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
					The specified control algorithm that calculates when to issue ADSBrakeRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that brake request is issued at the right time	If the processing time for the calculation of the brake request exceeds a defined threshold value,appropriate notifications shall be issued
					ADSBrakeRequest was issued at the right time, but due to a communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSBrakeRequest due to communication delays and appropriate notifications issued
					The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issue to carry out maintenance/replacement.
				AutonomousDriveController / believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	The ADSBrakeStatus feedback was delayed.	Delayed Feedback	The ADSBrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSBrakeStatus.
					BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSBrakeStatus due to communication delays and appropriate notifications issued
					Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.



					AutonomousDriveController received updated ADSBrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSBrakeStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSBrakeStatus exceeds a defined threshold value,appropriate notifications shall be issued
			AutonomousDriveController believes	AutonomousDriveController believes that because it was referring to EnableAD to determine the ADS status.	The EnableAD command from HMI was delayed.	Delayed Control Input	The EnableAD command from HMI shall be received by the Autonomous Drive Controller within a specified duration once the Driver has requested for activation of ADS.	There shall be a mechanism to detect delays in issuing EnableAD.
			control of DDT	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
	AutonomousDriveController provides ADSBrakeRequest too late when ADS is enabled, the CAV is operating on a metonum. (insmod bichury)				The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) were inadequately updated.	Delayed Feedback	The feedback signals from Sensors (Temperature, Humidity, AmbientLighting) shall be updated on time to indicate the actual status of the weather conditions with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (Temperature,Humidity,AmbientLighting)
UCA-6.5.1	ramp/dense urban road, at S.1 Night, weather conditions are adverse[rain/snow/fog/ice on road] and there is a significant obstacle (eg: parked vehicle, decelerating lead vehicle, road works, blocked lane etc.)or a VRU in the CAV path.	H-1,3	AutonomousDriveController believes that time of day and weather conditions are favorable for operation of the ADS	AutonomousDriveController believes that because it was referring to the feedback signals from Sensors to determine the time of day and weather conditions	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (Temperature,Humidity,AmbientLighting) due to communication delays and appropriate notifications issued
		or a			The feedback signals from Sensors (Temperature,Humidity, Ambient lighting)were received on time on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from Sensors (Temperature, Humidity, Ambient lighting) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signals from Sensors (Temperature,Humidity, Ambient lighting) exceeds a defined threshold value, appropriate notifications shall be issued
			AutonomousDriveController believes that there are no obstacles or VRUs in the CAV path	AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GFSData,PointCloud, RadarData,RawImage, etc) were inadequately updated. Note:This could be due to performance limitations owing to adverse weather and time of day	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to performance limitations owing to adverse weather and time of day
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to	The feedback signal from the Map (Mapimage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
				determine the CAV position	The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
				AutonomousDriveController believes so because It was referring to the feedback signal from V2X to determine the presence/position of	The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
					The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays



				objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time.	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
					The specified control algorithm that calculates when to issue ADSBrakeRequest is flawed.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue brake request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
				AutonomousDriveController	The specified control algorithm that calculates when to issue ADSBrakeRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that brake request is issued at the right time	If the processing time for the calculation of the brake request exceeds a defined threshold value,appropriate notifications shall be issued
				believes that because it was following the control algorithm to provide ADSBrakeRequest	ADSBrakeRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSBrakeRequest due to communication delays and appropriate notifications issued
			AutonomousDriveController believes that it has provided ADSBrakeRequest at the right time		The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
					The ADSBrakeStatus feedback was delayed.	Delayed Feedback	The ADSBrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSBrakeStatus.
		H-2,3,4	AutonomousDriveController believes that ADS is not enabled/Driver is in control of DDT	AutonomousDriveController believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSBrakeStatus due to communication delays and appropriate notifications issued
A p la UCA-6.5.2 C v v a					Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
					AutonomousDriveController received updated ADSBrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSBrakeStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSBrakeStatus exceeds a defined threshold value, appropriate notifications shall be issued
				AutonomousDriveController believes that because it was referring to EnableAD to determine the ADS status.	The EnableAD command from HMI was delayed.	Delayed Control Input	The EnableAD command from HMI shall be received by the Autonomous Drive Controller within a specified duration once the Driver has requested for activation of ADS.	There shall be a mechanism to detect delays in issuing EnableAD.
	AutonomousDriveController provides ADSBrakeRequest too late when ADS is enabled , the CAV is approaching a			AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
	roundabout, there are no lead vehicles and there are vehicles approaching from the right		A t t t	AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData, RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
			AutonomousDriveController believes		The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)



			that there are no vehicles approaching from the right/they are far away	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
					The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of	The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
				objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time.	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
			AutonomousDriveController believes that it has provided ADSBrakeRequest at the right time	AutonomousDriveController believes that because it was following the control algorithm to provide ADSBrakeRequest	The specified control algorithm that calculates when to issue ADSBrakeRequest is flawed.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue brake request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
					The specified control algorithm that calculates when to issue ADSBrakeRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that brake request is issued at the right time	If the processing time for the calculation of the brake request exceeds a defined threshold value, appropriate notifications shall be issued
					ADSBrakeRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSBrakeRequest due to communication delays and appropriate notifications issued
					The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
				AutonomousDriveController believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	There was a delay in the update of ADSBrakeStatus feedback.	Delayed Feedback	The ADSBrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSBrakeStatus.
					BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSBrakeStatus due to communication delays and appropriate notifications issued
					Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
Autonomous provides ADSI JCA-6.5.3 liate when ADS the CAV is app traffic light.		ю Н-3,4			AutonomousDriveController received updated ADSBrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSBrakeStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSBrakeStatus exceeds a defined threshold value,appropriate notifications shall be issued
	AutonomousDriveController provides ADSBrakeRequest too late when ADS is enabled and the CAV is approaching a red traffic light.		4 AutonomousDriveController believes that ADS is not enabled/Driver is in control of DDT	AutonomousDriveController believes that because it was referring to EnableAD to determine the ADS status.	The EnableAD command from HMI was delayed.	Delayed Control Input	The EnableAD command from HMI shall be received by the Autonomous Drive Controller within a specified duration once the Driver has requested for activation of ADS.	There shall be a mechanism to detect delays in issuing EnableAD.
				AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.



					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,Rawimage, etc)
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / nosition of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
			AutonomousDriveController believes that the traffic light is far ahead or not showing red		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data. Note: The distance and color of traffic lights must be processed accurately and in a timely manner	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the distance and color of traffic lights.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
				determine the CAV position	The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
					The specified control algorithm that calculates when to issue ADSBrakeRequest is flawed.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue brake request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
			AutonomousDriveController believes that it has provided ADSBrakeRequest at the right time	AutonomousDriveController believes that because it was following the control algorithm to provide ADSBrakeRequest	The specified control algorithm that calculates when to issue ADSBrakeRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that brake request is issued at the right time	If the processing time for the calculation of the brake request exceeds a defined threshold value,appropriate notifications shall be issued
					ADSBrakeRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSBrakeRequest due to communication delays and appropriate notifications issued
					The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required.	There shall be a mechanism to detect degradations of the actuator(VehicieMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
					There was a delay in the update of ADSBrakeStatus feedback.	Delayed Feedback	The ADSBrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSBrakeStatus.
				AutonomousDriveController	BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSBrakeStatus due to communication delays and appropriate notifications issued
	AutonomousDriveController			believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
					AutonomousDriveController received updated ADSBrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSBrakeStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSBrakeStatus exceeds a defined threshold value,appropriate notifications shall be issued
UCA-6.5.4	provides ADSBrakeRequest too late when ADS is enabled and the CAV is approaching a sharp turn/bend/curve.	H-2,3	AutonomousDriveController believes	AutonomousDriveController believes that because it was referring to EnableAD to determine the ADS status.	The EnableAD command from HMI was delayed.	Delayed Control Input	The EnableAD command from HMI shall be received by the Autonomous Drive Controller within a specified duration once the Driver has requested for activation of ADS.	There shall be a mechanism to detect delays in issuing EnableAD.



Image: Single state		control of DDT	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
Image: second				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
Image: space			AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
Image: space spac		AutonomousDriveController believes that the sharp turn/bend/curve is still further ahead		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
Image: state in the state in the state is the state i				The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
Image: second approximation of the second approximation and second approximation approximatin approximate approximaterial approximation approximation approxim			AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
AutoonousDiveController beleves tat he right time AutoonousDiveController beleves tat he right time AutoonousDiveController beleves tat he right time Feasy and page of the control algorithm tat scale of 2000 Feasy and page of the control algorithm tat scale of 2000 The scalable week of the control algorithm Feasy and page of the control algorithm control algorithm The scalable week of the control algorithm Feasy and page of the control algorithm control algorithm The scalable week of the control algorithm AutoonousDiveController beleves AutoonousDiveController beleves Feasy and the right time. Feasy and the right time. The control algorithm The scalable week of the control algorithm AutoonousDiveController beleves AutoonousDiveController beleves Feasy and the right time. The control algorithm The control algorithm The control algorithm AutoonousDiveController beleves AutoonousDiveController beleves The control algorithm The control algorithm The control algorithm The control algorithm AutoonousDiveController beleves AutoonousDiveController beleves The control algorithm The control algorithm<				The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
Image: A properties of the specified control algorithm that calculates when is processing delay. Processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified control algorithm that calculates when is processing delay. The specified cont control algorithm that calculates w		AutonomousDriveController believes that it has provided ADSGrakeRequest at the right time	AutonomousDriveController believes that because it was following the control algorithm to provide ADSBrakeRequest	The specified control algorithm that calculates when to issue ADSBrakeRequest is flawed. Note: The control algorithm must cater for steady braking in the ego lane in a timely manner when there is no response to take over request issued upon exit of ODD	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue brake request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
Deleves that because it was following the control algorithm in provide ADSBrakeRequest DoSBrakeRequest was issued at the right time, but de to communication delay between AutonomousDriveController and Vehicle Actuators, the communication delay between AutonomousDriveController and Vehice Autons was not received on time. The communication delay between AutonomousDriveController and Vehice Autons was not received on time. The actuator (VehiceAutors, AutonomousDriveController and Vehice A				The specified control algorithm that calculates when to issue ADSBrakeRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that brake request is issued at the right time	If the processing time for the calculation of the brake request exceeds a defined threshold value,appropriate notifications shall be issued
AutonomousDriveController believes that it has provided ADSBrakeReistatis at the right time AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the at the right time The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the at the right time The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the at the right time The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that in implementation of the actuator action and optication of aniantenance/replacement. AutonomousDriveController believes that be cause that referring to the ADSBrakeStatus feedback to determine the status of on time. There was a delay in the update of ADSBrakeStatus was not delays not exceeding a specified threshold. There shall be a mechanism antenance/replacement. AutonomousDriveController believes that be cause it was referring to the ADSBrakeStatus feedback to determine the status of on time. The destatus feedback was issued, but due to assort degradations, ADSBrakeStatus was not une. The destatus feedback was issued, but due to and vehicle Actuators shall not exceed a defined threshold autonomousDriveController and vehicle Actuators shall be well maintained, error of drakeStatus so no ince, but there was a delay in updated ADSBrakeStatus on on time. The sensor between AutonomousDriveController and vehicle Actuators shall be well amintained, error of degradations and not cause of drakatostatus was not updated to and appropriveController and vehicle Actuators shall be well maintained, error of drakatostatus on une, but there w				ADSBrakeRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSBrakeRequest due to communication delays and appropriate notifications issued
AutonomousDriveController here was a delay in the update of ADSBrakeStatus belayed Feedback The ADSBrakeStatus of brake implementation with dalays not exceeding a specified threshold. There shall be a mechanism update of ADSBrakeStatus was not consumption of the calcula status of brake implementation with dalays not exceeding a specified threshold. There shall be a mechanism update of ADSBrakeStatus set of the calcula status of brake implementation with dalays not exceed a defined dalays and appropriate notified threshold value. The delays in the communication channel There shall be a mechanism update of ADSBrakeStatus was not received on time. Communication delay between Vehicle Actuators & the brake request implementation is the brake request implementation is the brake request implementation. There shall be a mechanism update of BrakeStatus was not updated of threshold value. The sensor between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value. There shall be a mechanism update of BrakeStatus was not updated of threshold value. AutonomousDriveController received on time. Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated of threshold value. The sensor between AutonomousDriveController shall be a mechanism of time. AutonomousDriveController received updated Sensor Degradation The sensor between AutonomousDriveController shall be a mechanism of time. AutonomousDriveController received updated Sensor Degradation The sensor between AutonomousDriveController shall be a mechanism of time.				The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
AutonomousDriveController believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation BrakeStatus feedback was issued on time, but due to communication delay between Vehicle Actuators & al AutonomousDriveController, ADSBrakeStatus was not received on time. The delays in the communication channel between AutonomousDriveController, ADSBrakeStatus du delays and appropriate notification The delays in the communication channel between AutonomousDriveController, ADSBrakeStatus was not received on time. The delays in the communication channel between AutonomousDriveController, ADSBrakeStatus du delays and appropriate notification AutonomousDriveController believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation feedback to determine the status of danse determine the status of none Bransor between AutonomousDriveController and Vehicle Actuators shall not exceed a defined and				There was a delay in the update of ADSBrakeStatus feedback.	Delayed Feedback	The ADSBrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSBrakeStatus.
Image: Control algorithm of the brake request implementation Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus seedback was issued, but due to on time. Sensor Degradation The sensor between AutonomousDriveController fragmentation and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time. The sensor between AutonomousDriveController fragmentation and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time. The sensor between AutonomousDriveController fragmentation and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time. The control algorithm of AutonomousDriveController fragmentation and Vehicle Actuators shall be capable of the brake status on time, but there was a delay in Processing Delay The control algorithm of AutonomousDriveController shall be capable of threshold value. If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to process the ADSBrakeStatus within a specified If the time take hy Autonom to proc		/ F t	AutonomousDriveController believes that because it was referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSBrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSBrakeStatus due to communication delays and appropriate notifications issued
AutonomousDriveController received updated The control algorithm of If the time taken by Autonom AutonomousDriveController shall be capable of ADSBrakeStatus on time, but there was a delay in Processing Delay processing ADSBrakeStatus within a specified threshold value,appropriate				Correct BrakeStatus feedback was issued, but due to sensor degradations, ADSBrakeStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
processing the feedback. duration of time. be issued				AutonomousDriveController received updated ADSBrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSBrakeStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSBrakeStatus exceeds a defined threshold value,appropriate notifications shall be issued


					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were inadequately updated.	Inadequate Feedback	(GFSData, PointCloud, RadarData, Rawlmage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of chierts around the CAV.	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
				position of objects around the eve	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
	AutonomousDriveController		AutonomousDriveController believes		The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
UCA-6.5.5	too late when ADS is enabled, there are obstacles around the CAV, and there is no response to the takeover request issued	H-5,2,3	that the obstacles are still further ahead	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
	upon exit of ODD.	to the takeover request issued upon exit of ODD.		determine the CAV position	The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	(Mapimage) within a specified duration of time The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position objects around the CAV The delays in the communication channel between AutonomousDriveController and V2X	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to	The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
				objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time to determine the presence/position of objects around the CAV	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
					The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
					The DriverOverrideStatus from Vehicle Motion Controller was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Motion Controller shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DriverOverrideStatus due to communication delays
					The DriverOverrideStatus from Vehicle Motion Controller was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing DriverOverrideStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process the DriverOverrideStatus exceeds a defined threshold value, appropriate notifications shall be issued
		AutonomousDriveController b that the Driver has responded take-over request in a timely n			There was a delay in the issue of TakeOverRequest	Delayed Feedback	The Autonomous Drive Controller shall issue TakeOverRequest in a timely manner when required.	There shall be a mechanism for the detection of delayed TakeOverRequest
			AutonomousDriveController believes that the Driver has responded to the	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	TakeOverRequest was issued on time, but due to sensor (HMI)degradation, the Haptic/Audio/Visual warnings were not issued on time	Sensor Degradation	The HMI shall be well maintained, ensuring that Haptic/Audio/Visual warnings are issued/updated on time.	There shall be a mechanism to detect delays or failures in the update of Haptic/Audio/Visual warnings due to HMI degradation and notifications issued to carry out maintenance/replacement.
			take-over request in a timely manner		TakeOverRequest was issued on time, but due to sensor (HMI)degradation, DisplayedADStatus was not updated on time.	Sensor Degradation	The HMI shall be well maintained, ensuring that DisplayedADStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of DisplayedADStatus due to HMI degradation and notifications issued to carry out maintenance/replacement.



					TakeOverRequest was issued on time but due to delay in the communication channel between AutonomousDriveController and the HMI, Haptic/Audio/Visual warnings were not issued on time	Communication Delay	The delays in the communication channel between AutonomousDriveController and HMI shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated Haptic/Audio/Visual warnings due to communication delays
					TakeOverRequest was issued on time but due to delay in the communication channel between AutonomousDriveController and the HMI,DisplayedADStatus was not updated on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and HMI shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DisplayedADStatus due to communication delays
				AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
					The control algorithm inside AutonomousDriveController was degraded and therefore unable to issue the brake request anymore.	Control Algorithm Degradation	The control algorithm inside AutonomousDriveController shall be able to continuously process brake request when required.	There shall be a mechanism to detect failure to provide brake request continuously due to control algorithm degradation
					AutonomousDriveController is degraded and hence ADSBrakeRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that the brake request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide brake request continuously due to the degradation of AutonomousDriveController
				AutonomousDriveController believes that because it was following the control algorithm to provide brake request.	ADSBrakeRequest was being issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, BrakeRequest was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously propagated.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
			AutonomousDriveController believes that it is continuing to provide brake		ADSBrakeRequest was still being issued, but due to actuator degradations, the BrakeRequest was not implemented anymore.	Actuator Degradation	The actuator between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously implemented upon request.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the actuator between AutonomousDriveController and VehicleActuators
			request.		The ADSBrakeStatus feedback incorrectly indicates the brake implementation status.	Inadequate Feedback	The ADSBrakeStatus shall correctly indicate the status of implementation of brake request.	There shall be a mechanism to detect incorrect ADSBrakeStatus.
				AutonomousDriveControllerbelieves that because it was referring to the ADSBrakeStatus feedback to	Correct BrakeStatus feedback was issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, the feedback was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that ADSBrakeStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
				determine the status of brake request implementation.	Correct BrakeStatus feedback was issued, but due to sensor degradations, the ADSBrakeStatus feedback was not correctly sensed anymore.	Sensor Degradation	The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSBrakeStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus due to sensor degradations
					AutonomousDriveController receives correct ADSBrakeStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process ADSBrakeStatus continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process ADSBrakeStatus .
			AutonomousDriveController believes that ADS has been disabled/ADS has	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
			been disabled/Driver has taken over control of the DDT.	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
	AutonomousDriveController stops providing ADSBrakeRequest too soon				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
JCA-6.7.1	CAV is operating on a motorway/highway/dense urban road, ADS is enabled, weather conditions are adverse(rain/snow/fog/ice on the road), the CAV is annroaching a significant	H-1,2,3		AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	Correct feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) were issued by Sensors, but due to degradation in the communication channel between Sensors and AutonomousDriveController, the feedback signals were not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors



approach	inte a siennicante -						
obstacle/ imminent prevails.	VRU in its path and an it collision risk			AutonomousDriveController receives correct feedback signals (GPSData,PointCloud, RadarData,RawImage, etc), but due to control algorithm degradation, it is unable to process the signals anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (GPSData,PointCloud, RadarData,Rawimage, etc) continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc).
				The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage)
		AutonomousDriveController believes that it has already evaded the obstacle/VRU and there is no more collision risk	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was not received anymore due to degradation in the communication channel between Maps and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Maps shall be well maintained, ensuring that the feedback signal from the Map (MapImage) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the Map (MapImage) continuously due to degradation of the communication channel between AutonomousDriveController and Maps.
				AutonomousDriveController receives the correct feedback signal from the Map (MapImage), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signal from the Map (MapImage)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signal from the Map (MapImage)
				The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData)
			AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) was not received anymore due to degradation in the communication channel between V2X and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and V2X shall be well maintained, ensuring that the feedback signal from the V2X (V2XObjectData) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the V2X (V2XObjectData) continuously due to degradation of the communication channel between AutonomousDriveController and V2X.
			objects around the CAV	AutonomousDriveController receives the correct feedback signal from the V2X (V2XObjectData), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process feedback signal from the V2X (V2XObjectData)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process feedback signal from the V2X (V2XObjectData)
				The feedback signal from the Sensors (Temperature,Humidity, AmbientLighting) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (Temperature,Humidity, AmbientLighting) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (Temperature,Humidity, AmbientLighting)
		AutonomousDriveController believes that weather conditions are favourable/have improved	AutonomousDriveController believes so because it was referring to the feedback signals(Temperature,Humidity, AmbientLighting) from Sensors	The feedback signal from the Sensors (Temperature,Humidity, AmbientLighting)were not received anymore due to degradation in the communication channel between Sensors and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (Temperature,Humidity, AmbientLighting) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (Temperature,Humidity, AmbientLighting)continuously due to degradation of the communication channel between AutonomousDriveController and Sensors
				AutonomousDriveController receives the correct feedback signals from the Sensors (Temperature,Humidity, AmbientLighting), but due to control algorithm degradation, it is unable to process the signals anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (Temperature,Humidity, AmbientLighting) continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signals (Temperature,Humidity, AmbientLighting)
			AutonomousDriveController believes so because there is no specific feedback included on road surface conditions	There is no feedback to the AutonomousDriveController on road surface conditions.	Missing Feedback	There shall be feedback to the AutonomousDriveController on road surface conditions from Sensors.	The AutonomousDriveController shall be able to identify road surface conditions from other available sources.
				The control algorithm inside AutonomousDriveController was degraded and therefore unable to issue the brake request anymore.	Control Algorithm Degradation	The control algorithm inside AutonomousDriveController shall be able to continuously process brake request when required.	There shall be a mechanism to detect failure to provide brake request continuously due to control algorithm degradation
				AutonomousDriveController is degraded and hence ADSBrakeRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that the brake request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide brake request continuously due to the degradation of AutonomousDriveController
			AutonomousDriveController believes that because it was following the control algorithm to provide brake request.	ADSBrakeRequest was being issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, BrakeRequest was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously propagated.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
		AutonomousDriveController believes that it is continuing to provide brake		ADSBrakeRequest was still being issued, but due to actuator degradations, the BrakeRequest was not implemented anymore.	Actuator Degradation	The actuator between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously implemented upon request.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the actuator between AutonomousDriveController and VehicleActuators
		request.		The ADSBrakeStatus feedback incorrectly indicates the brake implementation status.	Inadequate Feedback	The ADSBrakeStatus shall correctly indicate the status of implementation of brake request.	There shall be a mechanism to detect incorrect ADSBrakeStatus.



			AutonomousDriveControllerbelieves that because it was referring to the ADSBrakeStatus feedback to	Correct ADSBrakeStatus feedback was issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, the feedback was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that ADSBrakeStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
			determine the status of brake request implementation.	Correct BrakeStatus feedback was issued, but due to sensor degradations, the ADSBrakeStatus feedback was not correctly sensed anymore.	Sensor Degradation	The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSBrakeStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus due to sensor degradations
				AutonomousDriveController receives correct ADSBrakeStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process ADSBrakeStatus continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process ADSBrakeStatus .
		AutonomousDriveController believes that ADS has been disabledADS has	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
		been disabled/Driver has taken over control of the DDT.	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
AutonomousDriveController stops providing ADSBrakeRequest too soon when ADS is enabled and the current vehicle speed is still high for the situation (Eg: manoeuvering a sharp bend/ turn, approaching a slow speed zone with roadworks, decelerating lead vehicle, etc.)				The IMUData feedback from Sensors is not updated properly.	Inadequate Feedback	The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData
				The WheelSpeed feedback from Sensors is is not updated properly.	Inadequate Feedback	The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed
	H-2,3,4		AutonomousDriveController believes so because it was referring	Correct feedback signals (IMUData & WheelSpeed) were issued by Sensors, but due to a degradation in the communication channel between Sensors and Autonomous Drive Controller, the signals were not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (IMUData & WheelSpeed) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (IMUData & WheelSpeed) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors
			to the feedback signals from Sensors to determine vehicle speed	Correct feedback signals (IMUData & WheelSpeed) were received but due to control algorithm degradation, it is unable to process the feedback signals anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (IMUData & WheelSpeed) continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process thefeedback signals (IMUData & WheelSpeed)
				The 6DOFPosition&Orientation feedback from Vehicle Actuators isis not updated properly.	Inadequate Feedback	The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6D0FPosition&Orientation
				The WheelRotations feedback from Vehicle Actuators is is not updated properly.	Inadequate Feedback	The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations
				The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage)
			AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the road curvature	The feedback signal from the Map (MapImage) was not received anymore due to degradation in the communication channel between Maps and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Maps shall be well maintained, ensuring that the feedback signal from the Map (MapImage) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the Map (MapImage) continuously due to degradation of the communication channel between AutonomousDriveController and Maps.
		AutonomousDriveController believes that the current speed of the CAV is appropriate for the situation.		AutonomousDriveController receives the correct feedback signal from the Map (Mapimage), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signal from the Map (MapImage)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signal from the Map (MapImage)
				The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData)
			AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV(slow speed zone, roadworks, decelerating lead	The feedback signal from the V2X (V2XObjectData) was not received anymore due to degradation in the communication channel between V2X and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and V2X shall be well maintained, ensuring that the feedback signal from the V2X (V2XObjectData) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the V2X (V2XObjectData) continuously due to degradation of the communication channel between AutonomousDriveController and V2X.
			zone, roadworks, decelerating lead vehicle etc.)	AutonomousDriveController receives the correct feedback signal from the V2X (V2XObjectData), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process feedback signal from the V2X (V2XObjectData)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process feedback signal from the V2X (V2XObjectData)
	AutonomousDriveController stops providing ADSBrakeRequest too soon when ADS is enabled and the current vehicle speed is still high for the situation (Eg: manoeuvering a sharp bend/ turr, approaching a slow speet zone with roadworks, decelerating lead vehicle, etc.)	AutonomousDriveController stops providing ADSBrakeRequest too soon when ADS is enabled and the current vehicle speed is still high for the situation (Eg: manoeuvering a sharp bend/ turn, approaching a slow speed zone with roadworks, decelerating lead vehicle, etc.)	AutonomousDriveController stops providing Absolution Absolution stops providing Absolution AutonomousDriveController stops providing Absolution AutonomousDriveController stops providing absolution stops providing absolution stops providing AutonomousDriveController stops providing absolution absolution stops providing absolution absolution	AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController Steps providing AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController Steps providing AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController AutonomousDriveController Steps providing AutonomousDriveController AutonomousDriveController Deen disabled/Driver in a taken over on ADS of the CAV AutonomousDriveController AutonomousDriveController Description autonomousDriveController AutonomousDriveController AutonomousDriveController Description autonomousDriveController AutonomousDriveController AutonomousDriveController Description autonomousDriveController AutonomousDriveController AutonomousDriveController Description autonomousDriveController AutonomousDriveController AutonomousDriveController Deliveus so becauset twas referring to the feedback signal fro	AutoonousDivisController to generations, the Kalbana feedback trans source, the term request implementation. The implementation that because is use referring to the control ideation. The Kalbana feedback trans source, the term request implementation. AutoonousDivisController into participation in the intermanication function. AutoonousDivisController into search into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. The DivisController into participation. The DivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. The DivisController into participation. The DivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. The DivisController into participation. The DivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. The AutoonousDivisController into participation. The AutoonousDivisController into participation. AutoonousDivisController into participation. AutoonousDivisController into participation. The AutoonousDivisController into participation. </td <td>Autoonsee biscontexture factors Contractionation for technic which is also and it is also also also also also also also als</td> <td>Non-second production of the second production</td>	Autoonsee biscontexture factors Contractionation for technic which is also and it is also also also also also also also als	Non-second production of the second production



			Au	AutonomousDriveController	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence/position of objects around the CAV(slow speed zone, roadworks, decelerating load unbied sone.	Correct feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) were issued by Sensors, but due to degradation in the communication channel between Sensors and AutonomousDriveController, the feedback signals were not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors
				read venice etc.)	AutonomousDriveController receives correct feedback signals (GPSData, PointCloud, RadarData, RawImage, etc), but due to control algorithm degradation, it is unable to process the signals anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc).
					The control algorithm inside AutonomousDriveController was degraded and therefore unable to issue the brake request anymore.	Control Algorithm Degradation	The control algorithm inside AutonomousDriveController shall be able to continuously process brake request when required.	There shall be a mechanism to detect failure to provide brake request continuously due to control algorithm degradation
					AutonomousDriveController is degraded and hence ADSBrakeRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that the brake request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide brake request continuously due to the degradation of AutonomousDriveController
			AutonomousDriveController believes that it is continuing to provide brake request.	AutonomousDriveController believes that because it was following the control algorithm to provide brake request.	ADSBrakeRequest was being issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, BrakeRequest was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously propagated.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
					ADSBrakeRequest was still being issued, but due to actuator degradations, the BrakeRequest was not implemented anymore.	Actuator Degradation	The actuator between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously implemented upon request.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the actuator between AutonomousDriveController and VehicleActuators
				AutonomousDriveControllerbelieves that because it was referring to the ADSBrakeStatus feedback to determine the status of brake request implementation.	The ADSBrakeStatus feedback incorrectly indicates the brake implementation status.	Inadequate Feedback	The ADSBrakeStatus shall correctly indicate the status of implementation of brake request.	There shall be a mechanism to detect incorrect ADSBrakeStatus.
					Correct ADSBrakeStatus feedback was issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, the feedback was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that ADSBrakeStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
					Correct BrakeStatus feedback was issued, but due to sensor degradations, the ADSBrakeStatus feedback was not correctly sensed anymore.	Sensor Degradation	The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSBrakeStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus due to sensor degradations
					AutonomousDriveController receives correct ADSBrakeStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process ADSBrakeStatus continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process ADSBrakeStatus .
			AutonomousDriveController believes	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
	AutonomousDriveController stops providing ADSBrakeRequest too soon	Controller	taken over control of the DDT.	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
			AutonomousDriveController believes that a safe stopping location has been coi	AutonomousDriveController believes so because it followed the controller logic to determine that a	The control algorithm that determines whether a safe stopping location has been reached is degraded	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to determine whether a safe stopping location has been reached or not.	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to determine whether a safe stopping location has been reached or not.
ADSBrakeRequest too soon when ADS is in a degraded CA-6.7.3 mode performing a MRM, H there are significant	r H-1,2,3	reached. safe	reached	Feedback must be included in the design to inform the AutonomousDriveController of the criteria for a safe stopping location.	Missing Feedback	There shall be feedback to the AutonomousDriveController on the criteria for a safe stopping location	The AutonomousDriveController shall be able to identify a safe stopping location from other available sources.	



	obstacles/VRUs in the path of				The feedback signal from the Map (MapImage) was	land and reading	The feedback signal from the Map (MapImage)	There shall be a mechanism to detect incorrectly	
	location has not been reached.				inadequately updated.	Inadequate Feedback	shall be updated correctly	(MapImage)	
			AutonomousDriveController believes that there are no longer any significant obstacles/VRUs in the CAV path/lane of travel	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was not received anymore due to degradation in the communication channel between Maps and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Maps shall be well maintained, ensuring that the feedback signal from the Map (MapImage) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the Map (MapImage) continuously due to degradation of the communication channel between AutonomousDriveController and Maps.	
				-		AutonomousDriveController receives the correct feedback signal from the Map (MapImage), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signal from the Map (MapImage)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signal from the Map (MapImage)
						The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData)
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) was not received anymore due to degradation in the communication channel between V2X and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and VZX shall be well maintained, ensuring that the feedback signal from the VZX (VZXObjectData) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the V2X (V2XObjectData) continuously due to degradation of the communication channel between AutonomousDriveController and V2X.	
					AutonomousDriveController receives the correct feedback signal from the V2X (V2XObjectData), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process feedback signal from the V2X (V2XObjectData)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process feedback signal from the V2X (V2XObjectData)	
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc]shall be updated correctly to indicate the presence/position of objects around the CAV and lane markings	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc)	
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence/position of objects around the CAV and lane	Correct feedback signals (GPSData,PointCloud, RadarData,Rawlmage, etc) were issued by Sensors, but due to degradation in the communication channel between Sensors and AutonomousDriveController, the feedback signals were not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors	
				markings	AutonomousDriveController receives correct feedback signals (GPSData,PointCloud, RadarData,RawImage, etc), but due to control algorithm degradation, it is unable to process the signals anymore. Note: The Autonomous Drive Controller must be able to process these feedback signals in a timely manner to determine the lane markings/lane boundaries	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc).	
			AutonomousDriveController believes that it is no longer in a degraded mode performing MRM	AutonomousDriveController believes that because it followed the control algorithm to determine whether ADS is in a degraded mode or not	The control algorithm inside AutonomousDriveController that determines when the ADS is in a degraded mode is inadequate/degraded Note: The requirements on when the ADS must enter degraded mode and what actions must be taken may be inadequate	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to determine when the ADS must switch to a degraded mode and what actions must be taken therafter.	There shall be a mechanism to detect a failure of the AutonomousDriveController control algorithm to determine when the ADS must switch to a degraded mode and what actions must be taken thereafter.	
					The control algorithm within AutonomousDriveController that sends steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.	
					AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was not sent out.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of the AutonomousDriveController and appropriate notifications must be issued to the Driver	
			A b fr	AutonomousDriveController believes so because it correctly followed the control algorithm to provide steering request	ADSSteerRequest was sent by AutonomousDriveController, however due to errors in communication between the Drive Control Unit and the Vehicle Actuators, Steer Request was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators	
				provinci steering request	ADSSteerRequest was sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), SteerRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (VehicleMotionController) and appropriate notifications issued	



			AutonomousDriveController believes that it has provided Steer Request		The steer request calculated by the AutonomousDriveController is overwritten by the empty/faulty steer request from the Driver(unintended output) and hence empty SteerRequest is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
				AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
				to the ADSSteerStatus feedback to determine the status of steer request implementation	Correct SteerStatus Feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
				AutonomousDriveController	Correct ADSSteerStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.
			AutonomousDriveController believes that it should not send steering request	AutonomousDriveController believes that because it has correctly followed the control algorithm not to send steering request.	The specified control algorithm for sending steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSSteerRequest must be issued	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
	AutonomousDriveController does not provide ADSSteerRequest when ADS is enabled there is a significant				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc)
UCA-7.1.1	enabled, there is a significant obstacle(eg: parked vehicle, blocked lane, road works or special vehicles) or a suddenly appearing VRU in the lane of the CAV and adjacent lanes are available /free of obstacles	H-1,3,4		AutonomousDriveController believes so because it was referring to the feedback signals from the	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the presence/relative position of objects around the CAV,	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed. There shall be the communic AutonomousD The control algorithm inside The control algorithm inside The control algorithm inside	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				9	The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			AutonomousDriveController believes that the CAV is not approaching an object of significant size in its path	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
				AutonomousDriveController	V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X



				AutonomousDriveController	The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver. There shall be a mechanism to detect the
				referring to the sensor fusion algorithm to determine whether the object is significant or not	The sensor fusion algorithm that determines whether an object is significant or not is inadequate/incorrect	Faulty Control Algorithm	accurately determine whether an object is significant or not	inability of the AutonomousDriveController to accurately determine whether an object is significant or not
					The control algorithm within AutonomousDriveController that sends steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
					AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was not sent out.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of the AutonomousDriveController and appropriate notifications must be issued to the Driver
			AutonomousDriveController believes that it has provided Steer Request	AutonomousDriveController believes so because it correctly followed the control algorithm to provide steering request	ADSSteerRequest was sent by AutonomousDriveController, however due to errors in communication between the Drive Control Unit and the Vehicle Actuators, Steer Request was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					ADSSteerRequest was sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), SteerRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
					The steer request calculated by the AutonomousDriveController is overwritten by the empty/faulty steer request from the Driver(unintended output) and hence empty SteerRequest is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
				AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	here shall be a mechanism for the detection of tcorrect/erroneous ADSSteerStatus signals. here shall be a mechanism to detect the alfunctions of the sensor between Vehicle ctuators and AutonomousDriveController and ppropriate notifications issued here shall be a mechanism to detect faults in
				to the ADSSteerStatus feedback to determine the status of steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
1104-712	AutonomousDriveController does not provide ADSSteerRequest when ADS is enabled the CAV is	H-2 3			Correct ADSSteerStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.
	maneuvering a sharp turn/bend/curve and is too close to the border.	11-2,5	AutonomousDriveController believes that it should not send steering request	AutonomousDriveController believes that because it has correctly followed the control algorithm not to send steering request.	The specified control algorithm for sending steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSSteerRequest must be issued	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect, ie it doesn't adequately represent the road curvature/layout.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall accurately represent the CAV position and road curvature/layout	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			AL be to de ro	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position and the road curvature	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
				road curvature	The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage] adequately to determine the CAV position and road curvature/layout	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.



			AutonomousDriveController believes that is not navigating a sharp turn/bend/curve and is not too close to the border.		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring to the feedback simple from the	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, Rawimage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				RedarData,Rawlmage, etc) to determine the presence/relative position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) accurately, it shall notify the Driver.
					The control algorithm within AutonomousDriveController that sends steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
					AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was not sent out.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of the AutonomousDriveController and appropriate notifications must be issued to the Driver
				AutonomousDriveController believes so because it correctly followed the control algorithm to provide steering request	ADSSteerRequest was sent by AutonomousDriveController, however due to errors in communication between the Drive Control Unit and the Vehicle Actuators, Steer Request was not received by the Vehicle Actuators.	teerRequest was sent by nomousDriveController, however due to errors in nunication between the Drive Control Unit and helicle Actuators, Steer Request was not received e Vehicle Actuators.	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					ADSSteerRequest was sent by AutonomousDriveController, but due to but due to the malfunctioning actuator (VehicleMotionController), SteerRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
			AutonomousDriveController believes that it has provided Steer Request		The steer request calculated by the AutonomousDriveController is overwritten by the empty/faulty steer request from the Driver(unintended output) and hence empty SteerRequest is sent.	Conflicted Control	There shall be a mechanism to prevent/block unintentional inputs from the Driver	The Driver shall be made aware of potentially unintentional inputs.
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
				AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
				to the ADSSteerStatus feedback to determine the status of steer request implementation	Correct SteerStatus Feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
	AutonomousDriveController does not provide				Correct ADSSteerStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.
dd UCA-7.1.3 er m fr	ADSSteerRequest when ADS is enabled and the CAV is merging onto the main road from a ramp.	H-2,3	AutonomousDriveController believes that it should not send steering request	AutonomousDriveController believes that because it has correctly followed the control algorithm not to send steering request.	The specified control algorithm that determines when to send steering request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSSteerRequest must be issued	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect, ie it does not adequately represent the forward road scene	Inadequate Feedback	The feedback signal from the Map (MapImage) shall accurately represent the CAV position and the road layout/forward road scene	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			Aut		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued



				believes so because it was referring to the feedback signal from Maps to determine the CAV position and the road layout/forward road scene	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position and the road layout/forward road scene	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
			AutonomousDriveController believes that it is navigating a straight path		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the presence/relative position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
			and lane markings/boundaries	The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequatelyto determine the presence/relative position of objects around the CAV and lane markings/boundaries	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawimage, etc) accurately, it shall notify the Driver.	
				AutonomousDriveController believes that because it was following the control algorithm to provide steer request.	The control algorithm that calculates steer request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
			AutonomousDriveController believes that the steer request provided was correct.		AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was incorrectly sent. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSSteerRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, SteerRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					ADSSteerRequest was correctly sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), SteerRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (VehicleMotionController) and appropriate notifications issued
					The correct Steer request calculated by the AutonomousDriveController is overwritten by the faulty steer request from the Driver(unintended output) and hence incorrect Steer Request is sent to the Vehicle Actuators.	Conflicted Control	The Vehicle Motion Controller shall be able to identify false/unintended requests from the Driver and prioritise the requests from the AutonomousDriveController over these erroneous requests.	If the requests from the Autonomous Drive Controller have been overridden by the false/unintended inputs from the Driver,the Autonomous Drive Controller shall be notified about it.
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
				AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
		beli to A dete requ	believes so because it was referring - to ADSSteerStatus feedback to determine the status of the steer request implementation	Correct SteerStatus Feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators	
				Correct ADSSteerStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.	



					The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) shall be updated accurately	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from Sensors (Temperature,Humidity,AmbientLighting)
				AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals from Sensors (Temperature, Humidity, Ambient lighting) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	AutonomousDriveController provides incorrect ADSSteerRequest when ADS is enabled weather conditions			believes that because it was referring to the feedback signals from Sensors to determine the time of day, weather conditions and road conditions	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received/incorrectly received due to communication errors between Sensors & AutonomousDriveController,	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
UCA-7.2.1	are adverse (heavy rain/snow/fog/ice on the road), the CAV is maneuvering a sharp turn/bend/curve and is too close to the border.	H-2,3	AutonomousDriveController believes that the steering request provided is suitable for the weather conditions		The feedback signals from Sensors (Temperature, Humidity, Ambient lighting)were correctly received, but were misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from Sensors (Temperature, Humidity, Ambient lighting) to determine the time of day, weather conditions and road conditions	If AutonomousDriveController is unable to process the feedback signals from the Sensors (Temperature, Humidity, Ambient lighting)accurately, it shall notify the Driver.
				AutonomousDriveController believes that because there is no feedback on the road surface conditions	There is no feedback to the AutonomousDriveController on road surface conditions	Missing Feedback	There shall be a feedback to the AutonomousDriveController from Sensors on road surface conditions	The AutonomousDriveController shall be able to determine the road surface conditions from some other sources.
				AutonomousDriveController believes so because there is no feedback/input on the steering performance requirements in adverse weather conditions	The design must include adequate feedback/inputs on steering performance in adverse weather conditions	Missing Feedback	There shall be a feedback to the AutonomousDriveController from the Manufacturer on steering performance in adverse weather conditions	The AutonomousDriveController shall be able to gather inputs on steering performance in adverse weather conditions from some other sources.
					The feedback signal from the Map (MapImage) is incorrect, ie it doesn't adequately represent the road curvature/layout.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall accurately represent the the CAV position and the road curvature	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position and the road curvature	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (Mapimage) adequately to determine thethe CAV position and the road curvature	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
			AutonomousDriveController believes that the CAV is not too close to the		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
			border		Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				AutonomousDriveController believes so because it was referring to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				(determine the presence/relative position of objects around the CAV and lane markings/boundaries	The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The controller doesn't adequately process the input signals to determine the road curvature, layout, lane markings etc.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the determine the road curvature, layout, lane markings etc	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) accurately, it shall notify the Driver.
				Due to performance limitations of the Sensors (owing to adverse weather), the feedback signals from the Sensors (PointCloud, RawImage, etc) were inadequately updated	Performance Limitations(sensor)	The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility or occlusions.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notifications issued to the Driver	
					The control algorithm that calculates steer request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.



					AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				AutonomousDriveController believes that because it was following the control algorithm to provide steer request.	ADSSteerRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, SteerRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			Autonomous Deitor Constan Versite in State		ADSSteerRequest was correctly sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), SteerRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	unctioning Actuator Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators maifunctions of the act shall be guaranteed to ensure that it propagates the appropriate command. There shall be a mechan notifications issued	There shall be a mechanism to detect the malfunctions of the actuator (VehicleMotionController) and appropriate notifications issued
			AutonomousUnvec.ontroller believes that the steer request provided was correct.		The correct Steer request calculated by the AutonomousDriveController is overwritten by the faulty steer request from the Driver(unintended output) and hence incorrect Steer Request is sent to the Vehicle Actuators.	Conflicted Control	The Vehicle Motion Controller shall be able to identify false/unintended requests from the Driver and prioritise the requests from the Autonomous DriveController over these erroneous requests.	If the requests from the Autonomous Drive Controller have been overridden by the false/unintended inputs from the Driver, the Autonomous Drive Controller shall be notified about it.
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
	AutonomousDriveController provides incorrect ADSSteerRequest when ADS is			AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
		s		to ADSSteerStatus feedback to determine the status of the steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSSteerStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
UCA-7.2.2	enabled, there is a VRU(cyclist/horse-rider/mobility scooter user) in the lane of travel of the CAV and the CAV	H-2		AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	is performing an overtake maneuver.			to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the presence/relative position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				position of objects around the CAV	The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from the sensors	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, Radardata,RawImage, etc) adequately to determine the presence/relative position and speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GSPData, PointCloud, RadarData, RawImage, etc) accurately, it shall notify the Driver.
					fible.ndvaluer [auts etc. palur.hardware jours etc. There shall integrity of the communication thereen autonomoub/re-Controller Autonomoub/		There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).	
		AutonomousDriveController believes that the lateral distance to the VRU is sufficient for an overtake manoeuvre to de		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued	
			AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps	



					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
		AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X		
				The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from V2X	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjetDtata) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.	
					The control algorithm that calculates steer request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
					AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
			believes following the control algorithm to provide steer request.	ADSSteerRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController VehicleActuators, SteerRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators	
	AutonomousDriveContro that the steer request pr correct.	AutonomousDriveController believes that the steer request provided was correct.		ADSSteerRequest was correctly sent by AutonomousDriveController, but due to the maffunctioning actuator (VehicleMotionController), SteerRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (VehicleMotionController) and appropriate notifications issued	
					ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
				AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
				to ADSSteerStatus feedback to determine the status of the steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSSteerStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect, ie it doesn't adequately represent the road curvature/layout.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall accurately represent the the CAV position	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
JCA-7.2.3	AutonomousDriveController provides incorrect(excessive) ADSSteerRequest when ADS is enabled, lane markings are faded/absent and there are	H-2		AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps



	obstacles adjacent to the CAV.				The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
			AutonomousDriveController believes that the CAV is keeping to its lane		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the lane markings/boundaries	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The controller doesn't adequately process the input signals to determine the road layout and lane boundaries in the absence of lane markings.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawlmage, etc) adequately to determine the road layout and lane boundaries in the absence of lane markings.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) accurately, it shall notify the Driver.
				AutonomousDriveController believes so because It was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
			AutonomousDriveController believes that there are no obstacles adjacent to the CAV		Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from V2X	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the distance to the objects around CAV and their relative position/speed.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSSteerRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSSteerRequest when required	If AutonomousDriveController is unable to issue ADSSteerRequest when required, it shall notify the Driver.
				AutonomousDriveController believes that because it was following the control algorithm to	AutonomousDriveController is malfunctioning, hence, ADSSteerRequest was fault-issued. Note: Molfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				not provice steer request.	ADSSteerRequest was not sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), SteerRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (VehicleMotionController) and appropriate notifications issued
			AutonomousDriveController believes that it has not provided ADSSteerRequest		ADSSteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The ADSSteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSSteerStatus signals.
		A	Aussicei Request	AutonomousDriveController	Correct SteerStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSSteerStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued
			bel to / det req	believes so because it was referring to ADSSteerStatus feedback to determine the status of the steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus is incorrectly received by the AutonomousDriveController	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
	I I		1	1			I	1



						Correct ADSSteerStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSSteerStatus adequately	If AutonomousDriveController is unable to process ADSSteerStatus, it shall notify the Driver.	
						The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)	
					AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued	
	Ai pi (li	utonomousDriveController rovides ADSSteerRequest ane change) when ADS is nahled there is an				believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV and their size	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
UCA-7.3	1 in ol C/ ve	inducey, interest an significant(overdriveable) bstacle(eg:leaf, mud) in the AV path and there are ehicles in adjacent lanes.	H-2			The feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The classification of objects(significant/nsignificant) based on these input signals may be incorrect	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawlmage, etc) adequately to determine the the presence / position of objects around the CAV and their size	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.	
						The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall accurately represent the the CAV position	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).	
				AutonomousDriveController believes that there are significant obstacles ahead of the CAV		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued	
					AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps	
						The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.	
					AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV and their cite	The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).	
						V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued	
						Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X	
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The presence/position of objects and their classification may be inaccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XDbjectData) adequately to determine the presence/position of objects around the CAV and their size	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.		
					AutonomousDriveController believes that because it was referring to the sensor fusion algorithm to determine whether the object is significant or not	The sensor fusion algorithm that determines whether an object is significant or not is inadequate/incorrect	Faulty Control Algorithm	The sensor fusion algorithm shall be able to accurately determine whether an object is significant or not	There shall be a mechanism to detect the inability of the AutonomousDriveController to accurately determine whether an object is significant or not	
						The specified control algorithm that calculates when to issue ADSSteerRequest is flawed. Note: The control algorithm must cater for steady braking in the ego lane in a timely manner when there is no response to take over request issued upon exit of ODD	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue steer request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications	
					AutonomousDriveController	The specified control algorithm that calculates when to issue ADSSteerRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that steer request is issued at the right time	If the processing time for the calculation of the steer request exceeds a defined threshold value, appropriate notifications shall be issued	



				following the control algorithm to provide ADSSteerRequest	ADSSteerRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSSteerRequest due to communication delays and appropriate notifications issued
			AutonomousDriveController believes that it has provided ADSSteerRequest at the right time		The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
					There was a delay in the update of ADSSteerStatus feedback.	Delayed Feedback	The ADSSteerStatus shall be updated to indicate the actual status of steer implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSSteerStatus.
				AutonomousDriveController	SteerStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSSteerStatus due to communication delays and appropriate notifications issued
				referring to the ADSSteerStatus feedback to determine the status of the steer request implementation	Correct SteerStatus feedback was issued, but due to sensor degradations, ADSSteerStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSSteerStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of SteerStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
	AutonomousDriveController provides ADSSteerRequest too late when ADS is enabled, there is a significant variable and the service of the service blocked lane, road works), or a VRU in the lane of the CAV and adjacent lanes are available /free of obstacles				AutonomousDriveController received updated ADSSteerStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSSteerStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSSteerStatus exceeds a defined threshold value,appropriate notifications shall be issued
UCA-7.5.1		r oo H-1,3 ind	1,3	AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence' position of obstacles/VRUs in the CAV path	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
					The feedback signals from the Sensors (GPSDat,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data. Note: The feedback signals must be processed in a timely manner to detect obstacles correctly even when there are occlusions/other vehicles ahead. False detections must be flagged.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData, Rawimage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
			AutonomousDriveController believes		The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
			that there are no obstacles in the lane of the CAV and there are obstacles in adjacent lanes	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
				determine the CAV position	The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (Mapimage) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
			Ai bi to de of	AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/oosition of	The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
				determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XDbjetData) within a specified duration of time to determine the presence/position of objects around the CAV	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued



					The specified control algorithm that calculates when to issue ADSSteerRequest is flawed. Note: The control algorithm must cater for steady braking in the ego lane in a timely manner when there is no response to take over request issued upon exit of OD	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue steer request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
				AutonomousDriveController	The specified control algorithm that calculates when to issue ADSSteerRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that steer request is issued at the right time	If the processing time for the calculation of the steer request exceeds a defined threshold value, appropriate notifications shall be issued
				following the control algorithm to provide ADSSteerRequest	ADSSteerRequest was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSSteerRequest due to communication delays and appropriate notifications issued
			AutonomousDriveController believes that it has provided ADSSteerRequest at the right time		The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
				AutonomousDriveController believes that because it was referring to the ADSSteerStatus feedback to determine the status of the brake request implementation	There was a delay in the update of ADSSteerStatus feedback.	Delayed Feedback	The ADSSteerStatus shall be updated to indicate the actual status of steer implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSSteerStatus.
					SteerStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSSteerStatus was not received on time.	Communication Delay	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSSteerStatus due to communication delays and appropriate notifications issued
					Correct SteerStatus feedback was issued, but due to sensor degradations, ADSSteerStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSSteerStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of SteerStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
					AutonomousDriveController received updated ADSSteereStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSSteerStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSSteerStatus exceeds a defined threshold value,appropriate notifications shall be issued
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,Rawimage, etc)
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
	AutonomousDriveController provides ADSSteerRequest too late when ADS is enabled, a VRU suddenly appears, moving towards the path of the CAV, H-3 there are no obstacles on the adjacent lane and maximum deceleration is insufficient to avoid a collision with the VRU.				The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data. Note: There must be no false detections and obstacles must be detected in a timely manner even when there are occlusions	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
			AutonomousDriveController believes		The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
			that there is no VRU in the CAV path or that there are obstacles on the adjacent lane	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to	The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
11(24-7 5 2		н-3	to i det	determine the CAV position	The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
		γ, H-3 e i o U.			The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)



		AutonomousDriveController believes so because it was referring to the feedback signal from V2X to	The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
		determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data. Note: There must be no false detections and obstacles must be detected in a timely manner even when there are acclusions	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time to determine the presence/position of objects around the CAV	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
-			The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
		AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the relative position and speed of objects around the	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
		CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
	AutonomousDriveController believes that deceleration is sufficient to avoid collision with the VRU	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
			The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
1			The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
			The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
		AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the relative position and	The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
		speed of objects around the CAV	The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time to determine the presence/position of objects around the CAV	If the time taken by AutonomousDriveController to process the feedback signal from the VZX (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
		AutonomousDriveController believes so because it was referring to the control algorithm to determine the strategy(max deceleration or steering away) for the current circumstances	The control algorithm that determines the strategy to deal with suddenly appearing obstacles is inadequate	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall be able to determine how to avoid suddenly appearing obstacles in a safe and timely manner.	There shall be a mechanism to detect the inability of the AutonomousDriveController to avoid suddenly appearing obstacles
			The control algorithm that calculates the duration of the steer request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue steer request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
	Ai bi fo st	AutonomousDriveController believes that because it was following the control algorithm to stop providing Steer request.	AutonomousDriveController stops sending ADSSteerRequest at the correct time, but due to communication delay between the AutonomousDriveController and the Vehicle Actuators, SteerRequest was not received on time.	Communication Delay	The communication channel between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that the ADSSteerRequest is updated on time.	There shall be a mechanism to detect incorrectly received ADSSteerRequest due to communication delays and appropriate notifications issued



			AutonomousDriveController believes that it has stopped providing ADSSteerRequest.		AutonomousDriveController stops sending ADSSteerRequest at the correct time, but due to degradation of the actuators/Vehicle Motion Controller), it was responding late.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issue to carry out maintenance/replacement.
					The ADSSteerStatus feedback was delayed.	Delayed Feedback	The ADSSteerStatus shall be updated to indicate the actual status of steer implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSSteerStatus.
				AutonomousDriveController believes that because it was referring to the ADSSteerRequest Status to determine the status of	Correct SteerStatus feedback was issued, but due to sensor degradations, the ADSSteerStatus feedback was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSSteerStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of SteerStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.
					AutonomousDriveController received updated ADSSteerStatus feedback on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSSteerStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSSteerStatus exceeds a defined threshold value,appropriate notifications shall be issued
					The feedback signal from the Map (MapImage) is incorrectly updated, ie it doesn't adequately represent the road curvature/layout.	Delayed Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position and the	Due to communication delays between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was not received on time	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
1100 7 6 1	AutonomousDriveController provides ADSSteerRequest too long when ADS is enabled, weather conditions are	2		road curvature	The feedback signal from the Map (MapImage) is received on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
UCA-7.8.1	rain/snow//og/ice on the road), the CAV is maneuvering a sharp turn/bend/curve and is too close to the border.	n-2	AutonomousDriveController believes that is not navigating a sharp turn/bend/curve and is not too close to the border.	elieves o close to AutonomousDriveController believes so because it was referring to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the presence/relative position of objects around the CAV and lane markings/boundaries	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) are incorrectly updated.	Delayed Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					Due to communication delays between Sensors & AutonomousDriveController, the feedback signals from the Sensors were not received on time	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are received on time, but there was a delay in processing the feedback signals.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) were inadequately updated.	Delayed Feedback	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (Temperature,Humidity,AmbientLighting)
		AutonomousDriveController believes	AutonomousDriveController believes that because it was referring to the feedback signals from Sensors to determine the time	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (Temperature,Humidity,AmbientLighting) due to communication delays	
			that time of day and weather conditions are favorable for operation of the ADS	of day and weather conditions	The feedback signals from Sensors (Temperature,Humidity, Ambient lighting)were received on time on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (Temperature,Humidity,AmbientLighting) within a specified duration of time to accurately to determine the time of day and weather conditions	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (Temperature,Humidity,AmbientLighting) exceeds a defined threshold value, appropriate notifications shall be issued
				AutonomousDriveController believes so because there is no specific feedback on road surface conditions	There is no feedback to the AutonomousDriveController on road surface conditions.	Missing Feedback	There shall be feedback to the AutonomousDriveController on road surface conditions from Sensors.	The AutonomousDriveController shall be able to identify road surface conditions from other available sources.



					The control algorithm inside AutonomousDriveController was degraded and therefore unable to issue the steer request anymore.	Control Algorithm Degradation	The control algorithm inside AutonomousDriveController shall be able to continuously process steer request when required.	There shall be a mechanism to detect failure to provide steer request continuously due to control algorithm degradation
					AutonomousDriveController is degraded and hence ADSSteerRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that the steer request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide steer request continuously due to the degradation of AutonomousDriveController
				AutonomousDriveController believes that because it was following the control algorithm to provide steer request.	ADSSteerRequest was being issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, SteerRequest was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the steer request is continuously propagated.	There shall be a mechanism to detect failure to provide steer request continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
			AutonomousDriveController believes that it is continuing to provide		ADSSteerRequest was still being issued, but due to actuator degradations, the SteerRequest was not issued anymore.	Actuator Degradation	The actuator between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the steer request is continuously implemented upon request.	There shall be a mechanism to detect failure to provide steer request continuously due to degradation of the actuator between AutonomousDriveController and VehicleActuators
			ADSSteerRequest.		The ADSSteerStatus feedback incorrectly indicates the steer implementation status.	Inadequate Feedback	The ADSSteerStatus shall correctly indicate the status of implementation of steer request.	There shall be a mechanism to detect incorrect ADSSteerStatus.
				AutonomousDriveControllerbelieves that because it was referring to the ADSSteerStatus feedback to	Correct SteerStatus feedback was issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, the ADSSteerStatus feedback was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that ADSSteerStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ADSSteerStatus continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
				determine the status of steer request implementation.	Correct SteerStatus feedback was issued, but due to sensor degradations, the ADSSteerStatus feedback was not correctly sent anymore.	Sensor Degradation	The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSSteerStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSSteerStatus due to sensor degradations
					AutonomousDriveController receives correct ADSSteerStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process ADSSteerStatus continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process ADSSteerStatus .
			AutonomousDriveController believes that ADS has been disabledADS has	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
	AutonomousDriveController stops providing ADSSteerRequest too soon		been disabled/Driver has taken over control of the DDT.	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
JCA-7.7.1	when ADS is enabled, there is a significant obstacle(eg: parked vehicle, blocked lane,	H-1,2,3			The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage)
1	road works) or a VRU in the lane of the CAV, adjacent lanes are available /free of obstacles and an imminent collision risk prevails.			AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was not received anymore due to degradation in the communication channel between Maps and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Maps shall be well maintained, ensuring that the feedback signal from the Map (MapImage) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the Map (MapImage) continuously due to degradation of the communication channel between AutonomousDriveController and Maps.
					AutonomousDriveController receives the correct feedback signal from the Map (MapImage), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signal from the Map (MapImage)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signal from the Map (MapImage)
					The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData)
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of	The feedback signal from the V2X (V2XObjectData) was not received anymore due to degradation in the communication channel between V2X and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and VZX shall be well maintained, ensuring that the feedback signal from the VZX (VZXObjectData) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the V2X (V2XObjectData) continuously due to degradation of the communication channel between AutonomousDriveController and V2X.



			AutonomousDriveController believes that the CAV has evaded the obstacle/it is no longer in the CAV path/lane and there are obstacles in the adjacent lane.	objects around the CAV(eg: parked vehicle, blocked lane, road works)	AutonomousDriveController receives the correct feedback signal from the V2X (V2XObjectData), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process feedback signal from the V2X (V2XObjectData)continuously to determine the presence/position of objects around the CAV(eg: parked vehicle, blocked lane, road works)	There shall be a mechanism to detect failure of the AutonomousDiveController control algorithm to process feedback signal from the V2X (V2XObjectData)
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the presence/position of objects around the CAV(eg: parked vehicle, blocked lane, road works)and lane markings/boundaries	Correct feedback signals (GPSData,PointCloud, RadarData,Rawimage, etc) were issued by Sensors, but due to degradation in the communication channel between Sensors and AutonomousDriveController, the feedback signals were not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors
					AutonomousDriveController receives correct feedback signals (GPSData,PointCloud, RadarData,RawImage, etc), but due to control algorithm degradation, it is unable to process the signals anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously to determine the presence/position of objects around the CAV(eg: parked vehicle, blocked lane, road works)and lane markings/boundaries	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc).
				AutonomousDriveController believes that because it was following the sensor fusion algorithm to determine the forward road scene	The sensor fusion algorithm that matches sensor data is degraded	Control Algorithm Degradation	The sensor fusion algorithm shall be able to accurately match sensor data to determine the forward road scene	There shall be a mechanism to detect the inability of the AutonomousDriveController to accurately match sensor data
					The control algorithm inside AutonomousDriveController was degraded and therefore unable to issue the steer request anymore.	Control Algorithm Degradation	The control algorithm inside AutonomousDriveController shall be able to continuously process steer request when required.	There shall be a mechanism to detect failure to provide steer request continuously due to control algorithm degradation
				AutonomousDriveController believes that because it was following the control algorithm to provide steer request.	AutonomousDriveController is degraded and hence ADSSteerRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that the steer request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide steer request continuously due to the degradation of AutonomousDriveController
					ADSSteerRequest was being issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, SteerRequest was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the steer request is continuously propagated.	There shall be a mechanism to detect failure to provide steer request continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
			AutonomousDriveController believes that it is continuing to provide		ADSSteerRequest was still being issued, but due to actuator degradations, the SteerRequest was not issued anymore.	Actuator Degradation	The actuator between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the steer request is continuously implemented upon request.	There shall be a mechanism to detect failure to provide steer request continuously due to degradation of the actuator between AutonomousDriveController and VehicleActuators
			ADSSteerRequest.		The ADSSteerStatus feedback incorrectly indicates the steer implementation status.	Inadequate Feedback	The ADSSteerStatus shall correctly indicate the status of implementation of steer request.	There shall be a mechanism to detect incorrect ADSSteerStatus.
				AutonomousDriveControllerbelieves that because it was referring to the ADSSteerStatus feedback to	Correct SteerStatus feedback was issued, but due to degradation in the communication channel between AutonomousDriveController and VehicleActuators, the ADSSteerStatus feedback was not received anymore.	Communication Degradation	The communication channel between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that ADSSteerStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ADSSteerStatus continuously due to degradation of the communication channel between AutonomousDriveController and VehicleActuators
				determine the status of steer request implementation.	Correct SteerStatus feedback was issued, but due to sensor degradations, the ADSSteerStatus feedback was not correctly sent anymore.	Sensor Degradation	The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSSteerStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSSteerStatus due to sensor degradations
					AutonomousDriveController receives correct ADSSteerStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process ADSSteerStatus continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process ADSSteerStatus .
UCA-7.7.2	AutonomousDriveController stops providing ADSSteerRequest too soon when ADS is enabled, the CAV is continuing to maneuver a	H-2,3	AutonomousDriveController believes	AutonomousDriveController believes so because it was referring to the DriverOverrideStatus from Vehicle Motion Controller	The DriverOverrideStatus from Vehicle Motion Controller was inadequately updated.	Inadequate Feedback	The DriverOverrideStatus shall be updated on time to indicate correctly whether the Driver has overridden the ADS requests or not	There shall be a mechanism for the detection of incorrectly updated DriverOverrideStatus
		1	1	L			1	1



	snarp turn, beno/ curve.		been disabled/Driver has taken over control of the DDT.	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
					The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage)
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the road curvature	The feedback signal from the Map (MapImage) was not received anymore due to degradation in the communication channel between Maps and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and Maps shall be well maintained, ensuring that the feedback signal from the Map (Mapimage) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the Map (MapImage) continuously due to degradation of the communication channel between AutonomousDriveController and Maps.
					AutonomousDriveController receives the correct feedback signal from the Map (MapImage), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process the feedback signal from the Map (MapImage)continuously	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process the feedback signal from the Map (MapImage)
			AutonomousDriveController believes		The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData)
			that it has already navigated the sharp bend/curve.	AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV(slow speed zone, roadworks, decelerating lead vehicle etc.)	The feedback signal from the V2X (V2XObjectData) was not received anymore due to degradation in the communication channel between V2X and AutonomousDriveController	Communication Degradation	The communication channel between AutonomousDriveController and V2X shall be well maintained, ensuring that the feedback signal from the V2X (V2XObjectData) is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signal from the V2X (V2XObjectData) continuously due to degradation of the communication channel between AutonomousDriveController and V2X.
					AutonomousDriveController receives the correct feedback signal from the V2X (V2XObjectData), but due to control algorithm degradation, it is unable to process the signal anymore.	Control Algorithm Degradation	The AutonomousDriveController control algorithm shall be able to process feedback signal from the V2X (V2XDbjectData)continuously to determine the presence/position of objects around the CAV(eg: parked vehicle, blocked lane, road works)	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to process feedback signal from the V2X (V2XObjectData)
				AutonomousDriveController believes that because it was following the sensor fusion algorithm to determine the forward road scene	The sensor fusion algorithm that matches sensor data is degraded	Control Algorithm Degradation	The sensor fusion algorithm shall be able to accurately match sensor data to determine the forward road scene	There shall be a mechanism to detect the inability of the AutonomousDriveController to accurately match sensor data
					The control algorithm within AutonomousDriveController that sends throttle request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only when required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required, it shall notify the Driver.
				AutonomousDriveController believes so because it correctly followed the control algorithm to provide throttle request	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was not sent out.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSTInottleRequest was sent by AutonomousDriveController, however, due to errors in communication between the AutonomousDriveController and the Vehicle Actuators, ThrottleRequest was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that it has provided throttle Request		ADSThrottleRequest was sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), ThrottleRequest was not sent out to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
	AutonomousDriveController				ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
JCA-8.1.1	does not provide ADSThrottleRequest when the CAV is operating on a highway/motorway, ADS is in a	н-3		AutonomousDriveController	Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
	.1 highway/motorway, ADS is in a degraded mode performing a MRM to move to a safe stopping location and there are vehicles approaching from behind.	rway, ADS is in a e performing a to a safe on and there are aching from	A be to to	believes so because it was referring to the ADSThrottleStatus feedback to determine the status of throttle request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators



Image: space						Correct ADSThrottleStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
Image: section in the section is and stranger than the section is and stranger the section is and stranger t				AutonomousDriveController believes that it should not send throttle request	AutonomousDriveController believes that because it has correctly followed the control algorithm not to send throttle request.	The specified control algorithm that determines when to send throttle request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine when ADSThrottleRequest must be issued	If AutonomousDriveController is unable to issue ADSThrottleRequest when required, it shall notify the Driver.
Image: problem Image: problem <th< td=""><td></td><td></td><th></th><td>AutonomousDriveController believes that a safe stopping location has been</td><td>AutonomousDriveController believes so because it followed the controller logic to determine that a</td><td>The control algorithm that determines whether a safe stopping location has been reached is faulty</td><td>Faulty Control Algorithm</td><td>The AutonomousDriveController control algorithm shall correctly determine whether a safe stopping location has been reached</td><td>There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to determine whether a safe stopping location has been reached or not.</td></th<>				AutonomousDriveController believes that a safe stopping location has been	AutonomousDriveController believes so because it followed the controller logic to determine that a	The control algorithm that determines whether a safe stopping location has been reached is faulty	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly determine whether a safe stopping location has been reached	There shall be a mechanism to detect failure of the AutonomousDriveController control algorithm to determine whether a safe stopping location has been reached or not.
Image: state in the state is an intermediate state is an in				reaction	reached	Feedback must be included in the design to inform the AutonomousDriveController of the criteria for a safe	Missing Feedback	There shall be feedback to the AutonomousDriveController on the criteria for a	The AutonomousDriveController shall be able to identify a safe stopping location from other
Notes Notes Autoencontrol				AutonomousDriveController believes that its not performing a minimum risk manoeuvre	AutonomousDriveController believes so because it followed the controller logic to determine the mode and behavior in that mode	stopping location. The Control algorithm that determines the mode of operation of ADS and the expected behaviour in that mode is incorrect	Faulty Control Algorithm	sate stopping location The AutonomousDriveController control algorithm shall correctly determine the mode/status of operation of the ADS and execute appropriate actions.	available sources. There shall be a mechanism to detect a failure of the AutonomousDriveController control algorithm to determine the mode/status of operation of the ADS and execute appropriate actions
Image: Section						The control algorithm that calculates throttle request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only when required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required, it shall notify the Driver.
Normal Section Normal Section Normal Section			AutonomousDriveController believes that the throttle request provided was correct.		AutonomousDriveController believes that because it was following the control algorithm to provide throttle request.	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was incorrectly sent. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
AutonomousDiveController beleeves hat the througe values of provide experimentations correct. AutonomousDiveController beleeves hat the througe values values of the autonome correct. AutonomousDiveController beleeves hat the througe values values of the autonome correct. National constructions autonomousDiveController beleeves hat the througe value value value value values of the autonome duration of the autonome correct. National constructions autonomousDiveController beleeves hat the througe value value value value values of the autonome duration of the autonome autonomousDiveController beleeves hat the througe value value value value value value value values of througe values values of the autonome duration of the autonome autonomousDiveController beleeves hat the througe value value value value values of througe values values values values values values values of the autonome values of the autonome values of througe values						ADSThrottleRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators. ThrottleRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
ADSTructListatus feedback incorrectly reflects the tatus of throttle request implementation for tatus of throttle implementation incorrect/eroneous ADSTructListatus feedback is not by VehicdActuators, but VehicdActuators, VehicdActuators, but VehicdActuators, VehicdActuators, but VehicdActuators, VehicdActuators, VehicdAct					ADSThrottleRequest was correctly sent by AutonomousDriveController, but due to the maffunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued	
AutonomousDriveController AutonomousDriveController AutonomousDriveController Malfunctioning Sensor Communication Sensor Communication Sensor Communication Error Malfunctioning Sensor Fee Senal Be a mechanism to di malfunctioning Sensor Fee Senal Be a mechanism to di malfunctioning Sensor Fee Senal Be a mechanism to di malfunctioning Sensor Fee Senal Be a mechaninis to di sensor Senal Be a mechanism to di m					AutonomousDriveController believes so because it was referring to ADSThrottleStatus feedback to determine the status of the throttle request implementation	ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
believes because it was referring to ADSTINUCTIONAL Sector Communication for the communication error is between AutonomousDriveController, ADSTINUCTIONAL Sector Communication error is between AutonomousDriveController, ADSTINUCTIONAL Sector Communication error is between AutonomousDriveController, ADSTINUCTIONAL Sector Communication error is and Vehicle Actuators shall be guaranteed. Communication Error Cuality and integrity of the communication error is and Vehicle Actuators shall be guaranteed. There shall be a mechanism to discussed is and vehicle Actuators shall be guaranteed. There shall be a mechanism to discussed is and vehicle Actuators shall be guaranteed. There shall be a mechanism to discussed is and vehicle Actuators shall be guaranteed. The control algorithm inside Actuators shall be guaranteed. If AutonomousDriveController and Actuators was misinterpreted by the AutonomousDriveController. Correct ADSTINUTIEStatus feedback is received, but it was misinterpreted by the AutonomousDriveController. The feedback signals from the sensors (Temperature, Humidity, Ambient Updated. The feedback signals from the sensors (Temperature, Humidity, Ambient Updated. The feedback signals from the sensors (Temperature, Humidity, Ambient Updated. The feedback signals from the sensors (Temperature, Humidity, Ambient Updated. The feedback signals from the sensors (Temperature, Humidity, Ambient Updated. The feedback signals from Sensors (Temperature, Humidity, Ambient Updated. The feedback signals from Sensors (Temperature, Humidity, Ambient Updated. The feedback signals from Sensors (Temperature, Humidity, Ambient Updated. The feedback signals from Sensors (Temperature, Humidity, Ambient Updated.						Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
Image: state in the state						Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
AutonomousDriveController NatonomousDriveController Nater shall be aurechanism to drive Nater shall be aurechanism to drive <td></td> <th></th> <td></td> <td></td> <td>Correct ADSThrottleStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.</td> <td>Misinterpreted Feedback</td> <td>The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately</td> <td>If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.</td>						Correct ADSThrottleStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
AutonomousDriveController believes that because it was referring to the feedback signals from Sensors (Temperature, Humidity, Ambient lighting) were never sent/incorrectly sent.Malfunctioning Sensor ansure that accurate feedback signals be guaranteed to malfunctions of the Sensors shall be guaranteed to malfunctions of the Sensors and notifications must be issuedAutonomousDriveController believes that because it was referring to the feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received/incorrectly resultsThe feedback signals from Sensors referring to the feedback signals from Sensors of the feedback signals from Sensors of the feedback signals from Sensors referring to the feedback signals from Sensors of received/incorrectly resultsQuality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.The eshall be a mechanism to de the communication errorOutling and integrity of the communication of day, weather conditions andThe result accurate feedback signals from Sensors reserved/incorrectly reserved due to communication errors between Sensors &Outling and integrity of the communication and Sensors shall be guaranteed.The eshall be a mechanism to de the communication channel between AutonomousDriveController and AutonomousDriveController and AutonomousDriveController and						The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) were inadequately updated.	Inadequate Feedback	The feedback signals from the Sensors (Temperature,Humidity,AmbientLighting) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (Temperature,Humidity,AmbientLighting)
believes that because it was referring to the feedback signals from Sensors from Sensors of the feedback signals from Sensors from Sensors of the termine the time of day, weather conditions and The feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received/incorrectly received/incorrectly received/due to communication errors between Sensors & Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed. The reshall be a mechanism to due the communication channel between AutonomousDriveController and					AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals from Sensors (Temperature, Humidity, Ambient lighting) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
road conditions AutonomousDriveController,				Autor believ referr from 1 of day road (believes that because it was referring to the feedback signals from Sensors to determine the time of day , weather conditions and road conditions	The feedback signals from Sensors (Temperature,Humidity,AmbientLighting)were not received/incorrectly received due to communication errors between Sensors & AutonomousDriveController,	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors



			AutonomousDriveController believes that the throttle request provided is		The feedback size of feer Conner (Temperature		The control algorithm inside	lf Autonomous Drive Constralles is unable to
			appropriate for the weather conditions		The tecupack signals from Sensors (I emperature, Humidity, Ambient lighting)were correctly received, but were misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	AutonomousUnvectontroller shall be capable of processing the feedback signals from the Sensors (Temperature;Humidity;AmbientLighting) to to determine the time of day, weather conditions and road conditions	II AutonomousUnvec.ontroller is unable to process the feedback signals from the Sensors (Termperature,Humidity,AmbientLighting)accurat ely, it shall notify the Driver.
UCA-8.2.1	AutonomousDriveController provides incorrect(excessive) ADSThrottleRequest when ADS is enabled,weather conditions	н-3		AutonomousDriveController believes that because there is no feedback on the road surface conditions	There is no feedback to the AutonomousDriveController on road surface conditions	Missing Feedback	There shall be feedback to the AutonomousDriveController on road surface conditions from Sensors.	The AutonomousDriveController shall be able to identify road surface conditions from other available sources.
	are adverse(rain/snow/fog/ice on road) and there are lead vehicles on the CAV path.			AutonomousDriveController believes so because there is no feedback/input on the throttle performance requirements in adverse weather conditions	The design must include adequate feedback/inputs on throttle performance in adverse weather conditions	Missing Feedback	There shall be feedback to the AutonomousDriveController on the expected throttle performance in adverse weather conditions	The AutonomousDriveController shall be able to identify the expected throttle performance in adverse weather conditions from some other sources
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) to determine the presence/relative position of objects around the CW	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				position of objects around the CAV	The feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from the sensors	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequately to determine the presence and relative position/speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes		Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			that there are no lead vehicles in the CAV path	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
		o		The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly		The control algorithm inside AutonomousDriveController shall be capable of	If AutonomousDriveController is unable to	
					processed by theAutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from V2X	Misinterpreted Feedback	processing the reedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.



				AutonomousDriveController	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
				believes that because it was following the control algorithm to provide throttle request.	ADSThrottleRequest was correctly sent by AutonomousDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, ThrottleRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
			AutonomousDriveController believes that the throttle request provided was correct.		ADSThrottleRequest was correctly sent by AutonomousDriveController, but due to the mafunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
					ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
				AutonomousDriveController	Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
		H-4		beneves so because it was retering to ADSThrottleStatus feedback to determine the status of the throttle request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSThrottleStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
	AutonomousDriveController			AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the CAV speed	The IMUData feedback from Sensors is incorrect.	Inadequate Feedback	The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData
JCA-8.2.2	ADSThrottleRequest when ADS is enabled and the CAV current speed is the maximum allowed				The WheelSpeed feedback from Sensors is incorrect.	Inadequate Feedback	The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed
	for the zone of operation.				Correct feedback signals (IMUData & WheelSpeed) were issued by Sensors, but due to a communication error between Sensors and Autonomous Drive Controller, the signals were not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					Correct feedback signals (IMUData & WheelSpeed) were received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing IMUData & WheelSpeed to determine the actual vehicle speed	If AutonomousDriveController is unable to process IMUData & WheelSpeed, it shall notify the Driver
					Sensors are malfunctioning, hence feedback signals (IMUData & WheelSpeed) were never sent/incorrectly	Malfunctioning Sensor	Sensors shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Sensors and appropriate
			AutonomousDriveController believes		The 6DOFPosition&Orientation feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6DOFPosition&Orientation
			that the CAV current speed is well within the range allowed for the		The WheelRotations feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations
			current zone(average or less than	-	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
				AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
				believes so because it was referring to the feedback signals from Sensors to determine the speed limit for the current zone/road	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors



					The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The speed limit determined based on the processing of these input signals may be incorrect	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequately to determine the speed limit for the current zone/road	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
					The control algorithm that calculates throttle request is incorrect.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only when required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required, it shall notify the Driver.
				AutonomousDriveController	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was incorrectly sent. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
			AutonomousDriveController believes that the throttle request provided was correct.	following the control algorithm to provide throttle request.	ADSThrottleRequest was correctly sent by AutonomusDriveController, however due to errors in communication between AutonomousDriveController & VehicleActuators, ThrottleRequest was incorrectly received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					ADSThrottleRequest was correctly sent by AutonomousDriveController, but due to the mafunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to ADSThrottleStatus feedback to determine the status of the throttle request implementation	ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
					Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
					Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSThrottleStatus feedback is received, but it was misinterpreted by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
					The IMUData feedback from Sensors is incorrect.	Inadequate Feedback	The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData
					The WheelSpeed feedback from Sensors is incorrect.	Inadequate Feedback	The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed
	AutonomousDriveController provides incorrect(insufficient) ADSThrottleRequest when ADS				Correct feedback signals (IMUData & WheelSpeed) were issued by Sensors, but due to a communication error between Sensors and Autonomous Drive Controller, the signals were not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
UCA-8.2.3	is enabled, the CAV current speed is far below the maximum speed for the current zone of operation and there are vehicles approaching	Н-3,4		AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine the CAV speed	Correct feedback signals (IMUData & WheelSpeed) were received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing IMUData & WheelSpeed to determine the actual vehicle speed	If AutonomousDriveController is unable to process IMUData & WheelSpeed, it shall notify the Driver
	from behind. Note: This may lead to rear-				Sensors are malfunctioning, hence feedback signals (IMUData & WheelSpeed) were never sent/incorrectly sent.	Malfunctioning Sensor	Sensors shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Sensors and appropriate notifications must be issued to the Driver
	ena collision				The 6DOFPosition&Orientation feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6DOFPosition&Orientation
			AutonomousDriveController believes that the CAV current speed is optimum for the current zone frood		The WheelRotations feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations
		1	for the current zone /road		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)



		Aut	AutonomousDriveController	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued	
				believes so because it was referring to the feedback signals from Sensors to determine the speed limit for the current zone/road	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The speed limit determined based on the processing of these input signals may be incorrect.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine the speed limit for the current zone/road	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
			AutonomousDriveController believes that there are no fast-moving vehicles approaching the CAV	AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The distance to the objects and their relative position/speed are miscalculated based on the feedback signals from V2X	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSThrottleRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required or issues ADSThrottleRequest when not required, it shall notify the Driver.
			AutonomousDriveController believes	AutonomousDriveController believes that because it was following the control algorithm to not provide throttle request.	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was fault-issued. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
					ADSThrottleRequest was not sent by AutonomousDriveController, but due to the malfunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
			that it has not provided ADSThrottleRequest		ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
				AutonomousDriveController	Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued
			beli to A det reg	believes so because it was referring to ADSThrottleStatus feedback to determine the status of the throttle request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSThrottleStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)



	AutonomousDriveController provides ADSThrottleRequest when the CAV is operating on a motorway / jammed highway ramp/dense urban road. ADS is	a Aut beli	AutonomousDriveController believes so because it was referring	Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued	
UCA-8.3.1	ramp/dense urban road, ADS is enabled, and the CAV is approaching a significant obstacle(eg: stationary vehicle, blocked lane of travel.	H-1,3		believes so because it was referring to the feedback signals from Sensors to determine the presence / position of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
	decelerating lead vehicle, vehicle cutting in etc.)/or a VRU in its path.				The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) adequately to determine the presence / position of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.
					The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
			AutonomousDriveController believes	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
			that there are no obstacles or VRUs ahead of the CAV.		Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
			Autonomo believes so to the feed determine objects aro		The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the presence/position of objects around the CAV	The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
					Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
					The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The relative position of obstacles/VRUs calculated by the AutonomousDriveController may be inoccurate.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSThrottleRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required or issues ADSThrottleRequest when not required, it shall notify the Driver.
				AutonomousDriveController believes that because it was following the control algorithm to not provide throttle request.	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was fault-issued. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver
			Autonomous DriveController heliours		ADSThrottleRequest was not sent by AutonomousDriveController, but due to the mafunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued
			that it has not provided ADSThrottleRequest		ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.
			A	AutonomousDriveController	Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued



			b tr d	believes so because it was referring to ADSThrottleStatus feedback to determine the status of the throttle request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController,ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSThrottleStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.
					The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued
	AutonomousDriveController provides ADSThrottleRequest when ADS is enabled, the CAV	H-1,3,4	1,3,4 AutonomousDriveController believes that it is not approaching a red traffic light or pedestrian crossing with VRUs	AutonamousDriveController believes so because It was referring to the feedback signal from Sensors to determine the presence / relative position and speed of objects around the CAV	Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
UCA-8.3.	is approaching a red traffic light or a pedestrian crossing and there are VRUs crossing the road				The feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController. Note: The traffic light colour must be adequately detected even there is dust/dirt over it. The VRUs actions must be predictable based on their relative position, movements and orientation.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the presence / position of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,Rawimage, etc) accurately, it shall notify the Driver.
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).
					Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued
					Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps
					The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (MapImage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.
					The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).
					V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued
				AutonomousDriveController believes so because it was referring to the feedback signal from V2X to determine the the presence /	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
				relative position and speed of objects around the CAV	The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController. Note: The traffic light colour must be adequately detected even there is dust/dirt over it. The VRUs actions must be predictable based on their relative position, movements and orientation.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine the presence and relative position/speed of objects around the CAV and predict their movements.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
					The control algorithm that sends ADSThrottleRequest is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall correctly issue ADSThrottleRequest when and only required	If AutonomousDriveController is unable to issue ADSThrottleRequest when required or issues ADSThrottleRequest when not required, it shall notify the Driver.



		-							
			Auti beli foli not	AutonomousDriveController believes that because it was following the control algorithm to not provide throttle request.	AutonomousDriveController is malfunctioning, hence, ADSThrottleRequest was fault-issued. Note: Molfunctioning could be coused by factors such as external disturbances.power supply failure,hardware faults etc.	Malfunctioning Controller	AutonomousDriveController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances.power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of AutonomousDriveController and appropriate notifications must be issued to the Driver	
			AutonomousDriveController believes		ADSThrottleRequest was not sent by AutonomousDriveController, but due to the maifunctioning actuator (VehicleMotionController), ThrottleRequest was incorrectly sent to the Vehicle Actuators.	Malfunctioning Actuator	Quality of the actuator from AutonomousDriveControleer to Vehicle Actuators shall be guaranteed to ensure that it propagates the appropriate command when required.	There shall be a mechanism to detect the malfunctions of the actuators and appropriate notifications issued	
			that it has not provided ADSThrottleRequest		ADSThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ADSThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ADSThrottleStatus signals.	
				AutonomousDriveController	Correct ThrottleStatus feedback is sent by VehicleActuators, but VehicleMotionController is malfunctioning, hence incorrect ADSThrottleStatus is sent	Malfunctioning Sensor	Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued	
					to ADSThrottleStatus feedback to determine the status of the throttle request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus is incorrectly received by AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Vehicle Actuators
					Correct ADSThrottleStatus feedback is received, but it was misinterpreted by AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing ADSThrottleStatus adequately	If AutonomousDriveController is unable to process ADSThrottleStatus, it shall notify the Driver.	
				AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to detect speed limit signs, relative position, and speed of objects around the CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrect	Inadequate Feedback	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)	
					Sensors are malfunctioning, hence the feedback signals (GPSData, PointCloud, RadarData, RawImage, etc) were never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued	
					Due to communication errors between Sensors & AutonomousDriveController, the feedback from the Sensors were never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors	
	AutonomousDriveController				The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are correct, but they are misinterpreted or improperly processed by the AutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData, RawImage, etc) adequately to determine speed limits, relative position, and speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData, Rawimage, etc) accurately, it shall notify the Driver.	
UCA-8.3.3	provides ADSThrottleRequest when the CAV is approaching a slower speed zone and there	H-4,3			The feedback signal from the Map (MapImage) is incorrect	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Map (MapImage).	
	are obstacles(eg: decelerating vehicles) ahead.				Map module is malfunctioning, hence the feedback signal (MapImage) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the Maps shall be guaranteed to ensure that accurate MapImage feedback signal is sent	There shall be a mechanism to detect the malfunctions of the Maps and appropriate notifications issued	
			AutonomousDriveController believes that the throttle request / current vehicle speed is appropriate for the	AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	Due to communication errors between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Maps shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Maps	
		AutonomousDriveController believes that the throttle request / current vehicle speed is appropriate for the circumstances			The feedback signal from the Map (MapImage) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from the Map (Mapimage) adequately to determine the CAV position	If AutonomousDriveController is unable to process the feedback signal from the Map (MapImage), it shall notify the Driver.	
				Т	The feedback signal from the V2X (V2XObjectData) is incorrect	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from from the V2X (V2XObjectData).	
	c			V2X is malfunctioning, hence the feedback signal (V2XObjectData) was never sent/incorrectly sent.	Malfunctioning Sensor	The quality of the V2X shall be guaranteed to ensure that accurate V2XObjectData feedback signal is sent	There shall be a mechanism to detect the malfunctions of the V2X and appropriate notifications issued		



			believes so because it was referring to the feedback signal from V2X to detect speed limit signs, presence / relative position, and speed of objects around the CAV	Due to communication errors between V2X & AutonomousDriveController, feedback signal from the V2X (V2XObjectData) was never received/incorrectly received by the AutonomousDriveController.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and V2X shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and V2X
			r p	The feedback signal from the V2X (V2XObjectData) is correct, but it is misinterpreted or improperly processed by theAutonomousDriveController.	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signal from V2X (V2XObjectData) adequately to determine speed limits, presence / relative position, and speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signal from V2X (V2XObjectData), it shall notify the Driver.
				The IMUData feedback from Sensors is incorrect.	Inadequate Feedback	The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData
			AutonomousDriveController believes so because it was referring to the feedback signals from Sensors to determine vehicle speed	The WheelSpeed feedback from Sensors is incorrect.	Inadequate Feedback	The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed
				Correct feedback signals (IMUData & WheelSpeed) were issued by Sensors, but due to a communication error between Sensors and Autonomous Drive Controller, the signals were not correctly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors
				Correct feedback signals (IMUData & WheelSpeed) were received but misinterpreted by the flawed control algorithm of the AutonomousDriveController	Misinterpreted Feedback	The control algorithm inside AutonomousDriveController shall be capable of processing IMUData & WheelSpeed to determine the actual vehicle speed	If AutonomousDriveController is unable to process IMUData & WheelSpeed, it shall notify the Driver
				Sensors are malfunctioning, hence feedback signals (IMUData & WheelSpeed) were never sent/incorrectly sent.	Malfunctioning Sensor	Sensors shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Sensors and appropriate notifications must be issued to the Driver
				The 6DOFPosition&Orientation feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6DOFPosition&Orientation
				The WheelRotations feedback from Vehicle Actuators is incorrect	Inadequate Feedback	The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations
			AutonomousDriveController believes that because it was following the control algorithm to provide ADSThrottleRequest	The specified control algorithm that calculates when to issue ADSThrottleRequest is flawed.	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue throttle request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
				The specified control algorithm that calculates when to issue ADSThrottleRequest is too complicated and there is a processing delay.	Processing Delay	The AutonomousDriveController control algorithm shall be optimized to ensure that throttle request is issued at the right time	If the processing time for the calculation of the throttle request exceeds a defined threshold value, appropriate notifications shall be issued
				ADSThrottleRequestt was issued at the right time, but due to communication delay between AutonomousDriveController and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ADSThrottleRequest due to communication delays and appropriate notifications issued
		AutonomousDriveController believes that it has provided ADSThrottleRequest at the right time		The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators was degraded, causing a delay in implementing the command.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications issued to carry out maintenance/replacement.
				The ADSThrottleStatus feedback was delayed.	Delayed Feedback	The ADSThrottleStatus shall be updated to indicate the actual status of throttle implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSThrottleStatus.
	Autor believ refer feedb the br	AutonomousDriveController believes that because it was	ThrottleStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & AutonomousDriveController, ADSThrottleStatus was not received on time.	Communication Delay from Controlled Process to Controller	The delays in the communication channel between AutonomousDriveController and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ADSThrottleStatus due to communication delays and appropriate notifications issued	
		referring to the ADSBrakeStatus feedback to determine the status of the brake request implementation	Correct ThrottleStatus feedback was issued, but due to sensor degradations, ADSThrottleStatus was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSThrottleStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of ADSThrottleStatus due to sensor degradations and issue notifications to carry out maintenance/replacement.	
			AutonomousDriveController received updated ADSThrottleStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSThrottleStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSThrottleStatus exceeds a defined threshold value,appropriate notifications shall be issued	



	AutonomousDriveController provides ADSThrottleRequest too late when ADS is enabled, the CAV has entered a higher		AutonomousDriveController believes	AutonomousDriveController believes that because it was referring to EnableAD to determine the ADS status.	The EnableAD command from HMI was delayed.	Delayed Control Input	The EnableAD command from HMI shall be received by the Autonomous Drive Controller within a specified duration once the Driver has requested for activation of ADS.	There shall be a mechanism to detect delays in issuing EnableAD.
UCA-8.5.1	speed zone, the current vehicle speed is far below the maximum speed for the current zone of operation, there are no obstacles ahead	н-3,4	control of the DDT	AutonomousDriveController believes that because there is no feedback on which entity is in control(Driver or ADS) of the CAV	The feedback to AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV is missing	Missing Feedback	There shall be feedback to the AutonomousDriveController regarding which entity is in control(Driver or ADS) of the CAV	The AutonomousDriveController shall be able to identify which entity is in control(Driver or ADS) of the CAV from other available sources.
	of the CAV and there are accelerating vehicles approaching from behind. Note: This may lead to rear- end collision			AutonomousDriveController	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were inadequately updated.	Inadequate Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to performance limitations owing to adverse weather and time of day
				believes so because it was referring to the feedback signals from Sensors to determine the speed for the current road/zone of operation and the relative speed and position of vehicles around CAV	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) were not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
			AutonomousDriveController believes that the throttle request provided is appropriate for the current road/zone of operation		The feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) were received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
				AutonomousDriveController believes so because it was referring to the feedback signal from Maps to determine the CAV position	The feedback signal from the Map (MapImage) was inadequately updated.	Inadequate Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
					The feedback signal from the Map (MapImage) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
					The feedback signal from the Map (MapImage)was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
					The feedback signal from the V2X (V2XObjectData) was inadequately updated.	Inadequate Feedback	The feedback signal from the V2X (V2XObjectData) shall be updated on time to indicate the actual status of presence/position of objects around the CAV	There shall be a mechanism to detect delayed feedback signal from the V2X (V2XObjectData)
					The feedback signal from the V2X (V2XObjectData) was not received on time due to communication delays	Communication Delay	The delays in the communication channel between AutonomousDriveController and V2X shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the V2X (V2XObjectData) due to communication delays
					The feedback signal from the V2X (V2XObjectData) was received on time, but there was a delay in processing the data.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the feedback signal from the V2X (V2XObjectData) within a specified duration of time.	If the time taken by AutonomousDriveController to process the feedback signal from the V2X (V2XObjectData) exceeds a defined threshold value, appropriate notifications shall be issued
					The control algorithm that calculates the duration of throttle request is incorrect	Faulty Control Algorithm	The AutonomousDriveController control algorithm shall issue throttle request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the AutonomousDriveController control algorithm and issue appropriate notifications
			AutonomousDriveController believes that it has stopped providing ADSThrottleRequest.	AutonomousDriveController believes that because it was following the control algorithm to stop providing throttleRequest.	AutonomousDriveController stops sending ADSThrottleRequest at the correct time, but due to communication delay between the AutonomousDriveController and the Vehicle Actuators, ThrottleRequest was not received on time.	Communication Delay	The communication channel between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that the ADSThrottleRequest is updated on time.	There shall be a mechanism to detect incorrectly received ADSThrottleRequest due to communication delays and appropriate notifications issued
				stop providing throttlekequest.	AutonomousDriveController stops sending ADSThrottleRequest at the correct time, but due to degradation of the actuators(Vehicle Motion Controller), it was responding late.	Actuator Degradation	The actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(VehicleMotionController) between AutonomousDriveController and Vehicle Actuators and notifications and issue notifications to carry out maintenance/replacement.



		Auton believ		The ADSThrottleStatus feedback was delayed.	Delayed Feedback	The ADSThrottleStatus shall be updated to indicate the actual status of throttle implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ADSThrottleStatus.	
				AutonomousDriveController believes that because it was referring to the ADSThrottleStatus to determine the status of throttle request implementation	Correct ThrottleStatus feedback was issued, but due to sensor degradations, the ADSThrottleStatus feedback was not updated on time.	Sensor Degradation	The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSThrottleStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of ADSThrottleStatus due to sensor degradations and issue notifications to carry out maintenance/replacement.
1104 9 6 1	AutonomousDriveController provides ADSThrottleRequest too long when ADS is enabled				AutonomousDriveController received updated ADSThrottleStatus feedback on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing ADSThrottleStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSThrottleStatus exceeds a defined threshold value,appropriate notifications shall be issued
004-8.0.1	and the CAV is manoeuvering a bend/sharp curve or around a static obstacle in its path.	11-2,5			The feedback signal from the Map (MapImage) is incorrectly updated, ie it doesn't adequately represent the road curvature/layout.	Delayed Feedback	The feedback signal from the Map (MapImage) shall be updated on time to indicate the actual position of the CAV	There shall be a mechanism to detect delayed feedback signal from the Map (MapImage)
				AutonomousDriveController believes so because It was referring to the feedback signal from Maps to determine the CAV position and the road curvature	Due to communication delays between Maps & AutonomousDriveController, the feedback feedback signal from the Map (MapImage) was not received on time	Communication Delay	The delays in the communication channel between AutonomousDriveController and Maps shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signal from the Map (MapImage) due to communication delays
					The feedback signal from the Map (MapImage) is received on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signal from the Map (MapImage) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signal from the Map (MapImage) exceeds a defined threshold value, appropriate notifications shall be issued
		AutonomousDriveController be that it has already navigated th bend/curve or around the stati obstacle	AutonomousDriveController believes that it has already navigated the sharp bend/curve or around the static obstacle	AutonomousDriveController believes so because it was referring to the feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) to determine the presence/relative position of objects around the CAV and lane markings/boundaries	The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) are incorrectly updated.	Delayed Feedback	The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)
					Due to communication delays between Sensors & AutonomousDriveController, the feedback signals from the Sensors were not received on time	Communication Delay	The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays
					The feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) are received on time, but there was a delay in processing the feedback signals.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,Rawimage, etc) exceeds a defined threshold value, appropriate notifications shall be issued
				VehicleMotionController believes so because it correctly followed the control algorithm to provide brake request	The control algorithm within VehicleMotionController that sends brake request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue BrakeRequest when and only when required	There shall be a mechanism for the detection of BrakeRequest issued incorrectly
					VehicleMotionController is malfunctioning, hence, BrakeRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
	VehicleMotionController does		VehicleMotionController believes that it has provided brake Request		BrakeRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
	not provide BrakeRequest when ADS is enabled, Autonomous Drive Controller			VehicleMotionController believes so	BrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The BrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous BrakeStatus signals.
UCA-9.1.1	has issued a brake request and the CAV is in a situation where deceleration is required(approaching a slow	H-1,2,3,4		because it was referring to the BrakeStatus feedback to determine the status of brake request implementation	Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
	speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide			inpenentation	Correct BrakeStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing BrakeStatus adequately	If VehicleMotionController is unable to process BrakeStatus adequately, appropriate notifications shall be issued
	trame ingn, about to coilide with an obstacle or a VRU, performing a MRM etc.).	ubdut to collide acte or a VRU, I MRM etc.).	VehicleMotionController believes that it should not send brake request	VehicleMotionController believes that because it correctly followed the control algorithm not to send brake request.	The specified control algorithm that determines when to send brake request is incorrect.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue BrakeRequest when and only when required	There shall be a mechanism for the detection of BrakeRequest issued incorrectly
			VehicleMotionController believes that		VehicleMotionController believes that because it was referring to the	Although ADSBrakeRequest was issued by Autonomous Drive Controller, due to communication errors it was never received by the VehicleMotionController	Communication Error	Quality and integrity of the communication channel between Autonomous Drive Controller and VehicleMotionController shall be guaranteed



			issued a brake request Autonomous Drive	ADSBrakeRequest from Autonomous Drive Controller	ADSBrakeRequest was correctly received by VehicleMotionController, but is misinterpreted by the control algorithm inside VehicleMotionController	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing ADSBrakeRequest adequately	If VehicleMotionController is unable to process ADSBrakeRequest adequately, appropriate notifications shall be issued
				VehicleMotionController believes	The control algorithm within VehicleMotionController that sends brake request is incorrect Note: There may be an arbitration error. The algorithm must prioritize Driver requests over ADS requests.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall prioritize valid driver requests over ADS requests	There shall be a mechanism for the detection of BrakeRequest issued incorrectly
			VehicleMotionController believes that the brake request provided was correct.	that because it was following the control algorithm to provide brake request.	VehicleMotionController is malfunctioning, hence, BrakeRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
	VehicleMotionController provides incorrect BrakeRequest when Driver has provided an override and the CAV is in a situation where deceleration is required(approaching a slow speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.)				BrakeRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received correctly by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
UCA-9.2.1		H-1,2,3,4,5		VehicleMotionController believes so because it was referring to the BrakeStatus feedback to determine the status of brake request implementation	BrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The BrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous BrakeStatus signals.
					Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
					Correct BrakeStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing BrakeStatus adequately	If VehicleMotionController is unable to process BrakeStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that	VehicleMotionController believes so	The DriverBrakeRequest was never received due to communication errors	Communication Error	Quality and integrity of the communication channel between the Driver and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between the Driver and VehicleMotionController.
			Driver has not provided an override	DriverBrakeRequest from the Driver	The DriverBrakeRequest was correctly received, but misinterpreted by the control algorithm inside Vehicle Motion Controller	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing DriverBrakeRequest adequately	If VehicleMotionController is unable to process DriverBrakeRequest adequately, appropriate notifications shall be issued
	VehicleMotionController		VehicleMotionController believes that it has not provided brake Request	VehicleMotionController believes so because it correctly followed the control algorithm to not provide brake request	The control algorithm within VehicleMotionController that sends brake request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue BrakeRequest when and only when required	There shall be a mechanism for the detection of BrakeRequest issued incorrectly
		u 2			VehicleMotionController is malfunctioning, hence, BrakeRequest was fault issued.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
UCA-9 3 1	ADS is enabled, no brake request has been issued by the Autonomous Drive Controller			VehicleMotionController believes so because it was referring to the BrakeStatus feedback to determine the status of brake request	BrakeStatus feedback incorrectly reflects the status of brake request implementation	Inadequate Feedback	The BrakeStatus feedback shall reflect the actual status of brake implementation.	There shall be a mechanism for the detection of incorrect/erroneous BrakeStatus signals.
	or the Driver, there are no obstacles or VRUs ahead of the CAV and there are vehicles				Correct BrakeStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
	Tonowing closely bening.			Imperientation	Correct BrakeStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing BrakeStatus adequately	If VehicleMotionController is unable to process BrakeStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that it must provide brake Request	VehicleMotionController believes so because it correctly followed the control algorithm to provide brake request	The control algorithm within VehicleMotionController that determines when to provide brake request is faulty.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue BrakeRequest when and only when required	There shall be a mechanism for the detection of BrakeRequest issued incorrectly
					The specified control algorithm that calculates when to issue BrakeRequest is flawed.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall issue BrakeRequest at the right time and for the required duration.	There shall be a mechanism to detect flaws with the VehicleMotionController control algorithm and appropriate notifications must be issued
				VehicleMotionController believes that because it was following the control algorithm to provide BrakeRequest	The specified control algorithm that calculates when to issue BrakeRequest is too complicated and there is a processing delay.	Processing Delay	The VehicleMotionController control algorithm shall be optimized to ensure that BrakeRequest is issued at the right time	If the processing time for the calculation of the BrakeRequest exceeds a defined threshold value, appropriate notifications shall be issued
	VehicleMotionController provides BrakeRequest too late when ADS is enabled, Autonomous Drive Controller				BrakeRequest was issued at the right time, but due to communication delay between Vehicle Motion controller and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between Vehicle Motion controller and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received BrakeRequest due to communication delays and appropriate notifications issued
UCA-9.5.1	Autonomous Drive Controller has issued a brake request and the CAV is in a situation where CA-9.5.1 deceleration is	H-1,2,3,4	VehicleMotionController believes that H-1,2,3,4 it has provided BrakeRequest at the		The BrakeStatus feedback was delayed.	Delayed Feedback	The BrakeStatus shall be updated to indicate the actual status of brake implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed BrakeStatus.



	speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.).		right time	VehicleMotionController believes that because it was referring to the BrakeStatus feedback to determine the status of the brake request	BrakeStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & VehicleMotionController, BrakeStatus was not received on time.	Communication Delay	The delays in the communication channel between Vehicle Actuators & VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated BrakeStatus(due to communication delays) and appropriate notifications issued
	performing a MRM etc.).			implementation	VehicleMotionController received updated BrakeStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of VehicleMotionController shall be capable of processing BrakeStatus within a specified duration of time.	If the time taken by VehicleMotionController to process BrakeStatus exceeds a defined threshold value, appropriate notifications shall be issued
				VehicleMotionController believes that because it was referring to the ADSBrakeRequest from Autonomous Drive Controller	The ADSBrakeRequest was issued at the right time, but due to a communication delay between Autonomous Drive Controller and Vehicle Motion Controller, it was received late.	Communication Delay	The delays in the communication channel between Autonomous Drive Controller and Vehicle Motion Controller shall not exceed a defined threshold value.	There shall be a mechanism to detect delayed ADSBrakeRequest
					The control algorithm inside VehicleMotionController was degraded and therefore unable to issue the brake request anymore.	Control Algorithm Degradation	The control algorithm inside VehicleMotionController shall be able to continuously process brake request when required.	There shall be a mechanism to detect failure to provide brake request continuously due to control algorithm degradation
	VehicleMotionController stops providing BrakeRequest too			VehicleMotionController believes that because it was following the control algorithm to provide brake request.	VehicleMotionController is degraded and hence BrakeRequest is not issued anymore.	Controller Degradations	VehicleMotionController shall be well maintained, ensuring that the brake request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide brake request continuously due to the degradation of VehicleMotionController
			VehicleMotionController believes that it is continuing to provide brake request		BrakeRequest was being issued, but due to degradation of the communication channel between VehicleMotionController and VehicleActuators, it was not received anymore.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that the brake request is continuously propagated.	There shall be a mechanism to detect failure to provide brake request continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
	Autonomous Drive Controller	d is H-1,2,3,4	request.	VehicleMotionController believes that because it was referring to the BrakeStatus feedback to determine the status of brake request implementation	The BrakeStatus feedback incorrectly indicates the brake implementation status.	Inadequate Feedback	The BrakeStatus shall correctly indicate the status of implementation of brake request.	There shall be a mechanism to detect incorrect BrakeStatus.
UCA-9.7.1	has issued a brace request and the CAV continues to be in a situation where deceleration is required(approaching a slow speed zone, navigating a sharp turn, at a roundabout or red traffic light, about to collide with an obstacle or a VRU, performing a MRM etc.)				Correct BrakeStatus feedback was issued, but due to degradation in the communication channel between VehicleMotionController and VehicleActuators, the feedback was not received anymore.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that BrakeStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated BrakeStatus continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
					VehicleMotionController receives correct BrakeStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The VehicleMotionController control algorithm shall be able to process BrakeStatus continuously	There shall be a mechanism to detect failure of the VehicleMotionController control algorithm to process BrakeStatus .
			VehicleMotionController believes that Autonomous Drive Controller has stopped providing brake request	VehicleMotionController believes that because it was referring to the ADSBrakeRequest from Autonomous Drive Controller	Autonomous Drive Controller is degraded and hence ADSBrakeRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that ADSBrakeRequest is continuously issued when needed.	There shall be a mechanism to detect a failure to provide ADSBrakeRequest continuously due to the degradation of AutonomousDriveController
					ADSBrakeRequest is issued but not received by the Vehicle Motion Controller due to degradation of the communication channel between Autonomous Drive Controller and Vehicle Motion Controller	Communication Degradation	The communication channel between AutonomousDriveController and Vehicle Motion Controller shall be well maintained, ensuring that ADSBrakeRequest is continuously propagated.	There shall be a mechanism to detect a failure in receiving ADSBrakeRequest continuously due to degradation of the communication channel between AutonomousDriveController and Vehicle Motion Controller
					The control algorithm within VehicleMotionController that sends steer request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue SteerRequest when required	There shall be a mechanism for the detection of SteerRequest issued incorrectly
	VehicleMotionController does not provide SteerRequest when ADS is enabled,			VehicleMotionController believes so because it correctly followed the control algorithm to provide steer request	VehicleMotionController is malfunctioning, hence, SteerRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times. Note: Malfunctioning could be caused by factors such as external disturbances,power supply failure,hardware faults etc.	There shall be a mechanism to detect malfunctions of the VehicleMotionController and appropriate notifications must be issued to the Driver
			VehicleMotionController believes that it has provided steer Request		SteerRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionControllerand Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
UCA-10.1.1 Auto has i the (UCA-10.1.1 Steen Appr bloci VRU man turn, MRN	has issued a steer request and the CAV is in a situation where	H-1 2 3		VehicleMotionController believes so	SteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The SteerStatus feedback shall reflect the actual status of steer implementation.	There shall be a mechanism for the detection of incorrect/erroneous SteerStatus signals.
	steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or VRU in the lane of the CAV, maneuvering a sharp turn/bend/curve, performing a MRM etc.)	g. H-1,2,3 Ivehicle, rrks, or CAV, forming a	3	because it was referring to the SteerStatus feedback to determine the status of steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
				implementation	Correct SteerStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing SteerStatus adequately	If VehicleMotionController is unable to process SteerStatus adequately, appropriate notifications shall be issued



			VehicleMotionController believes that Autonomous Drive Controller has not	VehicleMotionController believes that because it was referring to the ADSteerPequest from Autonomous	Although ADSSteerRequest was issued by Autonomous Drive Controller, due to communication errors it was never received by the VehicleMotionController	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and VehicleMotionController
			issued a steer request	Drive Controller	ADSSteerRequest was correctly received by the VehicleMotionController, but is misinterpreted by the control algorithm inside VehicleMotionController	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing ADSSteerRequest adequately	If VehicleMotionController is unable to process ADSSteerRequest adequately, appropriate notifications shall be issued
				VehicleMotionController believes that because it was following the control algorithm to provide steer request.	The control algorithm within VehicleMotionController that sends steer request is incorrect Note: There may be an arbitration error. The algorithm must prioritize Driver requests over ADS requests.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall prioritize valid driver requests over ADS requests	There shall be a mechanism for the detection of SteerRequest issued incorrectly
			VehicleMotionController believes that the steer request provided was correct.		VehicleMotionController is malfunctioning, hence, SteerRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
	VehicleMotionController provides incorrect SteerRequest when Driver has provided an override and the CAV is in a situation where steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or VRU in the lane of the CAV, maneuvering a sharp	H-1,2,3,5			SteerRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received correctly by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
UCA-10.2.1				VehicleMotionController believes so because it was referring to the SteerStatus feedback to determine the status of steer request implementation	SteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The SteerStatus feedback shall reflect the actual status of steering implementation.	There shall be a mechanism for the detection of incorrect/erroneous SteerStatus signals.
					Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by the VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
	turny benay curve etc.y			Implementation	Correct SteerStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing SteerStatus adequately	If VehicleMotionController is unable to process SteerStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that	VehicleMotionController believes so because it was referring to the	The DriverSteerRequest was never received due to communication errors	Communication Error	Quality and integrity of the communication channel between the Driver and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between the Driver and VehicleMotionController.
			Driver has not provided an override	DriverSteerRequest from the Driver	The DriverSteerRequest was correctly received, but misinterpreted by the control algorithm inside Vehicle Motion Controller	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing DriverSteerRequest adequately	If VehicleMotionController is unable to process DriverSteerRequest adequately, appropriate notifications shall be issued
				VehicleMotionController believes so because it correctly followed the control algorithm to not provide steer request	The control algorithm within VehicleMotionController that sends steer request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue SteerRequest when and only when required	There shall be a mechanism for the detection of SteerRequest issued incorrectly
	VehicleMotionController				VehicleMotionController is malfunctioning, hence, SteerRequest was fault issued.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
UCA-10 3 1	provides SteerRequest when ADS is enabled, no steer request has been issued by the	H-1 2	VehicleMotionController believes that it has not provided steer Request	VehicleMotionController believes so	SteerStatus feedback incorrectly reflects the status of steer request implementation	Inadequate Feedback	The SteerStatus feedback shall reflect the actual status of steering implementation.	There shall be a mechanism for the detection of incorrect/erroneous SteerStatus signals.
000-10.5.1	Autonomous Drive Controller or the Driver, and there are vehicles or VRUs in adjacent lanes.	11 1,2		because it was referring to the SteerStatus feedback to determine the status of steer request implementation	Correct SteerStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
					Correct SteerStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing SteerStatus adequately	If VehicleMotionController is unable to process SteerStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that it must provide steer Request	VehicleMotionController believes so because it correctly followed the control algorithm to provide steer request	The control algorithm within VehicleMotionController that determines when to provide steer request is faulty.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue SteerRequest when and only when required	There shall be a mechanism for the detection of SteerRequest issued incorrectly
					The specified control algorithm that calculates when to issue SteerRequest is flawed.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall issue SteerRequest at the right time and for the required duration.	There shall be a mechanism to detect flaws with the VehicleMotionController control algorithm and appropriate notifications must be issued
	VehicleMotionController provides SteerRequest too late when ADS is enabled, Autonomous Drive Controller		Vel tha Cor Ste	VehicleMotionController believes that because it was following the control algorithm to provide SteerRequest S	The specified control algorithm that calculates when to issue SteerRequest is too complicated and there is a processing delay.	Processing Delay	The VehicleMotionController control algorithm shall be optimized to ensure that SteerRequest is issued at the right time	If the processing time for the calculation of the SteerRequest exceeds a defined threshold value, appropriate notifications shall be issued
					SteerRequest was issued at the right time, but due to communication delay between Vehicle Motion controller and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between Vehicle Motion controller and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received SteerRequest due to communication delays and appropriate notifications issued


	UCA-10.5.1	has issued a steer request and the CAV is in a situation where steering is required (eg. Approaching a parked vehicle, H blocked lane, road works, or VRII in the lane of the CAV and	H-1,2,3	VehicleMotionController believes that it has provided SteerRequest at the right time		The SteerStatus feedback was delayed.	Delayed Feedback	The SteerStatus shall be updated to indicate the actual status of steering implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed SteerStatus.
		blocked lane, road works, or VRU in the lane of the CAV and adjacent lanes are free; maneuvering a sharp		ngir une	VehicleMotionController believes that because it was referring to the SteerStatus feedback to determine the status of the steer request	SteerStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & VehicleMotionController, SteerStatus was not received on time.	Communication Delay	The delays in the communication channel between Vehicle Actuators & VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated SteerStatus(due to communication delays) and appropriate notifications issued
		turn/bend/curve, performing a MRM etc.)			implementation	VehicleMotionController received updated SteerStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of VehicleMotionController shall be capable of processing SteerStatus within a specified duration of time.	If the time taken by VehicleMotionController to process SteerStatus exceeds a defined threshold value, appropriate notifications shall be issued
					VehicleMotionController believes that because it was referring to the ADSSteerRequest from Autonomous Drive Controller	The ADSSteerRequest was issued at the right time, but due to a communication delay between Autonomous Drive Controller and Vehicle Motion Controller, it was received late.	Communication Delay	The delays in the communication channel between Autonomous Drive Controller and Vehicle Motion Controller shall not exceed a defined threshold value.	There shall be a mechanism to detect delayed ADSSteerRequest
		VahieleMationController		VehicleMotionController believes that it has stopped providing SteerRequest at the right time.	VehicleMotionController believes that because it was following the control algorithm to stop providing Steer request.	The control algorithm that calculates the duration of the steer request is incorrect.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall issue steer request at the right time and for the required duration.	There shall be a mechanism to detect flaws with the VehicleMotionController control algorithm and issue appropriate notifications
	10.6.1	ventuenduduction user provides SteerRequest too long when ADS is enabled, Autonomous Drive Controller has issued a steer request, weather conditions are adverse(heavy rain,snow,fog or ice on road) and the CAV is maneuvering a sharp turn/bend/curve, performing a MRM etc	H-2			VehicleMotionController stops sending SteerRequest at the correct time, but due to communication delay it was not received on time.	Communication Delay	The communication channel between VehicleMotionController and Vehicle Actuators shall be well maintained, ensuring that the SteerRequest is updated on time.	There shall be a mechanism to detect incorrectly received SteerRequest due to communication delays and appropriate notifications issued
UCA-10.0.1	UCA-10.8.1				VehicleMotionController believes that because it was referring to the	The SteerStatus feedback was delayed.	Delayed Feedback	The SteerStatus shall be updated to indicate the actual status of steering implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed SteerStatus.
					SteerStatus feedback to determine the status of steer request implementation.	VehicleMotionController received updated SteerStatus feedback on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of VehicleMotionController shall be capable of processing SteerStatus within a specified duration of time.	If the time taken by VehicleMotionController to process SteerStatus exceeds a defined threshold value, appropriate notifications shall be issued
				VehicleMotionController believes that it is continuing to provide brake	VehicleMotionController believes that because it was following the control algorithm to provide steer request.	The control algorithm inside VehicleMotionController was degraded and therefore unable to issue the steer request anymore.	Control Algorithm Degradation	The control algorithm inside VehicleMotionController shall be able to continuously process steer request when required.	There shall be a mechanism to detect failure to provide steer request continuously due to control algorithm degradation
						VehicleMotionController is degraded and hence SteerRequest is not issued anymore.	Controller Degradations	VehicleMotionController shall be well maintained, ensuring that the steer request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide steer request continuously due to the degradation of VehicleMotionController
		VehicleMotionController stops				SteerRequest was being issued, but due to degradation of the communication channel between VehicleMotionController and VehicleActuators, it was not received anymore/incorrectly received.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that the steer request is continuously propagated.	There shall be a mechanism to detect failure to provide steer request continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
		providing Steerkequest too soon when ADS is enabled, ADS has issued a steer request and the CAV is still in a		request.		The SteerStatus feedback incorrectly indicates the steer implementation status.	Inadequate Feedback	The SteerStatus shall correctly indicate the status of implementation of steering request.	There shall be a mechanism to detect incorrect SteerStatus.
	UCA-10.7.1	situation where steering is required (eg. Approaching a parked vehicle, blocked lane, road works, or VRU in the lane of the CAV, maneuvering a chart ture/band/curve	H-1,2,3		VehicleMotionController believes that because it was referring to the SteerStatus feedback to determine the status of steer request implementation.	Correct SteerStatus feedback was issued, but due to degradation in the communication channel between VehicleMotionController and VehicleActuators, the feedback was not received anymore.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that SteerStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated SteerStatus continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
		performing a MRM etc.)				VehicleMotionController receives correct SteerStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The VehicleMotionController control algorithm shall be able to process SteerStatus continuously	There shall be a mechanism to detect failure of the VehicleMotionController control algorithm to process SteerStatus continuously .
				VahicleMotionController, believes that	VehicleMotionController believes	Autonomous Drive Controller is degraded and hence ADSSteerRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that ADSSteerRequest is continuously issued when needed.	There shall be a mechanism to detect a failure to provide ADSSteerRequest continuously due to the degradation of AutonomousDriveController
				VenicleMotionController believes that Autonomous Drive Controller has stopped providing steer request	that because it was referring to the ADSSteerRequest from Autonomous Drive Controller	ADSSteerRequest is issued but not received by the Vehicle Motion Controller due to degradation of the communication channel between Autonomous Drive Controller and Vehicle Motion Controller	Communication Degradation	The communication channel between AutonomousDriveController and Vehicle Motion Controller shall be well maintained, ensuring that ADSSteerRequest is continuously propagated.	There shall be a mechanism to detect a failure in receiving ADSSteerRequest continuously due to degradation of the communication channel between AutonomousDriveController and Vehicle Motion Controller
						The control algorithm within VehicleMotionController that sends throttle request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue ThrottleRequest when required	There shall be a mechanism for the detection of ThrottleRequest issued incorrectly



			t t t t t t t t t t t t t t t t t t t	VehicleMotionController believes so because it correctly followed the control algorithm to provide throttle request	VehicleMotionController is malfunctioning, hence, ThrottleRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times. Note: Molfunctioning could be caused by factors such as external disturbances, power supply failure, hardware faults etc.	There shall be a mechanism to detect malfunctions of the VehicleMotionController and appropriate notifications must be issued to the Driver
	Vakiala Matina Canton Van dana		VehicleMotionController believes that it has provided throttle Request		ThrottleRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionControllerand Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
	when ADS is enabled,			Mahida Mada Araba II.a kalisa sa	ThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	TheThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ThrottleStatus signals.
UCA-11.1.1	Autonomous Drive Controller has issued a throttle request and there are vehicles approaching from behind.	H-3		Venice/wolding.com/oner-beneves so because it was referring to the ThrottleStatus feedback to determine the status of steer request implementation	Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
					Correct ThrottleStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing ThrottleStatus adequately	If VehicleMotionController is unable to process ThrottleStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that Autonomous Drive Controller has not issued a throttle request	VehicleMotionController believes that because it was referring to the ADSThrottleRequest from Autonomous Drive Controller	Although ADSThrottleRequest was issued by Autonomous Drive Controller, due to communication errors it was never received by the VehicleMotionController	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and VehicleMotionController
					ADSThrottleRequest was correctly received by the VehicleMotionController, but is misinterpreted by the control algorithm inside VehicleMotionController	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing ADSThrottleRequest adequately	If VehicleMotionController is unable to process ADSThrottleRequest adequately, appropriate notifications shall be issued
	VehicleMotionController provides incorrect Throttle Request(recessive) when the Driver has provided an override, weather conditions are adverse (rain/snow/fog/rec	H-2,3	VehicleMotionController believes that the throttle request provided was correct.	VehicleMotionController believes that because it was following the control algorithm to provide throttle request.	The control algorithm within VehicleMotionController that sends throttle request is incorrect Note: There may be an arbitration error. The algorithm must prioritize Driver requests over ADS requests.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall prioritize valid driver requests over ADS requests	There shall be a mechanism for the detection of ThrottleRequest issued incorrectly
					VehicleMotionController is malfunctioning, hence, ThrottleRequest was not sent out.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
					ThrottleRequest was sent by VehicleMotionController, however, due to errors in communication, it was not received correctly by the Vehicle Actuators.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
UCA-11.2.1				VehicleMotionController believes so because it was referring to the ThrottleStatus feedback to determine the status of throttle request implementation	ThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ThrottleStatus signals.
	on the road), the CAV is very close to the road border and there are lead vehicles on the CAV path.				Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors, it was incorrectly received by the VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators
					Correct ThrottleStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing ThrottleStatus adequately	If VehicleMotionController is unable to process ThrottleStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that	VehicleMotionController believes so because it was referring to the	The DriverThrottleRequest was never received due to communication errors	Communication Error	Quality and integrity of the communication channel between the Driver and VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between the Driver and VehicleMotionController.
			Driver has not provided an override	DriverThrottleRequest from the Driver	The DriverThrottleRequest was correctly received, but misinterpreted by the control algorithm inside Vehicle Motion Controller	Misinterpreted Control Input	The control algorithm inside VehicleMotionController shall be capable of processing DriverThrottleRequest adequately	If VehicleMotionController is unable to process DriverThrottleRequest adequately, appropriate notifications shall be issued
				VehicleMotionController believes so because it correctly followed the	The control algorithm within VehicleMotionController that sends throttle request is incorrect	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue ThrottleRequest when and only when required	There shall be a mechanism for the detection of ThrottleRequest issued incorrectly
UCA-11.3.1	VehicleMotionController provides ThrottleRequest when ADS is enabled, no			control algorithm to not provide throttle request	VehicleMotionController is malfunctioning, hence, ThrottleRequest was fault issued.	Malfunctioning Controller	VehicleMotionController shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of VehicleMotionController and appropriate notifications must be issued
	issued by the Autonomous Drive Controller or the Driver,	H-1 3 4	VehicleMotionController believes that it has not provided throttle Request	VehicleMotionController believes so because it was referring to the ThrottleStatus feedback to determine the status of throttle resurct implementation	ThrottleStatus feedback incorrectly reflects the status of throttle request implementation	Inadequate Feedback	The ThrottleStatus feedback shall reflect the actual status of throttle implementation.	There shall be a mechanism for the detection of incorrect/erroneous ThrottleStatus signals.
	and the CAV is approaching an is obstacle(eg: stationary vehicle, blocked lane of travel, decelerating lead vehicle, vehicle cutting in oth Vac a	H-1,3,4			Correct ThrottleStatus feedback is sent by VehicleActuators, but due to communication errors it was incorrectly received by VehicleMotionController.	Communication Error	Quality and integrity of the communication channel between VehicleMotionController and Vehicle Actuators shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between VehicleMotionController and Vehicle Actuators



	VRU or red traffic light sign in its path.			request implementation	Correct ThrottleStatus feedback is received, but it was misinterpreted by VehicleMotionController.	Misinterpreted Feedback	The control algorithm inside VehicleMotionController shall be capable of processing ThrottleStatus adequately	If VehicleMotionController is unable to process ThrottleStatus adequately, appropriate notifications shall be issued
			VehicleMotionController believes that it must provide throttle Request	VehicleMotionController believes so because it correctly followed the control algorithm to provide throttle request	The control algorithm within VehicleMotionController that determines when to provide throttle request is faulty.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall correctly issue ThrottleRequest when and only when required	There shall be a mechanism for the detection of ThrottleRequest issued incorrectly
					The specified control algorithm that calculates when to issue ThrottleRequest is flawed.	Faulty Control Algorithm	The VehicleMotionController control algorithm shall issue ThrottleRequest at the right time and for the required duration.	There shall be a mechanism to detect flaws with the VehicleMotionController control algorithm and appropriate notifications must be issued
				VehicleMotionController believes that because it was following the control algorithm to provide ThrottleRequest	The specified control algorithm that calculates when to issue ThrottleRequest is too complicated and there is a processing delay.	Processing Delay	The VehicleMotionController control algorithm shall be optimized to ensure that ThrottleRequest is issued at the right time	If the processing time for the calculation of the ThrottleRequest exceeds a defined threshold value, appropriate notifications shall be issued
	VehicleMotionController provides ThrottleRequest too late when ADS is enabled, Autonomous Drive Controller has issued a throttle request, there are no obstacles ahead of the CAV and there are vehicles following closely behind.				ThrottleRequest was issued at the right time, but due to communication delay between Vehicle Motion controller and Vehicle Actuators, the command was not received on time.	Communication Delay	The communication delay between Vehicle Motion controller and Vehicle Actuators shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly received ThrottleRequest due to communication delays and appropriate notifications must be issued
UCA-11.5.1		Н-3	VehicleMotionController believes that it has provided ThrottlerRequest at the right time		The ThrottleStatus feedback was delayed.	Delayed Feedback	The ThrottlerStatus shall be updated to indicate the actual status of throttle implementation with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed ThrottleStatus.
				VehicleMotionController believes that because it was referring to the ThrottleStatus feedback to determine the status of the throttle	ThrottleStatus feedback was issued on time, but due to a communication delay between Vehicle Actuators & VehicleMotionController, ThrottleStatus was not received on time.	Communication Delay	The delays in the communication channel between Vehicle Actuators & VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated ThrottleStatus(due to communication delays) and appropriate notifications issued
				request implementation	VehicleMotionController received updated ThrottleStatus on time, but there was a delay in processing the feedback.	Processing Delay	The control algorithm of VehicleMotionController shall be capable of processing ThrottleStatus within a specified duration of time.	If the time taken by VehicleMotionController to process ThrottleStatus exceeds a defined threshold value, appropriate notifications shall be issued
				VehicleMotionController believes that because it was referring to the ADSThrottleRequest from Autonomous Drive Controller	The ADSThrottleRequest was issued at the right time, but due to a communication delay between Autonomous Drive Controller and Vehicle Motion Controller, it was received late.	Communication Delay	The delays in the communication channel between Autonomous Drive Controller and Vehicle Motion Controller shall not exceed a defined threshold value.	There shall be a mechanism to detect delayed ADSThrottleRequest
			VehicleMotionController believes that it is continuing to provide throttle	VehicleMotionController believes that because it was following the control algorithm to provide throttle request.	The control algorithm inside VehicleMotionController was degraded and therefore unable to issue the throttle request anymore.	Control Algorithm Degradation	The control algorithm inside VehicleMotionController shall be able to continuously process throttle request when required.	There shall be a mechanism to detect failure to provide throttle request continuously due to control algorithm degradation
					VehicleMotionController is degraded and hence ThrottleRequest is not issued anymore.	Controller Degradations	VehicleMotionController shall be well maintained, ensuring that the throttle request is continuously issued when needed.	There shall be a mechanism to detect a failure to provide throttle request continuously due to the degradation of VehicleMotionController
					ThrottleRequest was being issued, but due to degradation of the communication channel between VehicleMotionController and VehicleActuators,it was not received anymore.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that the throttle request is continuously propagated.	There shall be a mechanism to detect failure to provide throttle request continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
	VehicleMotionController stops providing ThrottleRequest too		request.		The ThrottleStatus feedback incorrectly indicates the throttle implementation status.	Inadequate Feedback	TheThrottle Status shall correctly indicate the status of implementation of throttlerequest.	There shall be a mechanism to detect incorrect ThrottleStatus.
UCA-11.7.1	soon when ADS is enabled and providing ADSThrottleRequest, there are no obstacles ahead of the CAV and there are vehicles following closely behind.	н-3		VehicleMotionController believes that because it was referring to the ThrottleStatus feedback to determine the status of throttle request implementation.	Correct ThrottleStatus feedback was issued, but due to degradation in the communication channel between VehicleMotionController and VehicleActuators, the feedback was not received anymore/incorrectly received.	Communication Degradation	The communication channel between VehicleMotionController and VehicleActuators shall be well maintained, ensuring that ThrottleStatus is continuously propagated.	There shall be a mechanism to detect a failure in receiving updated ThrottleStatus continuously due to degradation of the communication channel between VehicleMotionController and VehicleActuators
					VehicleMotionController receives correct ThrottleStatus, but due to control algorithm degradation, it is unable to process the feedback anymore.	Control Algorithm Degradation	The VehicleMotionController control algorithm shall be able to process ThrottleStatus continuously	There shall be a mechanism to detect failure of the VehicleMotionController control algorithm to process ThrottleStatus continuously .
			VehicleMotionController believes that Autonomous Drive Controller has stopped providing throttle request	VehicleMotionController believes	Autonomous Drive Controller is degraded and hence ADSThrottleRequest is not issued anymore.	Controller Degradations	AutonomousDriveController shall be well maintained, ensuring that ADSThrottleRequest is continuously issued when needed in a timely manner.	There shall be a mechanism to detect a failure to provide ADSThrottleRequest continuously due to the degradation of AutonomousDriveController
				that because it was referring to the ADSThrottleRequest from Autonomous Drive Controller	ADSThrottleRequest is issued but not received by the Vehicle Motion Controller due to degradation of the communication channel between Autonomous Drive Controller and Vehicle Motion Controller	Communication Degradation	The communication channel between AutonomousDriveController and Vehicle Motion Controller shall be well maintained, ensuring that ADSThrottleRequest is continuously propagated.	There shall be a mechanism to detect a failure in receiving ADSThrottleRequest continuously due to degradation of the communication channel between AutonomousDriveController and Vehicle Motion Controller



						The user manual/procedure that instructs the Driver how and when to provide brake request is missing in the design	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide braking request.	Driver must be able to determine when and how to provide braking request from some other sources
					Driver believes that because they thought they had correctly followed the user	DriverBrakeRequest is sent out, but due to communication error between the Driver Inputs (brake pedal) and the VehicleMotionController, the signal is not received.	Communication Error	Quality and integrity of the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController
				Driver believes that they have	manual/procedure to send braking request.	The brake pedal is malfunctioning, hence the braking request was not sent.	Malfunctioning Actuator	The quality of the actuator (brake pedal) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (brake pedal) and appropriate notifications must be issued
						The driver is not competent enough (poor driving skills, knowledge/memory,inadequate training etc.) and hence unable to provide brake request appropriately.	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
		Driver deer net provide	H-13		Driver believes that because they were referring to the feedback indicating brake request	DriverBrakeStatus was sent correctly, but due to communication error between VehicleMotionController & Driver Inputs (Brake Pedal), it was not received /incorrectly received	Communication Error	Quality and integrity of the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController
	UCA-3.1.1	DriverBrakeRequest when ADS is disabled and the CAV is			implementation	DriverBrakeStatus was inadequately updated	Inadequate Feedback	The DriverBrakeStatus shall correctly indicate the status of implementation of driver brake request.	There shall be a mechanism to detect incorrect DriverBrakeStatus.
		about to collide with a significant obstacle or a VRU in		Driver believes that ADS is still enabled and hence there is no need to provide braking inputs.		DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate	There shall be a mechanism to detect incorrect DisplayedADStatus
		its path.			Driver believes that because they were referring to the	Correct ADMode was sent from AutonomousDriveController, but due to communication errors between AutonomousDriveController and HMI, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
					UISPIAYEDAUStatus feedback on HMI to determine whether ADS was enabled or disabled	The DisplayedADStatus shown on the HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
						Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was incorrectly updated.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
				Driver believes that there is no collision risk	Driver believes that because they had referred to the user manual and were not attentive/aware of the driving environment.	The user manual does not inform the driver that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
					Driver believes that because there was no feedback/warning on objects (dynamic and static) too close to the CAV.	The feedback/warning to the driver from the HMI on objects (dynamic and static) too close to the CAV is missing. Note: This is missing in the req/design.	Missing Feedback	There must be HMI feedback to the Driver on objects too close to the CAV posing a collision risk.	The Driver must be made aware of obstacles in the close vicinity of the CAV through other soureces
						The user manual/procedure that instructs the Driver how and when to provide brake request is missing in the design	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide braking request.	Driver must be able to determine when and how to provide braking request from some other sources
					Driver believes that because they thought they had correctly followed the user	DriverBrakeRequest is sent out, but due to communication error between the Driver Inputs (brake pedal) and the VehicleMotionController, the signal is not received.	Communication Error	Quality and integrity of the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController
				Driver believes that they have	manual/procedure to send braking request.	The brake pedal is malfunctioning, hence the braking request was not sent.	Malfunctioning Actuator	The quality of the actuator (brake pedal) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator (brake pedal) and appropriate notifications must be issued
				provides the proke inputs		The driver is not competent enough (poor driving skills, knowledge/memory,inadequate training etc.) and hence unable to provide brake request appropriately.	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
		Driver does not provide DriverBrakeRequest when ADS	s		Driver believes that because they were referring to the feedback indicating brake request	DriverBrakeStatus was sent correctly, but due to communication error between VehicleMotionController & Driver Inputs (Brake Pedal), it was not received /incorrectly received	Communication Error	Quality and integrity of the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController
ل UCA-3.1.2 ii ہ	s disabled and the CAV is pproaching a red traffic light ignal.	It H-4		implementation E	DriverBrakeStatus was inadequately updated	Inadequate Feedback	The DriverBrakeStatus shall correctly indicate the status of implementation of driver brake request.	There shall be a mechanism to detect incorrect DriverBrakeStatus.	
	sign					DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
1									



		Driver believes that ADS is enabled and hence there is no need to provide	Driver believes that because they were referring to the DisplayedADStatus feedback on	Correct ADMode was sent from AutonomousDriveController, but due to communication errors between AutonomousDriveController and HMI, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI	
			braking inputs.	HMI to determine whether ADS was enabled or disabled	The DisplayedADStatus shown on the HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
					Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was incorrectly updated.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
			Driver believes that the CAV is not approaching a red traffic light	Driver believes that because they were not attentive/aware of the driving environment.	The user manual does not inform the driver that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
					The specified user manual/procedure that instructs how and when to provide brake is missing/inadequate	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide braking request in a timely manner.	Driver must be able to determine when and how to provide braking request from some other sources
	Driver provides DriverBrakeRequest too late when ADS is disabled and the CAV is about to collide with a significant obstacle or a VRU in its path.		Driver believes that they have provided the brake inputs at the right time.	Driver believes that because they thought they had correctly followed the procedure to send braking	DriverBrakeRequest is sent out at the right time, but due to a communication delay between the Driver Inputs (brake pedal) and the VehicleMotionController, it was not received on time.	Communication delay	The delays in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DriverBrakeRequest(due to communication delays) and appropriate notifications issued
		H-1,3		request.	The Driver Inputs (brake pedal) is degraded, hence DriverBrakeRequest was sent late.	Actuator Degradation	The actuator(brake pedal) shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(brake pedal) and issue notifications to carry out maintenance/replacement.
					The driver is not competent enough (poor driving skills, knowledge,inadequate training etc.) and hence unable to provide brake request appropriately(at the right time).	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
			Driver believes that the CAV is not approaching or too close to an obstacle or VRU	Driver believes that because there is no feedback to the driver on the static and dynamic objects in the close vicinity of the CAV and their position.	There is no feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
UCA-3.5.1				Driver believes that because there is no feedback to the driver from the AutonomousDriveController that the driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	There is no feedback to the driver from the AutonomousDriveController that the driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status). Note: This is missing in the req/design.	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
					The DisplayedADStatus was inadequately updated.	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
				Driver believes that because he was referring to the DisplayedADStatus	ADMode was issued from AutonomousDriverController at the right time, but due to delay in communication between AutonomousDriverController and HMI, the DisplayedADStatus was not updated on time.	Communication Delay	The delays in the communication channel between AutonomousDriverController and HMI shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DisplayedADStatus(due to communication delays) and appropriate notifications issued
			Driver believes that ADS is still enabled	feedback on HMI to determine whether ADS was enabled or disabled	HMI was degraded, hence DisplayedADStatus was Inadequately updated.	Sensor Degradation	The HMI shall be well maintained, ensuring that it updates DisplayedADStatus in a timely manner.	There shall be a mechanism to detect degradations of the HMI and issue notifications to carry out maintenance/replacement.
					Correct DisplayedADStatus was displayed on the HMI, but the information was complicated /confusing, and hence caused delays for the Driver to interpret the information.	Processing Delay	The DisplayedADStatus shall be shown in a clear and intuitive manner such that the Driver can easily process it	
					The specified user manual/procedure that instructs how and when to provide brake is missing/inadequate	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide braking request in a timely manner.	Driver must be able to determine when and how to provide braking request from some other sources
			Driver believes that they have provided the brake inputs at the right time.	Driver believes that because they thought they had correctly followed the procedure to send braking	DriverBrakeRequest is sent out at the right time, but due to a communication delay between the Driver Inputs (brake pedal) and the VehicleMotionController, it was not received on time.	Communication delay	The delays in the communication channel between Driver Inputs (brake pedal) and the VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DriverBrakeRequest(due to communication delays) and appropriate notifications issued



		requ	request.	The Driver Inputs (brake pedal) is degraded, hence DriverBrakeRequest was sent late.	Actuator Degradation	The actuator(brake pedal) shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(brake pedal) and issue notifications to carry out maintenance/replacement.	
					The driver is not competent enough (poor driving skills, knowledge,inadequate training etc.) and hence unable to provide brake request appropriately(at the right time).	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
				Driver believes that because there is no feedback to the driver on the static and dynamic objects in the close vicinity of the CAV and their position.	There is no feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position)	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
UCA-3.5.2	Driver provides DriverBrakeRequest too late when ADS is enabled, there is a takeover request and a load is falling from a truck ahead.	H-3	Driver believes that there is no falling load or impending danger ahead	Driver believes that because there is no feedback to the driver from the AutonomousDriveController that driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	There is no feedback to the driver from the AutonomousDriveController that the driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status). Note: This is missing in the req/design.	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through warnings on the HMI or adequate trainings	
			Driver initially believes that there is no transition demand		HMI is degraded, hence, Haptic/Audio/VisualWarnings were delayed.	Sensor Degradation	The HMI shall be well maintained, ensuring that Haptic/Audio/Visual warnings are issued/updated on time.	There shall be a mechanism to detect delays or failures in the update of Haptic/Audio/Visual warnings due to HMI degradation and notifications issued to carry out maintenance/replacement.
				Driver believes that because they were referring to the	Due to communication delays between the HMI and the AutonomousDriveController,TakeOverRequest was received too late by HMI, although it was issued on time.	Communication Delay	The delays in the communication channel between HMI and the AutonomousDriveController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated TakeOverRequest(due to communication delays) and appropriate notifications issued
				Haptic/Audio/Visualwarnings from HMI to determine whether there is a takeover request	TakeOverRequest was received too late .	Delayed Feedback	The Autonomous Drive Controller shall issue TakeOverRequest in a timely manner when required.	There shall be a mechanism for the detection of delayed TakeOverRequest
					The algorithm within AutonomousDriveController which processes the Feedback signals from Sensors(GPSData,RadarData, PointCloud, Raw Images) is too complex and hence there was delay in detecting the load failing from the truck ahead and issuing the TakeOverRequest.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the Feedback signals from Sensors(GPSData,RadarData, PointCloud, Raw Images) within a specified duration of time.	If the time taken by AutonomousDriveController to process the Feedback signals from Sensors(GPSData,RadarData, PointCloud, Raw Images) exceeds a defined threshold value, appropriate notifications shall be issued
				Driver believes that because they thought they had correctly followed the user	The user manual/procedure that instructs the Driver how and when to provide steer request is missing in the design	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide steering request.	Driver must be able to determine when and how to provide steering request from some other sources
					DriverSteerRequest is sent out, but due to communication error between the Driver Inputs (steering wheel) and the VehicleMotionController, the signal is not received.	Communication Error	Quality and integrity of the communication channel between Driver Inputs (steering wheel) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (steering wheel) and the VehicleMotionController
			Driver believes that they have	manual/procedure to send steering request.	The steering wheel is malfunctioning, hence the steering request was not sent.	Malfunctioning Actuator	The quality of the actuator(steering wheel) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator(steering wheel) and appropriate notifications must be issued
			protect the secting input		The driver is not competent enough (poor driving skills, knowledge/memory,inadequate training etc.) and hence unable to provide steer request appropriately.	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
				Driver believes that because they were referring to the feedback indicating steer request	DriverSteerStatus was sent correctly, but due to communication error between VehicleMotionController & Driver Inputs (steering wheel), it was not received /incorrectly received	Communication Error	Quality and integrity of the communication channel between Driver Inputs (steering wheel) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (steering wheel) and the VehicleMotionController
	Driver does not provide			implementation	DriverSteerStatus was inadequately updated	Inadequate Feedback	The DriverSteerStatus shall correctly indicate the status of implementation of driver steer request.	There shall be a mechanism to detect incorrect DriverSteerStatus.
	DriverSteerRequest when ADS is disabled at Night in cold and				DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
is disabled at Night in cold and H UCA-4.1.1 wet weather (rain)and CAV is H in a situation where steering is required (e.g. maneuvering a roundabout, bend/curve).	H-2,3	Driver believes that ADS is enabled	Driver believes that because they were referring to the DisplayerdADStatus feedback on	Correct ADMode was sent from AutonomousDriveController, but due to communication errors between AutonomousDriveController and HMI, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI	



			steering inputs.	HMI to determine whether ADS was enabled or disabled	The DisplayedADStatus shown on the HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
					Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was incorrectly updated.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
				Driver believes that because they had referred to the user manual and were not attentive/aware of the driving environment.	There is no feedback to the driver that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through warnings on the HMI or adequate trainings	
			Driver believes that steering request is not needed to be provided	The Driver believes that because they had not noticed the static/duranic objects in the vicinity.	The wind screen and/or side view mirrors were not clear(dirty/misty)or it was raining and there was no feedback to the driver to clear the wind screen and/or side view mirrors/turn wiper on etc.	Missing Feedback	There must be a feedback to the Driver to clear the wind screen and/or side view mirrors/turn wiper on dependent on the environmental conditions	
				of the vehicle, requiring steering inputs, as their sight is	The ambient lighting is too low /dark outside and there was no feedback to the Driver to turn headlamps on.	Missing Feedback	There must be feedback to the Driver to turn headlamps on when the ambient lighting is too low/dark outside	
				obsequed visionity is poor	The car cabin was too misty and there was no feedback to the driver to turn demist on.	Missing Feedback	There must be feedback to the Driver to turn demister on when the car cabin is too misty	
			Driver believes that they must provide steering input	Driver believes that because they thought they had followed the user manual on when and how to provide steering inputs	The specified user manual/procedure that instructs how and when to provide DriverSteerRequest is missing/inadequate	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide steering request.	Driver must be able to determine when and how to provide steering request from some other sources
	Driver provides DriverSteerRequest when ADS is disabled and there are vehicles beside the CAV in adjacent lanes or CAV is too close to the central reservation		Driver believes that they have not provided steering input	Driver believes that because they had followed the procedure not to provide steering inputs.	Driver had not provided steering inputs , but due to malfunctioning Driver Inputs (steering wheel) , DriverSteerRequest is fault issued	Malfunctioning Actuator	The quality of the actuator(steering wheel) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator(steering wheel) and appropriate notifications must be issued
UCA-4.3.1		н-2	Driver believes that there are no vehicles in adjacent lanes, beside the CAV / its not close to the central reservation	Driver believes that because the vehicles are in the Drivers blind spot and they could not see it	There is no feedback/warning to the driver to check blindspots for objects	Missing Feedback	There must be feedback to the Driver to check for objects in the blindspot.	The Driver must be made aware of objects in the blindspot through other sources.
				Driver believes so because there is no feedback from the Autonomous Drive Controller to the driver on the static and dynamic objects in the close vicinity of the vehicle and their position	There is no feedback from the Autonomous Drive Controller to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the vehicle and their position)/road scene.	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
					The specified user manual/procedure that instructs how and when to provide steering request is missing/inadequate	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide steering request in a timely manner.	Driver must be able to determine when and how to provide steering request from some other sources
			Driver believes that they have provided	Driver believes that because they thought they had correctly followed the procedure to send steering	DriverSteerRequestis sent out at the right time, but due to a communication delay between the Driver Inputs (steering wheel) and the VehicleMotionController, it was not received on time.	Communication delay	The delays in the communication channel between Driver Inputs (steering wheel) and the VehicleMotionController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DriverSteerRequest(due to communication delays) and appropriate notifications issued
				request.	The Driver Inputs (steering wheel) is degraded, hence DriverSteerRequest was sent late.	Actuator Degradation	The actuator(steering wheel) shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the actuator(steering wheel) and issue notifications to carry out maintenance/replacement.
					The driver is not competent enough (poor driving skills, knowledge,inadequate training etc.) and hence unable to provide steer request appropriately(at the right time).	Inadequate Control Input	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
					The DisplayedADStatus was inadequately updated.	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
UCA-4.5.1	Driver provides DriverSteerRequest too late when ADS is disabled, a VRU suddenly appears, moving towards the path of the CAV,	н-3	D Driver believes that ADS is still fe enabled w d	Driver believes that because he was referring to the DisplayedADStatus	ADMode was issued from AutonomousDriverController at the right time, but due to delay in communication between AutonomousDriverController and HMI, the DisplayedADStatus was not updated on time.	Communication Delay	The delays in the communication channel between AutonomousDriverController and HMI shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated DisplayedADStatus(due to communication delays) and appropriate notifications issued
UCA-4.5.1	there are no obstacles on the adjacent lane and maximum deceleration is insufficient to avoid a collision with the VRU.			feedback on HMI to determine whether ADS was enabled or disabled	HMI was degraded, hence DisplayedADStatus was Inadequately updated.	Sensor Degradation	The HMI shall be well maintained, ensuring that it updates DisplayedADStatus in a timely manner.	There shall be a mechanism to detect degradations of the HMI and issue notifications to carry out maintenance/replacement.
					Correct DisplayedADStatus was displayed on the HMI, but the information was complicated /confusing, and hence caused delays for the Driver to interpret the information.	Processing Delay	The DisplayedADStatus shall be shown in a clear and intuitive manner such that the Driver can easily process it	



					Driver believes that because there is no feedback to the driver on the static and dynamic objects in the close vicinity of the CAV and their position.	There is no feedback from the AutonomousDriveController to the Driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position). Note: There should be warning message on suddenly appearing obstacles/VRUs	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on suddenly appearing obstacles/VRUs in the CAV path	The Driver must be made aware of suddenly appearing obstacles/VRUs in the CAV path through other sources
				Driver initially believes that there is no VRU in the CAV path	Driver believes that because there is no feedback to the driver from the AutonomousDriveController that the driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	There is no feedback to the driver from the AutonomousDriveController that the driver should be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status). Note: This is missing in the req/design.	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (rrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
U					Driver believes that because they thought they have correctly followed the user	The user manual/procedure that instructs how and when to provide DriverThrottleRequest is missing/ incorrect	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide throttle request in a timely manner.	Driver must be able to determine when and how to provide throttle request from some other sources
		Driver provides incorrect DriverThrottleRequest when ADS is disabled and the CAV is in a situation where optimal acceleration is needed(moving down a slope and there are leading vehicles in the path.)		Driver believes that they have provided the correct acceleration inputs		DriverThrottleRequest is sent out correctly, but due to communication error between the Driver Inputs (accelerator pedal) and the AutonomousDriveController, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between Driver Inputs (accelerator pedal) and the VehicleMotionController shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between Driver Inputs (accelerator pedal) and the VehicleMotionController
	UCA-5.2.1		H-2,3		acceleration request.	TheDriver Inputs (accelerator pedal) is malfunctioning, hence DriverThrottleRequest was not correctly sent.	Malfunctioning Actuator	The quality of the actuator(accelerator pedal) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator(accelerator pedal) and appropriate notifications must be issued
						The driver is not competent enough (poor driving skills, knowledge,inadequate training etc.) and hence unable to provide acceleration request appropriately	Inadequate Controller	The Driver must be provided adequate training and it must be ensured that they are capable of taking over and performing DDT at all times.	
				Driver believes that there are no lead vehicles in the CAV path	Driver believes that because there is no feedback/warning to the driver on the static and dynamic objects in the close vicinity of the vehicle and their position/road scene.	There is no feedback from the AutonomousDriveController to the Driver on the vehicle environment (static and dynamic objects in the vicinity of the vehicle and their position)/road scene.	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
		Driver provides DriverThrottleRequest when ADS is enabled and the CAV is approaching an obstacle in its path. Note: The driver override in this case may lead to collision	н-3	Driver believes that they must provide acceleration input	Driver believes that because they thought they had followed the user manual on when and how to provide acceleration inputs	The user manual/procedure that instructs how and when to provide DriverThrottleRequest is missing/ incorrect	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to provide throttle request in a timely manner.	Driver must be able to determine when and how to provide throttle request from some other sources
	UCA-5.3.1			Driver believes that they have not provided acceleration input	Driver believes that because they had followed the procedure not to provide acceleration inputs.	Driver had not provided acceleration inputs , but due to malfunctioning Driver Inputs (accelerator pedal) , DriverThrottleRequest is fault issued	Malfunctioning Actuator	The quality of the actuator(accelerator pedal) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator(accelerator pedal) and appropriate notifications must be issued
					Driver believes that there are no obstacles in the CAV path	Driver believes so because there is no feedback from the Autonomous Drive Controller to the Driver on the static and dynamic objects in the close vicinity of the vehicle and their position	There is no feedback from the Autonomous Drive Controller to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the vehicle and their position)/road scene.	Missing feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).
				Driver believes that the current speed	Driver believes that because there is	The specified feedback from the HMI to the Driver regarding CAV speed is missing.	Missing Feedback	There must be a feedback signal to the Driver regarding CAV speed	The Driver must be made aware of the vehicle speed through other sources
	UCA-5.3.2	Driver provides DriverThrottleRequest when ADS is disabled and the current speed is above the maximum	H-4	is well below the maximum allowed for the current zone/road	no feedback to the Driver on the CAV speed	There is no feedback included in the design to warn the driver that speed limit has been exceeded	Missing Feedback	There must be a feedback signal(warning) to the Driver when the CAV has exceeded the speed limit for the current road/zone of operation.	The Driver must be made aware of the vehicle having exceeded the speed limit through other sources
		limit for the current zone/road		Driver believes that they have not provided acceleration input	Driver believes that because they had followed the procedure not to provide acceleration inputs.	Driver had not provided acceleration inputs , but due to malfunctioning Driver Inputs (accelerator pedal) , DriverThrottleRequest is fault issued	Malfunctioning Actuator	The quality of the actuator(accelerator pedal) shall be guaranteed to ensure that it sends the appropriate command.	There shall be a mechanism to detect the malfunctions of the actuator(accelerator pedal) and appropriate notifications must be issued
				Driver believes that because they	There is no feedback(user manual) to the Driver on the procedure for activation/deactivation of ADS	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources	
				Driver believes that because they had followed what they learned from the user manual to activate ADS.	The command to activate ADS was not received by the Autonomous Drive Controller due to communication errors between the HMI and the Autonomous Drive Controller.	Communication Error	Quality and integrity of the communication channel between the HMI and the Autonomous Drive Controller shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between HMI and the Autonomous Drive Controller.	
		Driver does not provide				The HMI was malfunctioning, hence, EnableAD was not sent from the HMI to the Autonomous Drive Controller.	Malfunctioning Actuator	The quality of HMI shall be guaranteed to ensure that it sends the appropriate commands	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver



	HMIEnableAD when the CAV is approaching a significant	E	Driver believes that they have enabled/activated ADS.		DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
	approaching a significant obstacle or a VRU in its path, the driver intends to activate ADS and has stopped performing the DDT			Driver believes that because they	Correct ADMode was sent from Autonomous Drive Controller, but due to communication errors between Autonomous Drive Controller and HMI, ADMode is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
UCA-1.1.1	Note: The Driver may assume that they have already provided it, but the request may not have been actually	H-1,3,5		DisplayedADStatus to determine the status of ADS	The DisplayedADStatus information displayed on HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
	sent/received by the AutonomousDriveController due to various reasons.				Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was displayed incorrectly to the driver.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
			Driver believes there is no significant	Driver believes that because there is no feedback/warning regarding obstacles in the CAV path and their position.	The feedback to the Driver regarding obstacles in the CAV path and their position when there is a collision risk, is missing	Missing Feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
			object in its path	Driver believes so because they were not paying attention to the drive environment/road scene ahead	There is no feedback to the Driver from the HMI that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
				Driver believes that because they	There is no feedback(user manual) to the Driver on the procedure for activation/deactivation of ADS	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
				had followed what they learned from the user manual to activate ADS.	The command to activate ADS was not received by the Autonomous Drive Controller due to communication errors between the HMI and the Autonomous Drive Controller.	Communication Error	Quality and integrity of the communication channel between the HMI and the Autonomous Drive Controller shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between HMI and the Autonomous Drive Controller.
					The HMI was malfunctioning, hence,EnableAD was not sent from the HMI to the Autonomous Drive Controller.	Malfunctioning Actuator	The quality of HMI shall be guaranteed to ensure that it sends the appropriate commands	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
			Driver believes that they have enabled/activated ADS.	Driver believes that because they were referring to the DisplayedADStatus to determine the status of ADS	DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
UCA 1 1 2	Driver does not provide HMIEnableAD when the CAV is operating on a motorway, another vehicle is cutting into CAV path, the driver intends to activate ADS and has stopped performing the DDT.	H-3,5			Correct ADMode was sent from Autonomous Drive Controller, but due to communication errors between Autonomous Drive Controller and HMI, ADMode is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
004-1.1.2					The DisplayedADStatus information displayed on HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
					Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was displayed incorrectly to the driver.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
			Driver believes there is no vehicle cutting in, which poses a collision threat	Driver believes that because there is no feedback/warning regarding suddenly appearing obstacles and their position.	The feedback to the Driver regarding suddenly appearing obstacles in the CAV path and their position , is missing	Missing Feedback	There must be feedback from the AutonomousDriveController to the driver on suddenly appearing obstacles/VRUs in the CAV path	The Driver must be made aware of suddenly appearing obstacles/VRUs in the CAV path through other sources
				Driver believes so because they were not paying attention to the drive environment/road scene ahead	There is no feedback to the Driver from the HMI that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
UCA-1 2 1	Driver provides HMIEnableAD when the CAV is outside its ODD (Eg: heavy snow/rain, poor lighting/poor visibility, failures, a significant object has	H-2 3 5	Driver believes that ADS can be	Driver believes that because they had referred to the user manual to understand when (in what operating conditions) they could activate ADS	There is no feedback to the Driver (user manual from the Manufacturer) which provides information on pre conditions for activation of ADS (including the ODD).	Missing Feedback	There must be feedback to the driver on pre conditions for the activation of ADS (including the ODD)	The Driver must be made aware of preconditions for activation of ADS (including the ODD) through other sources
	been detected but not classified and collision is imminent) and Driver has stopped performing the DDT.		enabled in the current circumstances	Driver believes that because they were referring to the feedback on the HMI to determine whether the CAV was outside its ODD	There is no feedback to the Driver on whether the CAV is outside its ODD or not and hence can be enabled or not.	Missing Feedback	There must be feedback to the Driver on whether the CAV is outside its ODD or not and whether ADS can be enabled or not.	The Driver must be made aware of whether the CAV is outside its ODD or not through other sources.
			Driver believes that ADS can be enabled when there is a severe ADS/CAV failure	Driver believes that because they had referred to the user manual to understand when (in what operating conditions) they could activate ADS	There is no feedback to the Driver (user manual from the Manufacturer) which provides information on pre conditions for activation of ADS (including the ODD).	Missing Feedback	The Driver must be informed of the pre conditions for activation of ADS (including the ODD) through user manual/trainings.	The Driver must be made aware of the pre conditions for activation of ADS (including the ODD) through other sources
					Haptic/Audio/VisualWarnings were never issued/incorrectly issued due to malfunctioning HMI	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it issues appropriate Haptic/Audio/VisualWarnings	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver



				н	Haptic/Audio/VisualWarning signals are indequate	Inadequate Feedback	The Haptic/Audio/VisualWarning shall be issued with the expected quality	There shall be a mechanism to detect incorrectly/inadequately issued Haptic/Audio/VisualWarning
UCA-1.2.2	Driver provides HMIEnableAD when there is a severe ADS/CAV failure and the driver has stopped performing the	H-5		Driver believes that because they	Due to communication errors between the HMI and the AutonomousDriveController, the failure signals (Speed LimitSignDetectionFailure,LeadVehicleDistStima tionFailure,DSSBasedLocalisationFailure) were never received by the HMI	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
	DDT.		Driver believes that there are no ADS/CAV failures	were reterring to the Haptic/Audio/Visual Warnings to determine whether there are any failures	HMI incorrectly processes /misinterprets the feedback signals from AutonomousDriveController(SpeedLimitSignDetectionFailure,LeadVehicleDistEstima tionFailure,GNSSBasedLocalisationFailure)	Misinterpreted Feedback	The HMI shall process the failure signals (SpeedLimitSignDetectionFailure,LeadVehicleDistE stimationFailure,GNSSBasedLocalisationFailure) adequately	If HMI is unable to process the failure signals (SpeedlumitSignDetectionFailure_LeadVehicleDist EstimationFailure,GNSSBasedLocalisationFailure) adequately, appropriate notifications shall be issued
					SpeedLimitSignDetectionFailure signal was not received/incorrectly received by the HMI	Inadequate Feedback	SpeedLimitSignDetectionFailure shall clearly indicate the status of SpeedLimitSignDetection	There shall be a mechanism to detect incorrect/erroneous SpeedLimitSignDetectionFailure
					LeadVehicleDistEstimationFailure was not received/incorrectly received by the HMI	Inadequate Feedback	LeadVehicleDistEstimationFailure shall clearly indicate the status of LeadVehicleDistEstimation	There shall be a mechanism to detect incorrect/erroneous LeadVehicleDistEstimationFailure
					GNSSBasedLocalisationFailure was not received/incorrectly received by the HMI	Inadequate Feedback	GNSSBasedLocalisationFailure shall clearly indicate the status of GNSSBasedLocalisation	There shall be a mechanism to detect incorrect/erroneous GNSSBasedLocalisationFailure
					There is no feedback to the Driver (user manual from the Manufacturer) which provides information on when and how to activate/deactivate ADS.	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
	Driver provides HMIEnableAD	H-1,3,5	Driver believes that they have provided HMIEnableAD at the right time	Driver believes that because they correctly followed the procedure to enable ADS	The dedicated means/ button to enable/activate ADS was selected/pressed by the driver at the correct time, but due to communication delay between the HMI and the AutonomousDriveController, EnableAD was not received on time.	Communication Delay	The delays in the communication channel between the HMI and the AutonomousDriveController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated EnableAD(due to communication delays) and appropriate notifications issued
UCA-1.5.1	too late when the CAV is approaching a significant obstacle or VRU in its path, the driver intends to activate ADS and has stopped performing the DDT.				The dedicated means/ button to enable/activate ADS was selected/pressed by the driver at the right time, but due to the degraded HMI, EnableAD was sent too late.	Actuator Degradation	The HMI shall be well maintained, ensuring that it implements the commands as required in a timely manner.	There shall be a mechanism to detect degradations of the HMI and issue notifications to carry out maintenance/replacement.
			Driver initially believes there is no significant obstacle/VRU in its path	Driver believes that because there is no feedback/warning regarding obstacles in the CAV path and their position.	The feedback to the Driver regarding obstacles in the CAV path and their position when there is a collision risk, is missing	Missing Feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
				Driver believes so because they were not paying attention to the drive environment/road scene ahead	There is no feedback to the Driver from the HMI that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status).	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
				Driver believes that because they thought they knew how and when to deactivate ADS from the user manual	There is no feedback to the Driver (user manual from the Manufacturer) which provides information on when and how to activate/deactivate ADS.	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
					DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
			Driver believes that they have already deactivated/disabled ADS.	Driver believes that because they were referring to the	Correct ADMode was sent from AutonomousDriveController, but due to communication errors between AutonomousDriveController and HMI, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
UCA-2.1.1				DisplayedADStatus from HMI to determine the ADS status.	The DisplayedADStatus shown on the HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner	
	Driver does not provide				Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was incorrectly updated.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
	enabled, Driver is not performing the DDT, the CAV is getting close to a significant	H-1,3,5			Haptic/Audio/VisualWarnings were never issued/incorrectly issued due to malfunctioning HMI	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it issues appropriate Haptic/Audio/VisualWarnings	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
	getting close to a significant obstacle or VRU in its path and there is a takeover request due to exit of ODD.	to a significant (172,0,0) RU in its path and eover request due D.	Di	Driver believes that because they	Haptic/Audio/VisualWarning signals are incorrect/ indequate(The optical signals have inadequate size/contrast,acoustic signals are not loud/clear etc)	Inadequate Feedback	The Haptic/Audio/VisualWarning shall be issued with the expected quality	There shall be a mechanism to detect incorrectly/inadequately issued Haptic/Audio/VisualWarning



				Driver believes that there is no takeover request	Haptic/Audio/Visual Warnings to determine whether there is a takeover request	Due to communication errors between the HMI and the AutonomousDriveController, TakeOverRequest was never received /incorrectly received by the HMI	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
						HMI incorrectly processes /misinterprets the TakeOverRequest from AutonomousDriveController and hence Haptic/Audio/VisualWarnings are incorrectly issued	Misinterpreted Feedback	The HMI shall correctly process the TakeOverRequest from AutonomousDriveController and issue appropriate Haptic/Audio/VisualWarnings	If the HMI is unable to process the TakeOverRequest adequately, appropriate notifications shall be issued
				Driver believes that they need not deactivate ADS when there is a takeover request.	Driver believes that because they thought they knew how to respond to a take over request	There is no feedback to the driver (user manual) describing the required response to a takeover request.	Missing Feedback	The Driver must be informed of the expected response to a takeover request through user manual/training.	The Driver must be made aware of the expected response to a take over request through other sources.
				Driver believes that the CAV is still within its ODD	Driver believes that because there is no feedback to the Driver that the CAV is outside its ODD	There is no ODD exit notification to the Driver included in the design	Missing Feedback	There must be an ODD exit notification included in the design to inform the Driver when the CAV exits its ODD	The Driver must be made aware of exit of ODD through other sources
					Driver believes that because they thought they knew how and when to deactivate ADS from the user manual	There is no feedback to the Driver (user manual from the Manufacturer) which provides information on when and how to activate/deactivate ADS.	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
					dy Driver believes that because they were referring to the	DisplayedADStatus was incorrectly updated	Inadequate Feedback	The DisplayedADStatus shall correctly indicate the status of ADS	There shall be a mechanism to detect incorrect DisplayedADStatus.
				Driver believes that they have already deactivated/disabled ADS.		Correct ADMode was sent from AutonomousDriveController, but due to communication errors between AutonomousDriveController and HMI, the signal is incorrectly received.	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
				DisplayedADStatus from HMI to determine the ADS status.	The DisplayedADStatus shown on the HMI is too complicated/confusing and it is misinterpreted by the Driver.	Misinterpreted Feedback	The DisplayedADStatus shall clearly indicate the status of ADS to the Driver such that they can process it in a timely manner		
						Correct ADMode was received by the HMI, but due to HMI malfunction, DisplayedADStatus was incorrectly updated.	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it displays the appropriate status	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
						Haptic/Audio/VisualWarnings were never issued/incorrectly issued due to malfunctioning HMI	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it issues appropriate Haptic/Audio/VisualWarnings	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
						Haptic/Audio/VisualWarning signals are incorrect/ indequate(The optical signals have inadequate size/contrast,acoustic signals are not loud/clear etc)	Inadequate Feedback	The Haptic/Audio/VisualWarning shall be issued with the expected quality	There shall be a mechanism to detect incorrectly/inadequately issued Haptic/Audio/VisualWarning
					Driver believes that because they were referring to the Haptic/Audio/Visual Warnings to	Due to communication errors between the HMI and the AutonomousDriveController, TakeOverRequest was never received /incorrectly received by the HMI	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI
					determine whether there is a takeover request	HMI incorrectly processes /misinterprets the TakeOverRequest from AutonomousDriveController and hence Haptic/Audio/VisualWarnings are incorrectly issued /not issued	Misinterpreted Feedback	The HMI shall correctly process the TakeOverRequest from AutonomousDriveController and issue appropriate Haptic/Audio/VisualWarnings	If the HMI is unable to process the TakeOverRequest adequately, appropriate notifications shall be issued
						AutonomousDriveController does not have the logic built in to issue a take over request when there is a severe failure	Inadequate Sensor	AutonomousDriveController shall issue a take over request when there is a severe failure	There shall be a mechanism to detect the inability of the AutonomousDriveController to issue a takeover request when there is a severe failure
		Driver does not provide HMIDisableAD when the ADS is enabled, Driver is not				Haptic/Audio/VisualWarnings were never issued/incorrectly issued due to malfunctioning HMI	Malfunctioning Sensor	The quality of HMI shall be guaranteed to ensure that it issues appropriate Haptic/Audio/VisualWarnings	There shall be a mechanism to detect the malfunctions of HMI and appropriate notifications must be issued to the Driver
		performing the DDT, CAV is operating in a dense urban area, there is a vulnerable road				Haptic/Audio/VisualWarning signals are indequate	Inadequate Feedback	The Haptic/Audio/VisualWarning shall be issued with the expected quality	There shall be a mechanism to detect incorrectly/inadequately issued Haptic/Audio/VisualWarning
	UCA-2.1.2 user emerging from beh parked car and there is a severe ADS/CAV failure speed limit sign detectio failures/GNSS-based localization failures / lee vehicle distance estimat failures).	user emerging from behind a parked car and there is a severe ADS/CAV failure (eg: speed limit sign detection failures/GNSS-based localization failures / lead	erging from behind a ar and there is a DS/CAV failure (eg: mit sign detection GMS5-based ion failures / lead listance estimation Driver believes that there is no need for disabling ADS		Due to communication errors between the HMI and the AutonomousDriveController,the failure signals (SpeedLimitSignDetectionFailure,LeadVehicleDistEstima tionFailure,GNSSBasedLocalisationFailure) were never received by the HMI	Communication Error	Quality and integrity of the communication channel between AutonomousDriveController and HMI shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and HMI	
		vehicle distance estimation failures).		Driver believes that there is no need for disabling ADS		HMI incorrectly processes /misinterprets the feedback signals from AutonomousDriveController(SpeedLimitSignDetectionFailure,LeadVehicleDistEstima tionFailure,GNSSBasedLocalisationFailure)	Misinterpreted Feedback	The HMI shall process the failure signals (SpeedLimitSignDetectionFailure,LeadVehicleDistE stimationFailure,GNSSBasedLocalisationFailure) adequately	If HMI is unable to process the failure signals (SpeedLimitSignDetectionFailure,LeadVehicleDist EstimationFailure,GNSSBasedLocalisationFailure) adequately, appropriate notifications shall issued
						SpeedLimitSignDetectionFailure signal was not received/incorrectly received by the HMI	Inadequate Feedback	SpeedLimitSignDetectionFailure shall clearly indicate the status of SpeedLimitSignDetection	There shall be a mechanism to detect incorrect/erroneous SpeedLimitSignDetectionFailure



				Driver believes that because they were referring to the	LeadVehicleDistEstimationFailure was not received/incorrectly received by the HMI	Inadequate Feedback	LeadVehicleDistEstimationFailure shall clearly indicate the status of LeadVehicleDistEstimation	There shall be a mechanism to detect incorrect/erroneous LeadVehicleDistEstimationFailure
				Haptic/Audio/Visual Warnings to determine whether there is any failure	GNSSBasedLocalisationFailure was not received/incorrectly received by the HMI	Inadequate Feedback	GNSSBasedLocalisationFailure shall clearly indicate the status of GNSSBasedLocalisation	There shall be a mechanism to detect incorrect/erroneous GNSSBasedLocalisationFailure
					SelfAssessmentStatus was incorrect	Inadequate Feedback	SelfAssessmentStatus shall indicate the status of self assessment of the ADS	There shall be a mechanism to detect incorrect/erroneous SelfAssessmentStatus
					PerceptionReliabilityScore was incorrect	Inadequate Feedback	PerceptionReliabilityScore shall clearly indicate how reliable the perception system is	There shall be a mechanism to detect incorrect/erroneous PerceptionReliabilityScore
					AutonomousDriveController misinterprets/incorrectly processes the signals from Self-Assessment and hence TakeOverRequest was never issued	Misinterpreted Feedback	AutonomousDriveController shall correctly process the signals from Self-Assessment and issue TakeOverRequest if required.	If the HMI is unable to process the signals from Self-Assessment and issue TakeOverRequest when required, appropriate notifications shall be issued
					ObjectDetectionCheck feedback is incorrect/inadequate	Inadequate Feedback	ObjectDetectionCheck shall indicate the status of object detection of Perception & Localisation accurately	There shall be a mechanism to detect incorrect/erroneous ObjectDetectionCheck
					LocalizationCheck feedback is incorrect/inadequate	Inadequate Feedback	LocalizationCheck shall indicate the status of localisation check of Perception & Localisation accurately	There shall be a mechanism to detect incorrect/erroneous LocalizationCheck
					ObjectTrackingCheck feedback is incorrect/inadequate	Inadequate Feedback	ObjectTrackingCheck shall indicate the status of object tracking of Perception & Localisation accurately	There shall be a mechanism to detect incorrect/erroneous ObjectTrackingCheck
					SensorVisibility feedback is incorrect/inadequate	Inadequate Feedback	SensorVisibility shall indicate the status of visibility of sensors accurately	There shall be a mechanism to detect incorrect/erroneous SensorVisibility
					SensorObstruction feedback is incorrect/inadequate	Inadequate Feedback	SensorObstruction shall indicate the status of obstruction of the Sensors accurately	There shall be a mechanism to detect incorrect/erroneous SensorObstruction
				Driver believes that because they thought they knew when to disable/deactivate ADS	There is no feedback to the driver (user manual) describing when to deactivate ADS	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
	Driver provides HMIDisableAD when ADS is enabled. the CAV		Driver believes that CAV is outside its ODD	Driver believes that because they had assumed they knew the ODD of the CAV	There is no feedback to the Driver (user manual from the Manufacturer) which provides clear/adequate information on the ODD of the CAV and when to enable/disable ADS	Missing Feedback	The Driver must be informed of the pre- conditions for activation of ADS (including the ODD) and when to deactivate ADS through training/user manuals	The Driver must be made aware of the pre- conditions for the activation of ADS (including the ODD) and when to deactivate ADS through other sources
UCA-2.3.1	is within its ODD, there are static obstacles, dynamic obstacles and VRUs in the close vicinity of the CAV and the Driver is not performing the DDT.	H-1,2,3,5	Driver believes that they have not deactivated/disabled ADS.	Driver believes that because there was no feedback to the Driver on	There is no feedback to the Driver (user manual from the Manufacturer) which details the procedure for deactivation of ADS	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
				the procedure to deactivate/disable ADS	The HMI design is flawed , it doesn't protect against unintentional deactivation	Flawed Design	The HMI shall protect against unintentional activation/deactivation of ADS by the Driver	There shall be a mechanism to detect unintentional activation/deactivation of ADS by the Driver and appropriate notifications issued
				Driver believes that because they had followed the right procedure to deactivate/disable ADS	There was no feedback(user manual/training) to the Driver on when and how to deactivate ADS.	Missing Feedback	There must be adequate feedback provided to the driver (in the form of user manual or training) on when and how to activate/deactivate ADS in a timely manner	Driver must be able to determine when and how to activate/deactivate ADS in a timely manner from some other sources
					HMI is degraded, hence, Haptic/Audio/VisualWarnings were delayed.	Sensor Degradation	The HMI shall be well maintained, ensuring that Haptic/Audio/Visual warnings are issued/updated on time.	There shall be a mechanism to detect delays or failures in the update of Haptic/Audio/Visual warnings due to HMI degradation and notifications issued to carry out maintenance/replacement.
					Due to communication delays between the HMI and the AutonomousDriveController, TakeOverRequest was received too late by HMI, although it was issued on time.	Communication Delay	The delays in the communication channel between HMI and the AutonomousDriveController shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated TakeOverRequest(due to communication delays) and appropriate notifications issued
			Driver believes that they have provided HMIDisableAD at the right time	Driver believes that because they	TakeOverRequest was received too late .	Delayed Feedback	The Autonomous Drive Controller shall issue TakeOverRequest in a timely manner when required.	There shall be a mechanism for the detection of delayed TakeOverRequest
UCA-2.5.1	Driver provides HMIDisableAD too late when there is a request to take over, the driver is not performing the DDT, and there is a load falling from a truck ahead.	H-3,5		were referring to the Haptic/Audio/NusalWarnings from HMI to determine whether there is a takeover request	The algorithm within AutonomousDriveController which processes the Feedback signals from Sensors(GPSData, RadarData, PointCloud, Raw Images) is too complex and hence there was delay in detecting the load falling from the truck ahead and issuing the TakeOverRequest.	Processing Delay	The control algorithm of AutonomousDriveController shall be capable of processing the Feedback signals from Sensors(GPSData, Radarotata, PointCloud, Raw Images) within a specified duration of time and issue takeover request if required	If the time taken by AutonomousDriveController to process the Feedback signals from Sensors(GPSData,RadarData, PointCloud, Raw Images) exceeds a defined threshold value, appropriate notifications shall be issued
					GPS Data from Sensors is not updated on time	Delayed Feedback	The Sensors shall issue GPS Data in a timely manner	There shall be a mechanism for the detection of delayed GPS Data
					PointCloud from Sensors is not updated on time	Delayed Feedback	The Sensors shall issue PointCloud in a timely manner	There shall be a mechanism for the detection of delayed PointCloud
					RadarData from Sensors is not updated on time	Delayed Feedback	The Sensors shall issue RadarData in a timely manner	There shall be a mechanism for the detection of delayed RadarData
					RawImage from Sensors is not updated on time	Delayed Feedback	The Sensors shall issue RawImage in a timely manner	There shall be a mechanism for the detection of delayed Rawimage



			Driver believes that there is no load falling from a truck ahead / no risk of	Driver believes that because they were not paying attention to the road environment	There is no feedback to the Driver on the HMI that they must be attentive at all times and aware of the driving environment irrespective of the state of ADS	Missing Feedback	The Driver must be informed that they need to be attentive (aware of the driving environment) and available to take over DDT at all times (irrespective of ADS Status) through the user manual/ adequate training/warnings on the HMI	
			collision	Driver believes that because there is no feedback/warning regarding obstacles in the CAV path and their position.	The feedback to the Driver regarding obstacles in the CAV path and their position when there is a collision risk, is missing	Missing Feedback	There must be feedback from the AutonomousDriveController to the driver on the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position).	The Driver must be made aware of the vehicle environment (static and dynamic objects in the close vicinity of the CAV and their position) through other sources
	Remote Oriented days and		Pomoto Operator baliquer that they	Remote Operator believes that	There is no feedback(user manual/training) provided to the Remote Operator on how to provide DynamicPathVerificationResponse	Missing Feedback	There must be feedback(user manuals/training) to the Remote Operator on how to provide DynamicPathVerificationResponse	The remote Operator shall be made aware of how to provide DynamicPathVerificationResponse through other sources
UCA-12.1.1	NemoteOperator does not provide DynamicPathVerificationRespo nse when a DynamicPathVerificationReque st has been received and verified and the CAV is	Н-3	have already provided DynamicPathVerificationResponse	followed the right procedure to provide DynamicPathVerificationResponse	Although DynamicPathVerificationResponse was provided by the Remote Operator, due to errors in communication between the actuator and the AutonomousDriveController, it was never received by the AutonomousDriveController	Communication Error	Quality and integrity of the communication channel between the actuator and the AutonomousDriveController shall be guaranteed to ensure that DynamicPathVerificationResponse is correctly received.	There shall be a mechanism to detect faults in the communication channel between the actuator and the AutonomousDriveController
	vermed and the LAV is approaching a significant obstacle in its path.		Remote Operator believes that they do not have to provide DynamicPathVerificationResponse after a DynamicPathVerificationRequest has been received	Remote Operator believes that because they do not know how to respond to a DynamicPathVerificationRequest	There is no feedback(user manual/training) provided to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	Missing Feedback	There must be feedback(user manuals/training) to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	The remote Operator shall be made aware of how to respond / actions to be taken when a DynamicPathVerificationRequest is received through other sources
	RemoteOperator provides DynamicPathVerificationRespo nse incorrectly when a		Remote Operator believer that they	Remote Operator believes that because they thought they had	There is no feedback(user manual/training) provided to the Remote Operator on how to verify and provide DynamicPathVerificationResponse	Missing Feedback	There must be feedback(user manuals/training) to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	The remote Operator shall be made aware of how to respond / actions to be taken when a DynamicPathVerificationRequest is received through other sources
UCA-12.2.1	s has been received but not verified or verified incorrectly and the CAV is approaching a significant obstacle in its path.	H-3	have provided the right response	followed the right procedure to verify and provide DynamicPathVerificationResponse	Although DynamicPathVerificationResponse was correctly issued by the Remote Operator, due to errors in communication between the actuator and the AutonomousDiveController, it was incorrectly received by the AutonomousDriveController	Communication Error	Quality and integrity of the communication channel between the actuator and the AutonomousDriveController shall be guaranteed to ensure that DynamicPathVerificationResponse is correctly received.	There shall be a mechanism to detect faults in the communication channel between the actuator and the AutonomousDriveController
UCA-12.4.1	RemoteOperator provides DynamicPathVerificationRespo nse too early when a DynamicPathVerificationReque st has been received but not verified and the CAV is approaching a significant obstacle in its path.	н-3	RemoteOperator believes that they have provided DynamicPathVerificationResponse at the right time	Remote Operator believes that because they thought they had followed the right course of action once DynamicPathVerificationRequest was received.	There is no feedback(user manual/training) provided to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	Missing Feedback	There must be feedback(user manuals/training) to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	The remote Operator shall be made aware of how to respond / actions to be taken when a DynamicPathVerificationRequest is received through other sources
UCA-12.5.1	RemoteOperator provides DynamicPathVerificationRespo nse too late when a DynamicPathVerificationReque st has been received and verified and the CAV is approaching a significant obstacle in its path.	н-3	RemoteOperator believes that they have provided DynamicPathVerificationResponse at the right time	Remote Operator believes that because they thought they had followed the right course of action once DynamicPathVerificationRequest was received.	There is no feedback(user manual/training) provided to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	Missing Feedback	There must be feedback(user manuals/training) to the Remote Operator on how to respond / actions to be taken when a DynamicPathVerificationRequest is received	The remote Operator shall be made aware of how to respond / actions to be taken when a DynamicPathVerificationRequest is received through other sources



Annex 5: Safety Requirements

Requirement to Prevent the CF	Requirement to Detect the CF	ODD	HMI	Driver	V2X	Self-Assessment	Sensors	AutomousDriveController
Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor and appropriate notifications issued						x	
The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be accurate.	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)						x	
The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility or occlusions.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notify the Driver about this.			×			×	
The quality of the Sensors shall be guaranteed to ensure that accurate feedback signals are sent	There shall be a mechanism to detect the malfunctions of the Sensors and appropriate notifications must be issued			x			x	
Quality and integrity of the communication channel between AutonomousDriveController and Sensors shall be guaranteed.	There shall be a mechanism to detect faults in the communication channel between AutonomousDriveController and Sensors						x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.						x	
The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility, occlusions, etc.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notify the Driver about this.			x			x	
PerceptionReliabilityScore shall accurately indicate how reliable the perception system is.	There shall be a mechanism to detect incorrect/inadequately updated PerceptionReliabilityScore and appropriate notifications issued						x	
The SensorVisibility shall provide an estimate of sensor effective visibility	There shall be a mechanism to detect incorrect/inadequately updated SensorVisibility						x	
The SensorObstruction shall provide an estimate of amount of sensor obstruction	There shall be a mechanism to detect incorrect/inadequately updated SensorObstruction						x	
Self assessment shall process all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,Localizatio nCheck & ObjectTrackingCheck) to determine how reliable the perception and localisation systems are	If AutonomousDriveController is unable to process all feedback signals from Sensors(SensorVisibility&SensorObstruction) and Perception&Localisation(ObjectDetectionCheck,LocalizationCheck & ObjectTrackingCheck) to generate a reliability score, it shall notify the Driver.					x	x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the speed limits for the roads/zones.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.						x	



The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the presence and relative position/speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) to detect, classify objects accurately and track them	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The IMUData feedback signal shall indicate accurate IMU data	There shall be a mechanism for the detection of incorrect/erroneous IMUData			x	
The WheelSpeed feedback signal shall indicate accurate wheel speed	There shall be a mechanism for the detection of incorrect/erroneous WheelSpeed			x	
Sensors shall be free of malfunctions at all times.	There shall be a mechanism to detect malfunctions of Sensors and appropriate notifications must be issued to the Driver			x	
The 6DOFPosition&Orientation feedback signal shall indicate accurate 6DOF position and orientation	There shall be a mechanism for the detection of incorrect/erroneous 6DOFPosition&Orientation			×	
The WheelRotations feedback signal shall indicate accurate value of wheel rotations	There shall be a mechanism for the detection of incorrect/erroneous WheelRotations			x	
The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSBrakeStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of BrakeStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.			x	
The feedback signals from Sensors (Temperature, Humidity, AmbientLighting) shall be updated on time to indicate the actual status of the weather conditions with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (Temperature,Humidity,AmbientLighting)			x	
The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (Temperature,Humidity,AmbientLighting) due to communication delays and appropriate notifications issued			×	
The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from Sensors (Temperature, Humidity, Ambient lighting) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signals from Sensors (Temperature,Humidity, Ambient lighting) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to performance limitations owing to adverse weather and time of day			x	
The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) due to communication delays			x	



The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (GPSData,PointCloud, RadarData,RawImage, etc)			x	
The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the presence / position of objects around the CAV.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time to accurately determine the distance and color of traffic lights.	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) within a specified duration of time	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSBrakeStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSBrakeStatus due to sensor degradations			×	
The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)shall be updated correctly	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)			x	
The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (GPSData,PointCloud, RadarData,RawImage, etc) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors			x	
The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (Temperature,Humidity, AmbientLighting) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (Temperature,Humidity, AmbientLighting)continuously due to degradation of the communication channel between AutonomousDriveController and Sensors			x	x
There shall be feedback to the AutonomousDriveController on road surface conditions from Sensors.	The AutonomousDriveController shall be able to identify road surface conditions from other available sources.			x	



The communication channel between AutonomousDriveController and Sensors shall be well maintained, ensuring that the feedback signals (IMUData & WheelSpeed) are continuously propagated.	There shall be a mechanism to detect a failure in receiving updated feedback signals (IMUData & WheelSpeed) continuously due to degradation of the communication channel between AutonomousDriveController and Sensors			x	
The feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)shall be updated correctly to indicate the presence/position of objects around the CAV and Iane markings	There shall be a mechanism to detect incorrectly updated feedback signals from the Sensors (GPSData,PointCloud, RadarData,RawImage, etc)			x	
Quality of the sensor between Vehicle Actuators and AutonomousDriveController shall be guaranteed to ensure that feedback signals are correctly sensed.	There shall be a mechanism to detect the malfunctions of the sensor between Vehicle Actuators and AutonomousDriveController and appropriate notifications issued			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequatelyto determine the presence/relative position of objects around the CAV and lane markings/boundaries	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) shall be updated accurately	There shall be a mechanism for the detection of incorrect/erroneous feedback signals from Sensors (Temperature,Humidity,AmbientLighting)			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from Sensors (Temperature, Humidity, Ambient lighting) to determine the time of day, weather conditions and road conditions	If AutonomousDriveController is unable to process the feedback signals from the Sensors (Temperature, Humidity, Ambient lighting)accurately, it shall notify the Driver.			x	
There shall be a feedback to the AutonomousDriveController from Sensors on road surface conditions	The AutonomousDriveController shall be able to determine the road surface conditions from some other sources.			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the determine the road curvature,layout,lane markings etc	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The accuracy and performance of the Sensors shall not be inhibited by adverse weather conditions, poor visibility or occlusions.	There shall be a mechanism to detect the reduction in accuracy or performance of the Sensors and notifications issued to the Driver			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the presence/relative position and speed of objects around the CAV	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	



The control algorithm inside AutonomousDriveController					
shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the road layout and lane boundaries in the absence of lane markings.	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the the presence / position of objects around the CAV and their size	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The sensor between AutonomousDriveController and Vehicle Actuators shall be well maintained, ensuring that ADSSteerStatus is updated on time.	There shall be a mechanism to detect delays or failures in the update of SteerStatus due to sensor degradations and notifications issued to carry out maintenance/replacement.			x	
The feedback signals from Sensors (Temperature,Humidity,AmbientLighting) shall be updated on time to indicate the actual status of presence/position of objects around the CAV with delays not exceeding a specified threshold.	There shall be a mechanism to detect delayed feedback signals from Sensors (Temperature,Humidity,AmbientLighting)			x	
The delays in the communication channel between AutonomousDriveController and Sensors shall not exceed a defined threshold value.	There shall be a mechanism to detect incorrectly updated feedback signals from Sensors (Temperature,Humidity,AmbientLighting) due to communication delays			x	
The control algorithm of AutonomousDriveController shall be capable of processing feedback signals from the Sensors (Temperature,Humidity,AmbientLighting) within a specified duration of time to accurately to determine the time of day and weather conditions	If the time taken by AutonomousDriveController to process feedback signals from the Sensors (Temperature,Humidity,AmbientLighting) exceeds a defined threshold value, appropriate notifications shall be issued			x	
The sensor between AutonomousDriveController and VehicleActuators shall be well maintained, ensuring that the ADSSteerStatus feedback is continuously received.	There shall be a mechanism to detect a failure in receiving updated ADSSteerStatus due to sensor degradations			x	
The sensor fusion algorithm shall be able to accurately match sensor data to determine the forward road scene	There shall be a mechanism to detect the inability of the AutonomousDriveController to accurately match sensor data			x	
The control algorithm inside AutonomousDriveController shall be capable of processing the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) adequately to determine the speed limit for the current zone/road	If AutonomousDriveController is unable to process the feedback signals from the Sensors (GPSData, PointCloud, RadarData,RawImage, etc) accurately, it shall notify the Driver.			x	
The control algorithm of AutonomousDriveController shall be capable of processing ADSThrottleStatus within a specified duration of time.	If the time taken by AutonomousDriveController to process ADSThrottleStatus exceeds a defined threshold value,appropriate notifications shall be issued			x	
SensorVisibility shall indicate the status of visibility of sensors accurately	There shall be a mechanism to detect incorrect/erroneous SensorVisibility			x	



SensorObstruction shall indicate the status of obstruction	There shall be a mechanism to detect incorrect/erroneous				
of the Sensors accurately	SensorObstruction			x	
The Sensors shall issue GPS Data in a timely manner	There shall be a mechanism for the detection of delayed GPS Data			х	
The Sensors shall issue PointCloud in a timely manner	There shall be a mechanism for the detection of delayed PointCloud			x	
The Sensors shall issue RadarData in a timely manner	There shall be a mechanism for the detection of delayed RadarData			x	
The Sensors shall issue RawImage in a timely manner	There shall be a mechanism for the detection of delayed RawImage			x	