

# Topics to be addressed for edge cases

ARCADE Workshop on Edge cases

SYTZEKALISVAART APR 20, 2021 01:16PM

## What are the main challenges for edge cases?

### The metric used to "define" edge cases (criticality/severity).

*Can real edge cases, which you could not think of be measurable, predictable, extrapolatable at all?* – FEKE1

Are cyber attacks / hacking edge cases?

### Minimization

*Could you explain what minimization means?* – NATHANAEL TAN

*Finding the ones that are also common beyond a single occurrence only* – ANONYMOUS

### Universal edge-cases

Definition of universal edge-cases, instead of vehicle model specific ones.

What is an edge-case for a specific vehicle model, might not be one for another vehicle brand or model.

### Define the min/max thresholds while talking on edge spectrum

*We should also talk about the middle ground too! Not just the 25% and 75% but also the critical 50%* – NATHANAEL TAN

### Completeness of scenario pool with edge cases

### Edge cases may mean differently depending on the configuration of the ADS, is there any common ground?

### That you do not know them in advance.

## What should we not forget?

### Severity

Is an edge case always defined as an accident?

*What are measures to reduce criticality/severity of an "edge case" outside of car design?* – ANONYMOUS

*I still believe we should first categorise cases into internal and external* – NATHANAEL TAN

### Bad roads

### weather conditions

### Connectivity may be critical in the future and may introduce new risks

*Good point! I have reviewed a TRB paper on cybersecurity pertaining to AVs and though this is unlikely to happen (unless targeted), it is still worth looking into!* – NATHANAEL TAN

### Critical Scenarios for humans might not be critical for AVs (and the other way around). - -> Accident databases have limited validity, we cannot assume the same scenarios are critical for AVs

### System failure

### corner vs. edge vs. critical cases

As It was very well noticed by many participants: the definition is not consistent between communities.

- One definition would be recommended to avoid confusions: rare / known / unknown/ foreseeable / not foreseeable / expected / not expected?
- Clarify if corner / edge / critical cases are synonyms?

There are many references:

1. SOTIF:

“A corner case is a scenario in which two or more parameter values are each within the capabilities of the system, but together constitute a rare condition that challenges its capabilities. An edge case is a scenario in which the extreme values or even the very presence of one or more parameters results in a condition that challenges the capabilities of the system”[50].

Where 50 refers to [50] DIN SAE SPEC 91381:2019, “Terms and Definitions Related to Testing of Automated Vehicle Technologies”

2. Discussions going on in the UNECE IWG WMAD, SG1 Traffic Scenarios, the New Assessment and Test Method concept paper:

VMAD-16-03 provisional consolidated NATM MD.doc

‘Edge Case’ is a rare situation that still requires specific design attention for it to be dealt with by the AV in a reasonable and safe way. The quantification of “rare” is relative, and generally refers to situations or conditions that will occur often enough in a full-scale deployed fleet to be a problem but may have not been captured in the design process. Edge cases can be individual unexpected events, such as the appearance of a unique road sign or an unexpected animal type on a highway.

‘Critical Scenarios’ means a traffic scenario containing a situation in which the ADS needs to perform an emergency maneuver in order to avoid/mitigate a potential collision, or react to a system failure.

3. Prof. P. Kopmann paper ‘Credible Autonomy Safety Argumentation’. Where he refers to frequency (and UL 4600)

We define an edge case as a rare situation that will occur only occasionally, but still needs specific design attention to be dealt with in a reasonable and safe way.

It is useful to distinguish edge cases from corner cases. Corner cases are combinations of normal operational parameters. Not all corner cases are edge cases, and the converse. An example of a corner case could be a driving situation with an iced over road, low sun angle, heavy traffic, and a pedestrian in the roadway.

4. Other definitions mentioned by speakers like VV Methoden, other R&D projects...

*Another issue would be how we can distinguish between case types since some may overlap with another – NATHANAEL TAN*

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