VMAD Technical Workshop on In-Service Safety Performance of Automated Vehicles

FG-AI4AD Alignment

Bryn Balcombe - 24th March 2022

AI for Autonomous and Assisted Driving

ITU Focus Group

A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle.

There are no eye-witnesses.

The Molly Problem for Self-Driving Vehicles

What should happen next?

Respondents have clear expectations for the capability and behaviour of the self-driving software in the case of a pedestrian collision event.

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

97% ***to be aware*** **of the collision**

2% unsure & 1% don’t

94% ***to stop*** **at the collision site**

4% unsure & 2% don’t

97% ***to indicate a hazard*** **to other road users**

2% unsure & 1% don’t

94% ***to alert emergency services***

5% unsure & 1% don’t

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

1968 Convention on Road Traffic

Article 31 - Behaviour in case of accident

1. Without prejudice to the provisions of domestic legislation concerning the ***obligation to assist*** the injured, ***every driver or other road-user involved in a traffic accident*** shall:

(a) ***Stop*** as soon as he can do so without causing an additional danger to traffic;

(b) Endeavour to ***ensure traffic safety at the site*** of the accident and, if a person has been killed or seriously injured in the accident, to prevent, in so far as such action does not affect traffic safety, any change in conditions at the site, including the disappearance of traces which might be useful for determining responsibilities;

(c) If so requested by other persons involved in the accident, identify himself to them;

(d) If a person has been injured or killed in the accident, ***notify the police*** and remain on the scene of the accident or return to it and wait there until the arrival of the police, unless he has been authorized by the police to leave or has to assist the injured or to receive attention himself.

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(c) If so requested by other persons involved in the accident, identify himself to them;

(d) If a person has been injured or killed in the accident, ***notify the police*** and remain on the scene of the accident or return to it and wait there until the arrival of the police, unless he has been authorized by the police to leave or has to assist the injured or to receive attention himself.

What *traces* might be useful?

In addition to post-collision behaviour respondents were asked about the information recall capabilities of the self-driving software.

The overwhelming majority had strong and clear expectations for the development of explainable AI for self-driving software.

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

Safe interaction with other road users

Explainability - ITU FG-AI4AD driving behaviour data sources

Situation

Did the AI understand the circumstance and situation?

Hazard

Did the AI understand the hazards?

Action

Did the AI execute the correct mitigating action for the hazards?

Outcome

1968 Convention Article 7 - Compliant?

Road-users shall avoid any behaviour likely to endanger or obstruct traffic, to endanger persons, or to cause damage to public or private property.

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

99% **expect recall of the *time* of the collision**

1% don't

99% **expect recall of the *location* of the collision**

1% don't

98% **expect recall of the *speed* at point of the collision**

1% unsure 1% don't

93% **expect recall of *when* the collision risk was identified**

6% unsure 1% don't

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

96% **expect recall of *if* Molly was detected**

3% unsure 1% don’t

96% **expect recall of *when* Molly was detected**

2% unsure 2% don’t

91% **expect recall of *if* Molly was detected as a *human***

6% unsure 3% don’t

90% **expect recall of *when* Molly was detected as a *human***

7% unsure 3% don’t

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

98% **expect recall of *whether* mitigating action was taken**

1% unsure 1% don’t

97% **expect recall of *when* mitigating action was taken**

2% unsure 1% don’t

96% **expect recall of *what* mitigating action was taken**

3% unsure 1% don’t

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

88% **expect similar recall abilities for *near-miss events***

5% unsure 7% don’t

73% **expect *driving* to be *prohibited* for software *without recall capability***

15% unsure 12% don’t

The Molly Problem: A young girl called Molly is crossing the road alone and is hit by unoccupied self-driving vehicle. There are no eye-witnesses. What should happen next?

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Alignment

New Assessment/Test Method for Automated Driving (NATM)

10.3 The three main purposes of in-service monitoring and reporting is to use retrospective analysis of data from manufacturers and other relevant sources to:

(a) demonstrate that the initial safety assessment (residual risk) in the audit phase before the market introduction is confirmed in the field overtime ("**safety confirmation**").

(b) to fuel the common scenario database with important new scenarios that may happen with automated vehicles in the field ("**scenario generation**") and

(c) to derive safety recommendations for the whole community by sharing learnings derived from key safety accidents/ incidents to allow the whole community to learn from operational feedback, fostering continuous improvement of both technology and legislation ("**safety recommendations**").

The obligation to have "**real-time monitoring**" (self-checks/ on board diagnostics) of the performance of ADs subsystems by the manufacturer is **not part of this pillar but is part of the safety requirements**.

However, some reporting mechanisms on the performance of ADS subsystems overtime could be part of the first bullet above, and contribute to the predictive monitoring of safety performance degradation.

This pillar focuses on the type of data to be monitored and reported.

New Assessment/Test Method for Automated Driving (NATM)

10.8 Strengths and weaknesses of the pillar:

- 10.13 Methods to verify the reliability of collected data should be developed.
- The data collected should be **comparable amongst manufacturers**. It will create challenges on which data and how these data are collected and reported (definition of suitable reporting criteria).
- Time-wise, another challenge is the development of the in-service safety monitoring framework in a timely manner in order to serve AVs market deployment.
- Data privacy should also be taken into account.
- A **standardized format for communication of information** will be needed to allow **processing by authorities in a standard manner** and that any **outcomes are easily shareable or open for analysis by other authorities**.
- Different type of data may be needed depending on the purpose of the data collection.

New Assessment/Test Method for Automated Driving (NATM)

11 NATM Pillars/Element Interaction

- 11.1 The goal of the NATM is to **assess the safety of an ADS** in a manner that is as **repeatable, objective and evidence-based** as possible, whilst remaining **technology neutral** and **flexible enough to foster ongoing innovation** in the automotive industry.
- 11.2 The overall purpose of the NATM is to assess, based on the safety requirements, whether the ADS is able to cope with the occurrences that may be encountered in the real world. In particular by looking at **scenarios linked to road users behaviour/environmental conditions in traffic scenarios** but also scenarios linked to driver behaviour (e.g. HMI) and **ADS failures**.
- 11.7 In-service monitoring and reporting can **confirm the pre-deployment safety assessment** and fill the gaps between safety validation through virtual/physical testing and real-life conditions. Evaluation of in-service performance will also serve to **update the scenario database** with new scenarios deriving from increasing deployment of driving automation. Finally, the feedback from operational experience can **support ex-post evaluation of regulatory requirements**.

New Assessment/Test Method for Automated Driving (NATM)

Occurrences - Mapping to FG-AI4AD priorities

Occurrences list

OCCURRENCE	SHORT-TERM REPORTING [1 Month]	PERIODIC REPORTING [6 Month/1 Year]	
1.a. Safety critical occurrences known to the ADS manufacturer or OEM	x	x	FG-AI4AD
1.b. Occurrences related to ADS operation outside its ODD	x	x	
1.c. ADS failure to achieve a minimal risk condition when necessary	x	x	
1.d. Communication-related occurrences		x	
1.e. Cybersecurity-related occurrences		x	
1.f. Interaction with remote operator if applicable		x	
2.a. Driver unavailability (where applicable) and other user-related occurrences		x	
2.b. Occurrences related to Transfer of Control failure		x	
2.c. Prevention of takeover under unsafe conditions		x	
3.a. Occurrences related ADS failure		x	
3.b. Maintenance and repair problems		x	
3.c. Occurrences related to unauthorized modifications		x	
3.d. Modifications made by the ADS manufacturer or OEM to address an identified and significant ADS safety issue		x	
4. Occurrences related to the identification of new safety-relevant scenarios	x	x	FG-AI4AD

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Example

UK Highway Code

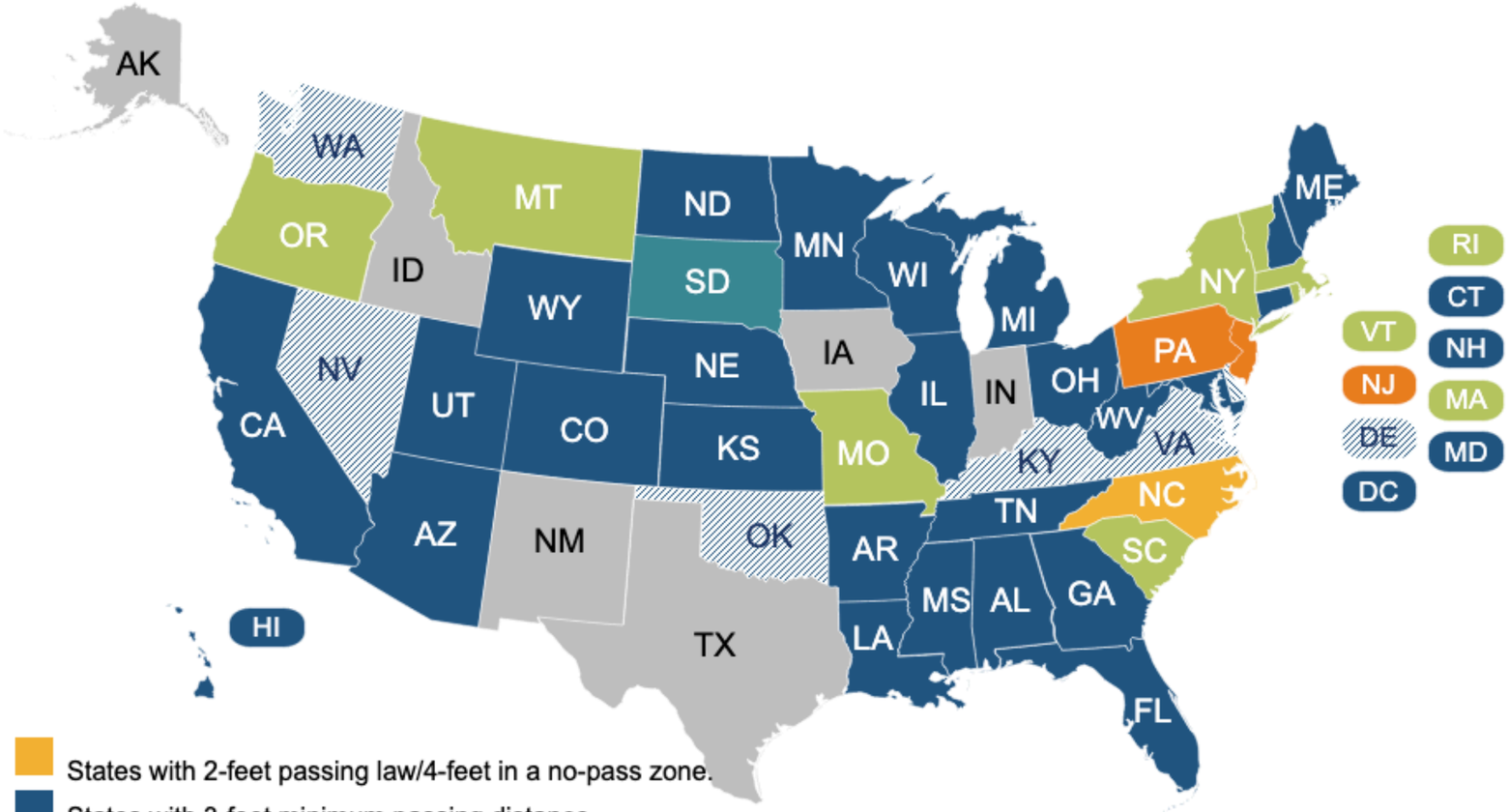
Rule 163 - Overtake only when it is safe and legal to do so. You should…

…give motorcyclists, cyclists and horse riders and horse drawn vehicles at least as much room as you would when overtaking a car (see Rules 211 to 215). As a guide:

- leave at least **1.5 metres when overtaking cyclists at speeds of up to 30mph**, and give them more space when overtaking at higher speeds
- pass **horse riders** and horse-drawn vehicles at speeds under **10 mph and allow at least 2 metres of space**
- allow at least **2 metres of space and keep to a low speed** when passing a **pedestrian who is walking in the road** (for example, where there is no pavement)
- take extra care and give more space when overtaking motorcyclists, cyclists, horse riders, horse drawn vehicles and pedestrians in bad weather (including high winds) and at night
- you should wait behind the motorcyclist, cyclist, horse rider, horse drawn vehicle or pedestrian and not overtake if it is unsafe or not possible to meet these clearances.

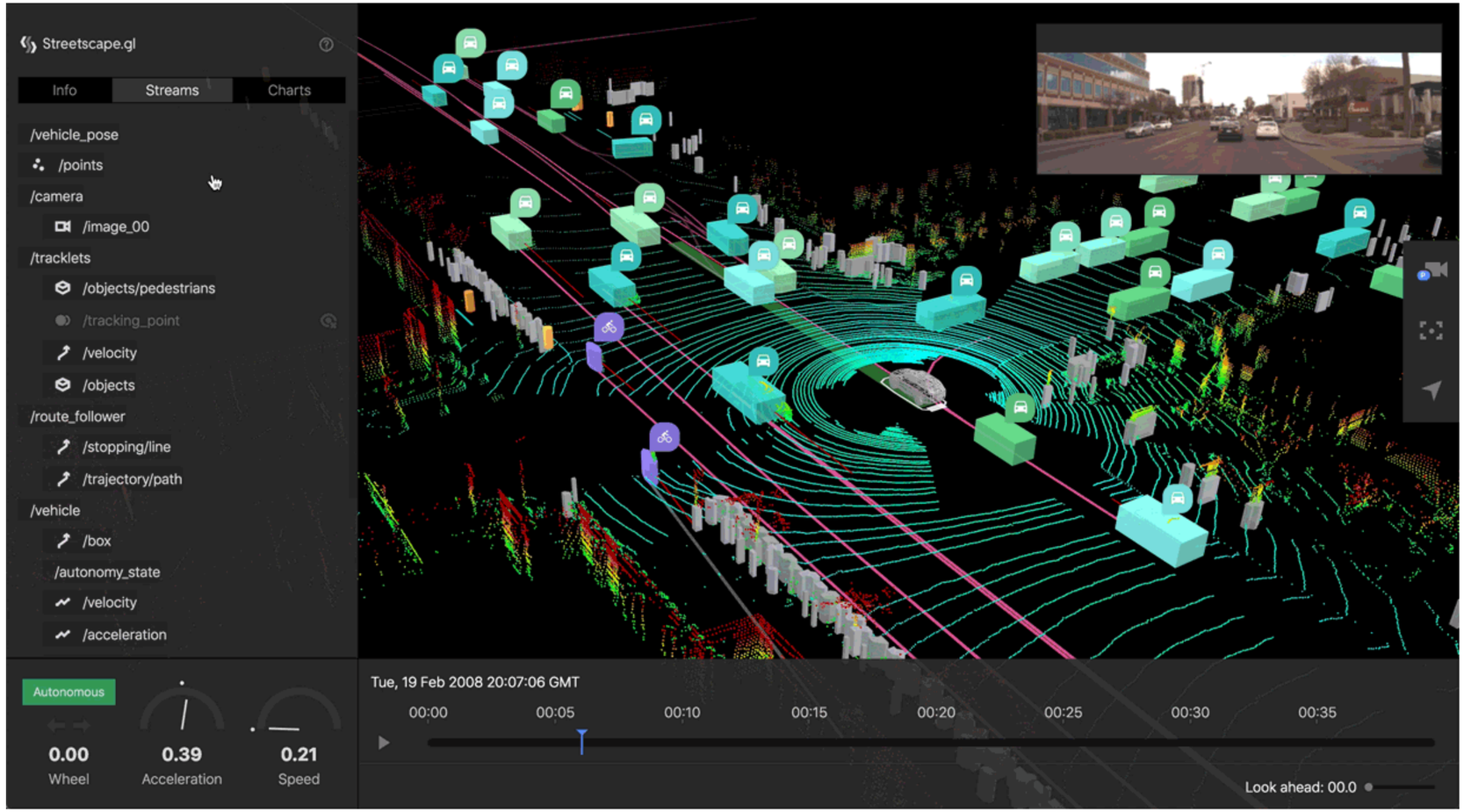
US State Statues Regarding Motorists passing Bicyclists

Safe passing distances and speeds



Uber ATG - Autonomous Vehicle Visualisation (AVS)

Showing real-world performance (Chen, Lisee, Wojtaszek, & Gupta, 2019)



ETSI TR 103 562 V2.1.1 (2019-12)

Analysis of the Collective Perception Service (CPS); Release 2

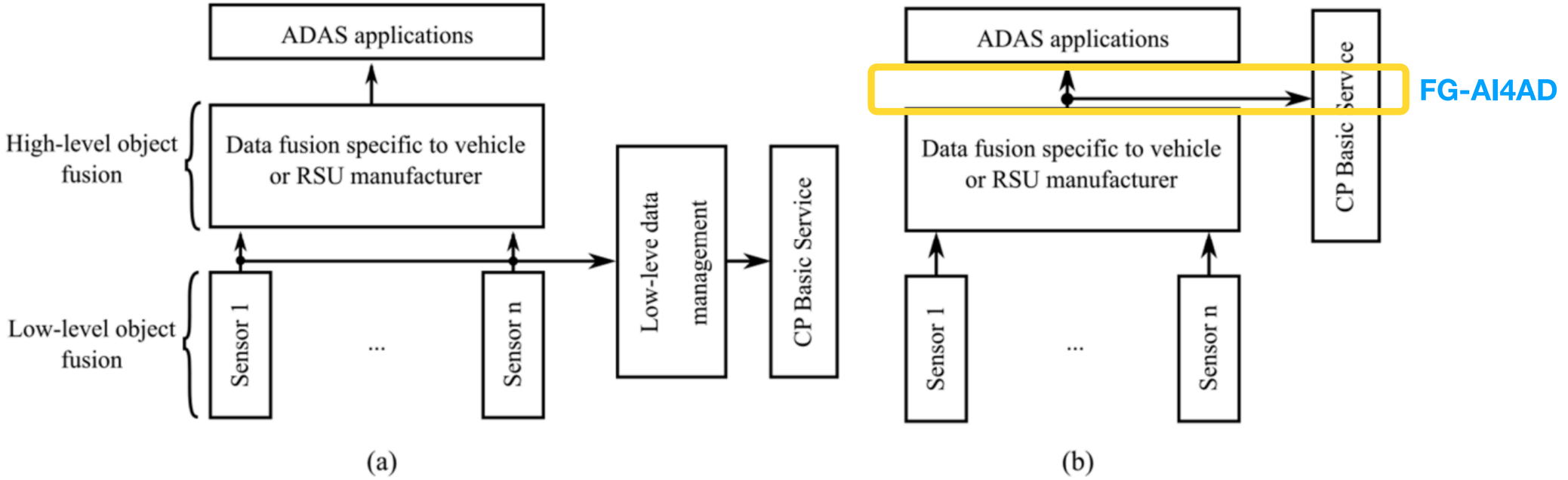


Figure 1: Object data extraction levels to be considered as part of the CP basic service

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THANK YOU. STAY SAFE. STAY HEALTHY.

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