



Test and Validation Overview

Safety will be demonstrated when, there is no unreasonable risk or risk is reduced to acceptable level.



How do we test



Subclaim : System is verified at multiple levels to check that they do not add unnecessary risk

EVALUATION OF MAY SYSTEM IN NORMAL & HAZARDOUS SCENARIO(S)

SCENARIO BASED SAFETY EVALUATION

SIMULATIONS

- (Synthetics)
1) LEGAL MANEUVERS
2) ILLEGAL MANEUVERS
3) ABNORMAL

SIMULATIONS

- (LOG BASED)
1) INTERVENTION BASED
2) LOG BASED DNI_B

SIMULATIONS

- (LOG BASED
PERTURBED)
1) INTERVENTION BASED
2) LOG BASED DNI_B

CONTROLLED TEST

- 1) CORRELATION
BETWEEN SIMS AND USE
CASE
2) TELE ASSIST SAFETY

SYSTEM BASED SAFETY EVALUATION

FALLBACK TESTING IN ODD

- 1) FAULT REACTION
2) TELE ASSIST

FALLBACK TESTING

- 1) BENCH LEVEL
2) REQ BASED

The system is tested in layers with increasing complexity of safety to ensure safe operations even when things go wrong.

Level of testing

	Type of Testing	What do we test
Data Collection (normal/expert drives)	Route Selection KPI Drive	This starts after Vehicle usage testing release vehicle for public road. We drive on route to collect data.
Test Curation (simulation and vehicle)	Simulation Bench On vehicle	Based on data collection and ODD review developed test case for simulation and on vehicle test including failure situation.
Controlled Back seat testing	Back seat in test ground	Vehicle test for safety critical interaction and feature test as required.
Public road Readiness: Emergency response plan review with local authorities, review of test results if needed to obtain approval for limited back seat testing on public road.		
Limited Backseat testing in ODD	Normal Driving	Backseat driving in ODD, Data collection in ODD with no driver in the seat.
Rider Only testing	Expanded Driving and Testing failure condition	Test in ODD and validate fallbacks, recovery and operations related test.

Vehicle usage level are specified to make sure the vehicle is tested against safety requirements for the intended use of the vehicle.

Level	Process	Owners	Requirement
Usage Level 0	Inspection	Manufacturing	Each Vehicle
Usage Level 1a	Checks all connections over ethernet	Manufacturing	Each Vehicle
Usage Level 1b	Checks all connections over CAN (RADARS only)	Manufacturing	Each Vehicle
Usage Level 2	Base Vehicle functionalities - (Manual AVIS)	T&V	Each configuration (VP and ADK)
Usage Level 3a	TSR's - (Autonomy AVIS)	T&V	Each configuration (VP and ADK)
Usage Level 3b	TSR's - (Autonomy site, only Engineers)	T&V	Each configuration (VP and ADK)
Usage Level 4	TSR's - (Auto at site, AVO's and Engineers)	T&V	Each configuration (VP and ADK)