

Optical and/or Audible Signals in DAS and ADS Vehicles

Considerations on the Recognizability of Automation State from the Perspective of Enforcement

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Recognizability of Automation State from the Perspective of Enforcement

Expanding on the discussion of whether optical and/or audible signals should be employed or required in ADS vehicles (and possibly some ADAS vehicles) to indicate their state (and intentions) to other road users...

The Netherlands has encouraged WP.1 and other interested parties to address a proposed need of enforcement officers to be able to identify the automation status of a vehicle.

Essential Issues Raised:

- How is an enforcement officer to understand who was in control of a vehicle in the case of a (possible) offense?
- This is necessary information in terms of who is to be held responsible and, particularly in the case of automation, identifying what might potentially be learned from the event.

Economic Commission for Europe

Inland Transport Committee

Global Forum for Road Traffic Safety

Eighty-sixth session

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Item 3 (d) (ii) of the provisional agenda

Convention on Road Traffic (1968)

Human factors and automated driving as key issues for future road traffic

Submitted by the Government of the Netherlands

**Informal Document No. 3 – March 2023 for the 86th Session
Submitted by the Government of the Netherlands**

- **Expands on original document submitted at the 85th Session in September 2022**

How Should a Vehicle Indicate the Driving State to Enforcement Officers?

While I expect that there is general conceptual agreement around the desirability of enforcement officers being able to determine who was responsible for operating a vehicle during a possible violation event...

Using Optical Signals to Show Vehicle Status – Case Against

Previous WP.1 Sessions:

- External signaling of vehicle status could lead to development of differential expectations for how automated vs. manually driven vehicles will behave – with possible negative consequences
- An optical signal adding movement could draw attention away from other critical events pedestrians & other road users should attend.
- Adding another optical signal to vehicles may actually increase confusion (sea of lights)

WP.29 (188th session):

- Recommended against requirements for additional light signaling devices beyond those required for manually driven vehicles



Potentially creating a sea of visual confusion?

Informal Document No. 3 (ECE-TRANS-WP.1-2021-Informal-No.3e), March 8-12, 2021.

WP.1 83rd Session, September 21, 2021

<https://unece.org/sites/default/files/2021-11/ECE-TRANS-WP1-2021-Presentation-21e.pdf>

International Federation of Pedestrians (IFP) Comments: ECE-TRANS-WP1-Informal document-6e, February 25, 2022

Another Argument Against Relying on an Optical Signal to Show Vehicle Status

Temporal Component

- Driving status and a violation can evolve over time
- A vehicle may be in an automated mode at the start of a critical event
- Automation may cut-out, turning off the optical automation status indicator, and ...
- Leave the driver to resume manual control but without enough time to avoid a crash

What does the enforcement officer see in terms of automation status when they come on the scene?



Even if a visual status signal can be seen by an enforcement officer at a given moment of offense, that does not mean that was the status leading up to the infraction

If Not an Optical Signal, What?

WP.29 (188th session):

- Recognized that some means other than light-signaling of automation status may be suitable to enable enforcement needs

FRAV/IGEAD workshop (Nov. 7-8, 2022):

- While discussing possible optical signal approaches, the option of a data signal that enforcement officers could access was discussed



A Challenging but Possible Option -

Limited Historical Status Data Interrogation?

- Wireless connection or physical interrogation port to provide *limited* status information for x minutes of history (to solve the temporal problem)?

Issues with Data History Access in the Field?

How Much Information?

- What data gives an officer enough information without becoming difficult to interpret?
- How far back in time should the record go?

Privacy Concerns?

- Option to refuse access, with consequential presumption of manual control?

Hacking?

- Directionality of data flow safeguarded

Cost vs. Benefit?

- Cost of adding module to vehicle
- Cost of equipping enforcement officers with control status data reading device



The Challenge of Knowing Who Was Responsible for “Driving”

	“Driver”	Automation	Remote Operator
Level 0	x		
Level 1	x	? ¹	
Level 2	x	? ¹	
Level 3	x	x ²	
Level 4	x ⁴	x	x ³
Level 5	x ⁴	x	x ³

- At what level of automation capability should information on automation status be required?



¹Are there any conditions under which software or sensor design issues “absolve” the driver of responsibility?

²At what point after a take-over request does the “driver” become the responsible operator?

³Manual vs. Automated are not the only options – remote operator(s) could be responsible for driving

⁴Since Level 4 & 5 vehicles could be equipped with a steering wheel for back-up / optional use, one cannot assume the presence of a steering wheel means the vehicle was manually operated



Recognizability of Automation State from the Perspective of Enforcement

Our colleagues from the Netherlands have made a solid case for why it is conceptually desirable for an enforcement officer to understand who was in control of a vehicle in the case of an offense (or crash).

Where Do We Take This Discussion?

- Arguments have been made both inside and outside of WP.1 against the advisability of using optical signals to indicate automation state – ***Are there further reasons to consider optical signals for this enforcement function?***
- If optical signals are used, how do we address the temporal aspects of a potential change in control state as an event unfolds?
- If not optical - **Is there sufficient need that we should consider mandating a data interrogation system in ADS and possibly some ADAS vehicles?** (If yes, there are technical, legal, and cost issues to consider as briefly mentioned.)
- If not a data interrogation system, then what?

Other Enforcement / Safety Issues:

- How is an enforcement officer or other safety worker (fire or medical worker) to communicate with an AV to command it to stop?
- To communicate with a remote operator / supervisor to move a stopped vehicle?



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