# KETs User Needs and Requirements

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# Scope

- ✓ Identify functional and technical requirements for KETs based on needs expressed by user groups.

  - ▪ The presented work is carried out as one Task in the HEADSTART Work package 1 "Use cases and requirements"

- ✓ The requirements are grouped, based on different principles and criteria

- ✓ This task Is linked to WP5 (Expert Groups) for additional input collection and consolidation by experts

- ✓ The requirements must be clearly expressed in order to be verifiable by the methods developed in WP2 ("Test, validation and certification methodologies and procedures")

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# Testability questionnaire

✓ Questionnaire with purpose to collect the stakeholders use cases with associated testing needs concerning the KETs:
- Communication
- Positioning
- Cybersecurity.

✓ The Questionnaire is made in Microsoft Forms and was distributed among the HEADSTART partners and in the network of the responsible partner (SAFER).

## Use cases and existing gaps for testing communication, cyber-security and positioning

### INTRODUCTION
Harmonized European Solutions for Testing Automated Road Transport (HEADSTART) https://www.headstart-project.eu/ HEADSTART will define testing and validation procedures of functions including its key enabling technologies by cross-linking of all test instances such as simulation, proving ground and real-world field tests to validate safety and security performance according to the needs of key user groups (technology developers, consumer testing and type approval).

### THE STEP OF DEFINING WHAT TO DEVELOP
The current stage in the project is to define and develop test, validation and certification methodologies and procedures for CAD building upon existing initiatives. HEADSTART will develop testing, validation and certification methodologies and procedures for CAD by: closing existing gaps and developing methodologies, procedures and tools beyond state-of-the-art. For the gaps identified, HEADSTART will develop methodologies, procedures and tools for the testing and validation of highly automated functions and its KET's according to stakeholder requirements, current state-of-the-art and in coordination with ongoing initiatives.

### PURPOSE OF QUESTIONNAIRE
In order to enable HEADSTART to "develop testing, validation and certification methodologies and procedures for CAD by: closing existing gaps and developing methodologies, procedures and tools beyond state-of-the-art."

The specific purpose of this questionnaire is to collect the Stakeholders ( ex : OEM, Tier 1, Testing facility, Regulatory) use case, with the specific associated testing needs with regards to to communication, cyber-security, positioning. Requirements will be extracted from the elaborated testing needs and used to create a catalogue of the (new) testable aspects of KET's (i.e. communication, cyber-security, positioning), that is not competently satisfied (or that has some aspects that need developing) under the current testing methodologies (paradigm).

### INSTRUCTIONS
One use case per form, if there are more than one use case please feel free to submit multiple forms.
Specific contact information is of course optional and will be handled with discretion.

# Let's make it interactive!

✓ Sli.do system for online surveys

✓ PROCEDURE:
- We will ask you some questions and then we will discuss them
- You have some time to answer them ← Do not rush!

✓ Connect to sli.do with your smartphone

✓ Enter the hashtag: #ERTICO

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# Let's make a test!

## QUESTION #1

What kind of stakeholder would you consider your organization in this context?
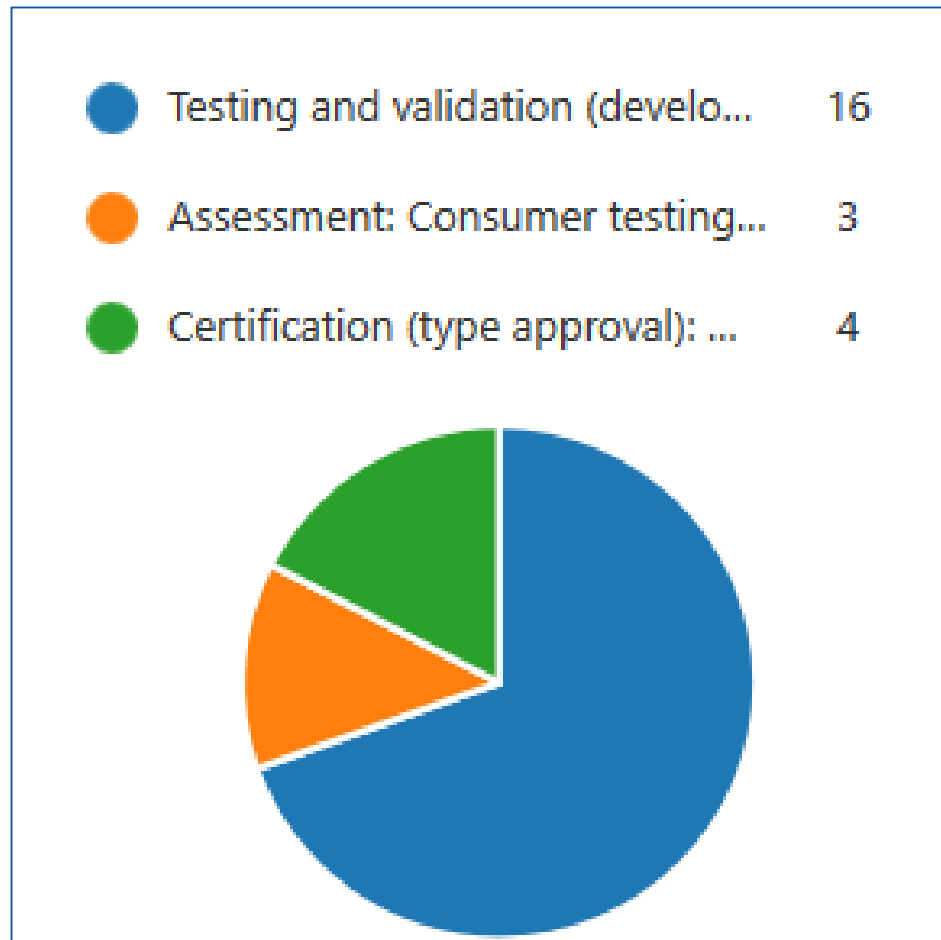
# Type of organization and expressed primary concern
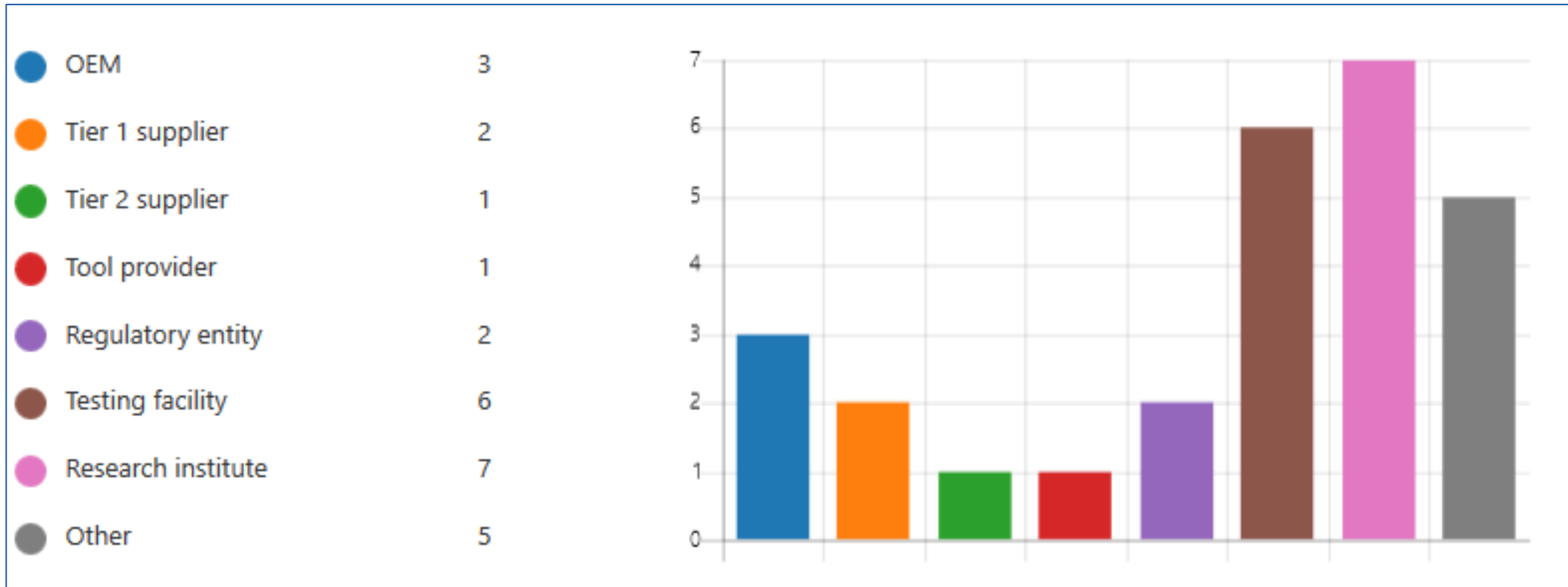
# QUESTION #2

# What kind of stake-hold would you consider is of primary concern for your user need?

# Type of organization and expressed primary concern

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Please, think of a Use Case you are involved or consider very relevant for CAV in which KETs are critical

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# Do you have it? Good!

# Now let's cathegorize it

# ERTRAC Use case cathegories - Freighter

- C-ACC Platooning (Level 1)
- Parking Garage Pilot (Level 4)
- Automated Truck Platooning (Level 2)
- Highway Pilot platooning (Level 4)
- Traffic Jam Assist (Level 2)
- Traffic Jam Chauffeur (Level 3)
- Highway Chauffeur (Level 3)
- Highly automated freight vehicles in Confined Areas (Level 4)
- Highly automated freight vehicles in Hub-to-Hub operation (Level 4)
- Highly automated freight vehicles on Open Roads and Urban (Level 4)
- Fully automated freight vehicles (Level 5)

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# ERTRAC Use case cathegories - Passenger

- ✓ Parking Assist (Level 2)
- ✓ Parking Garage Pilot (Level 4)
- ✓ Automated Valet Parking (Level 4)
- ✓ Traffic Jam Assist (Level 2)
- ✓ Traffic Jam Chauffeur (Level 3)
- ✓ Highway Chauffeur (Level 3)
- ✓ Urban and Suburban Pilot (Level 4)
- ✓ Highway Autopilot (Level 4)
- ✓ Highway Convoy (Level 4)
- ✓ Autonomous private vehicles on public roads (Level 5)

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# ERTRAC Use case cathegories – Urban mobility

- ✓ Parking Assistance (Level 2)
- ✓ Traffic Jam Assist (Level 2
- ✓ Urban Bus Assist (Level 2)
- ✓ Automated Bus Chauffeur (Level 3)
- ✓ Automated PRT/Shuttles on dedicated roads (Level 4)
- ✓ Automated PRT/Shuttles in mixed traffic (Level 4)
- ✓ Highly Automated Buses on Dedicated Lane (Level 4)
- ✓ Highly Automated Buses in Mixed Traffic (Level 4)
- ✓ Fully Automated Urban Vehicles (Level 5)

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# QUESTION #3

Please write which category better suits your use case

Please include the SAE level

If you feel that it is not well represented, describe it in your own words

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# Responses grouped into applications for each ERTRAC
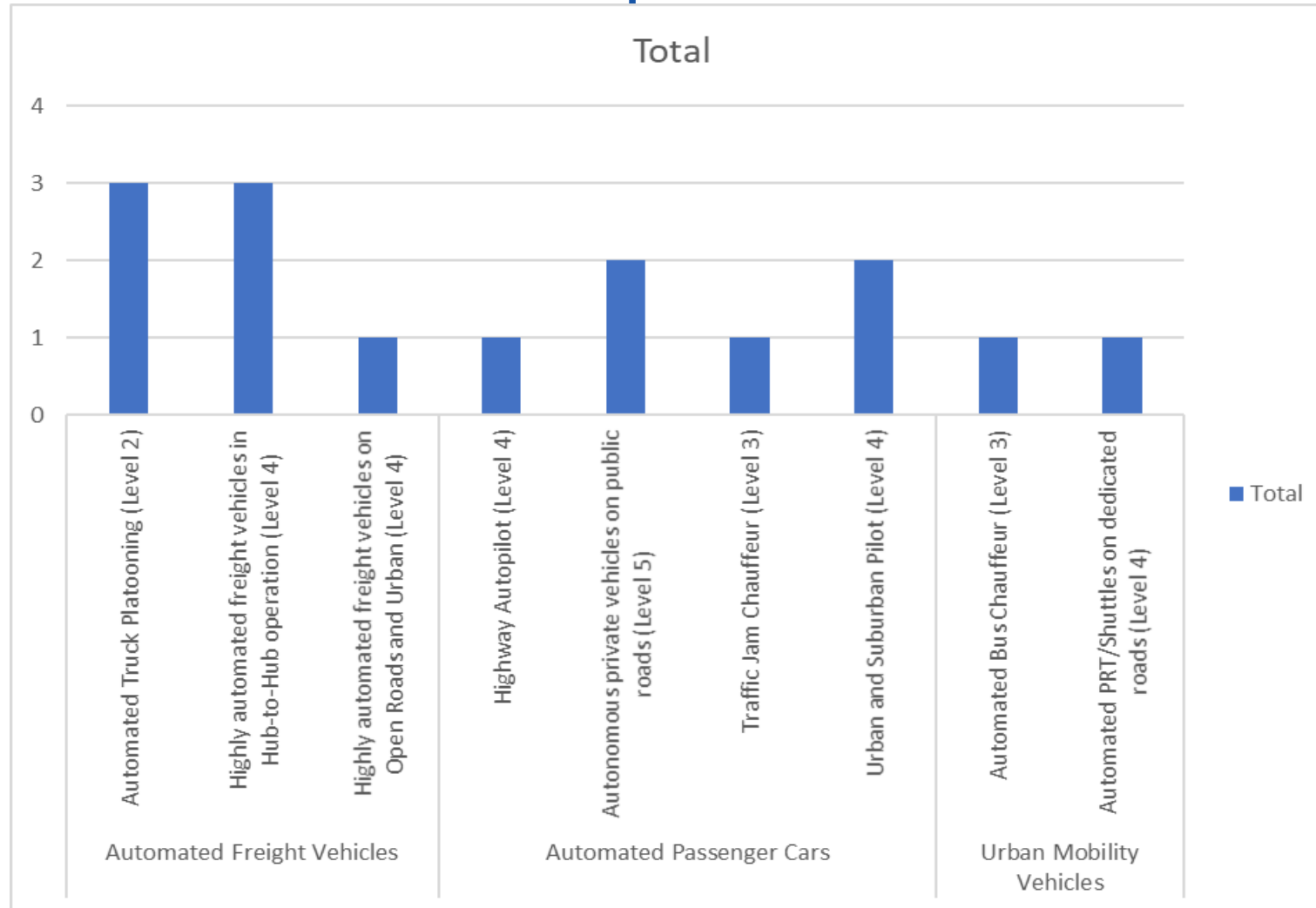
# QUESTION #4

# What is most relevant test propose for the key enabling technologies?

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# Expressed most relevant test purpose for the KETs



| | |
|---|---|
| ● Verification | 13 |
| ● Validation | 12 |
| ● Certification | 3 |
| ● Assessment (consumer testing) | 1 |
| ● Assessment required by stand... | 4 |
| ● Other | 0 |
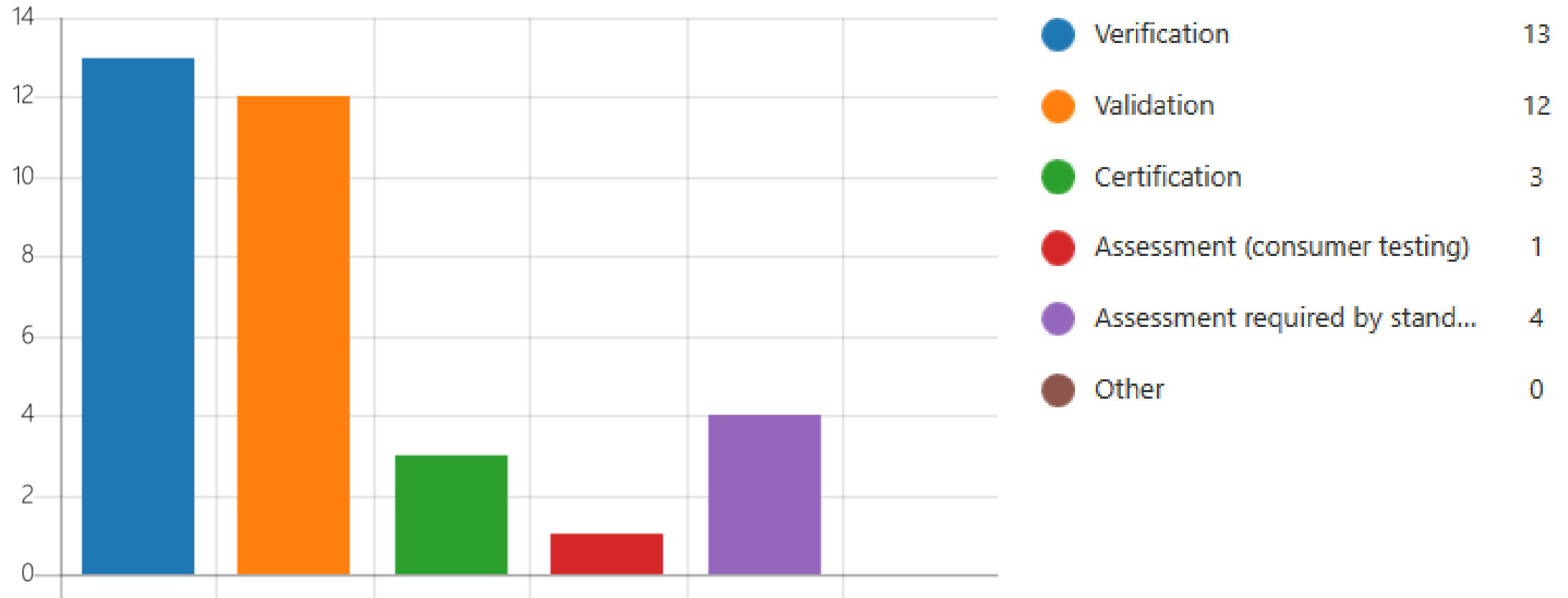
# QUESTION #5

Elaboration on the most relevant test propose (previous question) if applicable.

# Expressed most relevant test purpose for the KETs



Elaboration on the most relevant test propose

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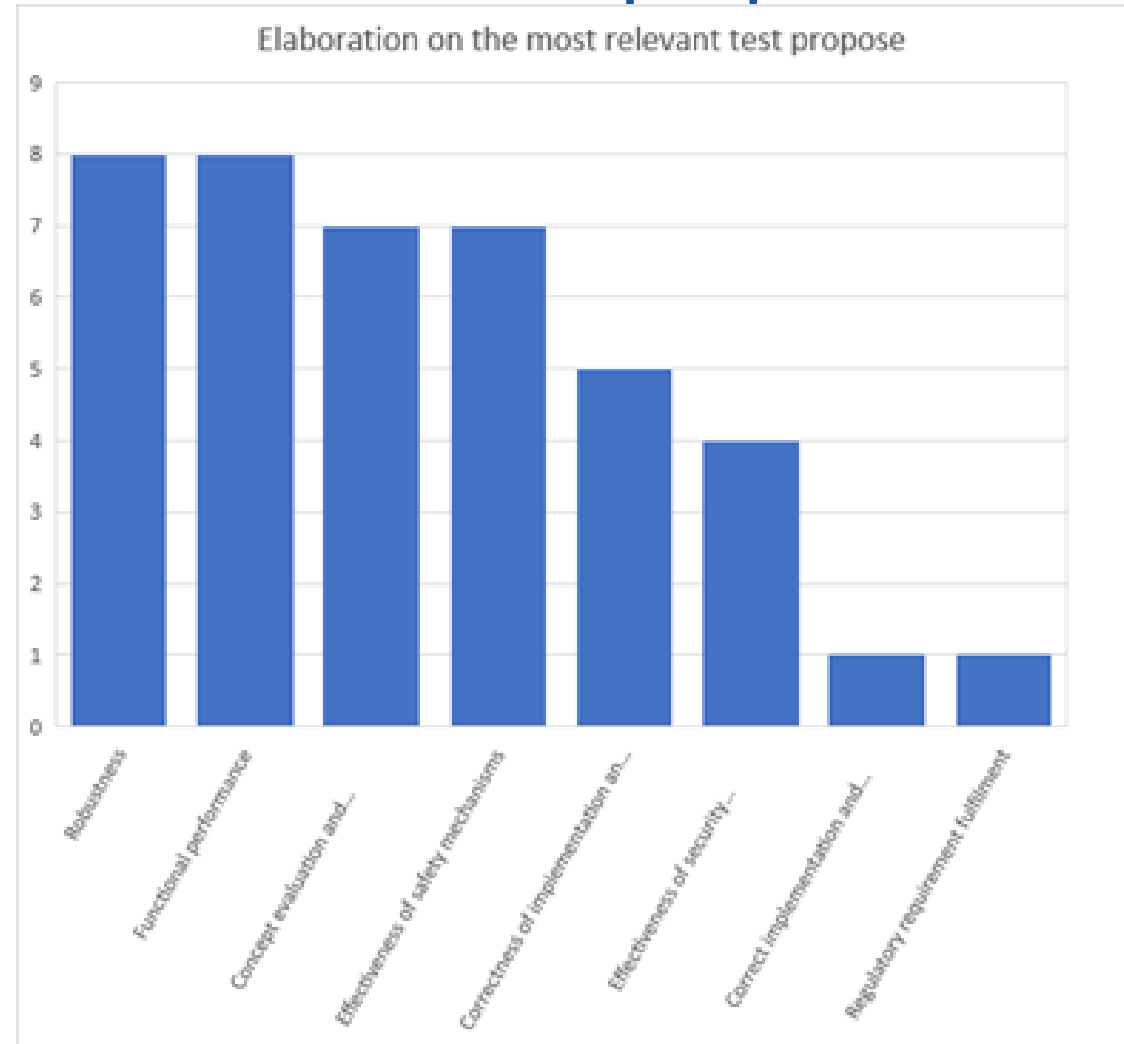
# Other sources for user needs and requirements used in T1.3

✓ To increase the data used for requirement identifications additional input was collected from other sources like research projects and initiatives.

## Do you believe there are any projects missing?

## Please let us know!

Sources
- 3GPP
- 5GCar
- Autopilot
- ENABLE-S3
- ENSEMBLE
- HoliSec
- ICT4CART
- InterACT
- MUCCA
- ProPART
- SaferTec
- SECREDAS

# Compiled requirements for Communication (part 1)

**Functional requirements at vehicle level**

- Communication may be applied through ITS-G5, 4G/LTE, 5G/LTE.
- Automotive OEM Clouds should be able to communicate (registration and data exchange) with service providers (e.g. parking, charging, etc.) through a common interface
- V2V communication means must integrate security requirements related to confidentiality, integrity and availability. (e.g. solutions for authentication, trusted IDs, encryption, …)
- Connected infrastructure, e.g., traffic lights, should be able to communicate through ITS-G5, 4G/LTE, 5G/LTE
- The system must support high connection density for congested traffic.
- Predictability- it is important to get information about when and where network KPI can't be fulfilled.
- The supported Vehicle velocity need to be specified. On German's autobahn it may be as high as 250 km/h. The relative velocity that must be supported is twice the absolute velocity.
- The automated vehicle must have a strategy to handle loss of V2X communication
- Seamless communication with Real/Virtual Cars
- Communication between the in-car system and a remote server/cloud

# QUESTION #6

# Please choose the 3 most important ones
# if not there, add one more
# COMMS: Functional requirements at vehicle level

# Compiled requirements for Communication (part 2)

**Technical constraints at vehicle component level**

- Low latency (5-60 ms per case)
- High reliability (99.00-99.99%)
- Data Rate (128kbps-29Mbps per case)
- Communication range (70m – several km per case)
- One Road Side Unit shall be able to communicate with up to 200 UEs.
- In platooning a specific vehicle shall be able to communicate with up to 19 other vehicles.

**Safety requirements for road-users**

- A vehicle must be possible to bring to a safe state if it has a critical failure (e.g. engine failure or loss of V2X communication)

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# QUESTION #7

Please choose the most important one
if not there, add one more

COMMS: Technical constraints at vehicle component level

# Compiled requirements for Communication (part 3)

**Potential physical constraints on test tracks (e.g. radio interference)**

- The test tracks must be equipped with relevant infrastructures for V2X communication to perform the tests.
- Information congestion in a v2x setting in an urban environment.
- If V2X communication testing is carried out in open air, no other radio transmission must influence the testing. If V2X communication testing is carried out in a shielded chamber, no other radio transmission must exist.

**How the requirement is expected to be partly verified by computer tools (simulation)**

- A V2X communication simulator to send pre-defined messages to the vehicle under test. The tool should make it possible to define and re-use test sequences of V2X messages. It should also be possible to record and save messages received from the vehicle under test.

**Technical feasibility**

- A challenge is that V2X, and especially C-V2X, is still in the development phase and devices meeting the requested requirements may not be available.

# QUESTION #8

## Please choose the most important one
## if not there, add one more

## COMMS: Potential physical constraints on test tracks
## (e.g. radio interference)

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# Compiled requirements for Positioning (part 1)

**Functional requirements at vehicle level**

- The vehicle should be equipped with equipment's for positioning.
- The positioning module shall have a HD map of the area in which will be operating.
- The system shall be able to provide positioning data at 10 Hz.
- Detect and evaluate GNSS uncertainty.
- The automated vehicle must have a strategy to handle loss of GNSS positioning.
- The GNSS system must handle jamming and spoofing.

**Technical constraints at vehicle component level**

- Accuracy:
  - Positioning accuracy within urban environment < 20 cm
  - The system shall be able to provide longitudinal positioning with 10 cm accuracy.
  - The system shall be able to provide lateral positioning with 10 cm of accuracy.
- In case of positioning using C-V2X::
  - A relative lateral position accuracy of 0.1 m between UEs shall be supported.
  - For platooning, a relative longitudinal position accuracy of less than 0.5 m for User Equipment's supporting V2X application for platooning.

# QUESTION #9

## Please choose the most important one
## if not there, add more

## Positioning: Functional requirements at vehicle level

# QUESTION #10

## Please qualify if you agree-disagree

## POSITIONING: Technical constraints at vehicle component level

# Compiled requirements for Positioning (part 2)

**Safety requirements for road-users**

- The vehicle must be possible to bring to a safe state when positioning is degraded/lost.

**Potential physical constraints on test tracks (e.g. radio interference)**

- "Simulate" different environments in regard to GNSS quality on the proving ground.
- Positioning signal quality vary in different urban environments. Robustness and high quality of the signal.
- The outdoor test track must allow easy GNSS connection, i.e. more than sufficient number of satellites must be possible to receive at the test track.
- Test tracks must be equipped with needed infrastructure to support tests of Positioning, e,g, base stations for RTK-GPS and UWB (Ultra Wide Band).
- A HD map of the test rack area must be available.

**How the requirement is expected to be partly verified by computer tools (simulation)**

- "Simulate" different environments in regard to GNSS quality on the proving ground.
- Proper simulation under weather conditions.

# QUESTION #11

Choose the most important one, if not please elaborate

POSITIONING: Potential physical constraints on test tracks (e.g. radio interference)

☐

# Compiled requirements for Cybersecurity (part 1)

**General**

- It should be required that the product has been developed following existing best practices for cybersecurity.
- Any cyber security issue regarding authentication and access within a vehicle should be reported by the vehicle to the corresponding service as an event
- Potential cyber-attacks shall be dually analysed; from the "Defenders" and the "Attackers" point of view

**Functional requirements at vehicle level**

- Adopt high levels of Confidentiality, Integrity and Availability
- V2X message reception shall be signed by a trusted third-party (message shall have valid and verified certificate and signature)
- Avoid the corruption of messages / Message shall be intact and uncorrupted
- This should be applied for all components in the system to ensure an end-to-end cybersecurity and besides vehicles also involving network and infrastructure like, e.g., traffic lights.

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# QUESTION #12

# Agree – Disagree
# please also elaborate

# General cybersecurity concept

# Compiled requirements for Cybersecurity (part 2)

**Potential physical constraints on test tracks (e.g. radio interference)**

- It must be possible to conduct penetration testing in dynamic conditions in specific scenarios and environments

**How the requirement is expected to be partly verified by computer tools (simulation)**

- Performed Cyber security testing:
  - Attack (Vulnerability) testing
  - Penetration testing
  - Fuzz testing

# Input is welcome

✓The HEADSTART project welcomes more input!

✓This and other questionnaires still open for input!

https://www.headstart-project.eu/2019/06/03/your-opinion-matters/

# HEADSTART Partners

# HEADSTART

## Thank you!

*Any questions?*

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