

**Draft Text for
FRAV Recommendations on
ADS External Light-Signalling**

This text has been prepared for consideration by FRAV during its 31st session (September 2022). The text aims to summarize the consensus outcomes of FRAV deliberations on ADS external light signals for ADS vehicles to date.

Summary

- FRAV does *not* recommend requirements for *mandatory* installation of additional light-signalling devices beyond those requirements established for manually driven vehicles.
- FRAV recommends the use of existing light-signalling devices to signal initiation of an automated fallback response designed to place the ADS vehicle in a minimal risk condition.
- FRAV recommends the establishment of uniform provisions for a light signal to communicate the operational status of the ADS *if fitted on an ADS vehicle and under certain conditions*.

Background

Pursuant to deliberations during its November 2021 session, AC.2 tasked GRVA and its Informal Working Group on Functional Requirements for Automated Vehicles (FRAV) to determine the conditions, if any, under which an ADS external lighting signal should be activated and recommend to GRE to whom the signal should be displayed (drivers in other vehicles, other road users) and from where it should be visible (e.g., front, rear, side).

FRAV consulted with the GRE Task Force on Autonomous Vehicle Signalling Requirements (AVSR), reviewed outcomes of these and other deliberations and research projects, surveyed its experts, and deliberated on the issue across its sessions between March 2021 and September 2022.

Recommendations

1. FRAV does not recommend requirements for mandatory installation of additional light-signalling devices beyond those requirements established for manually driven vehicles.

FRAV recommends that ADS be required to operate the vehicle in accordance with traffic laws. These laws prescribe requirements for signalling to other road users¹ (ORU) and are deemed sufficient to address road-safety needs.

Research and documented real-world cases indicate that identifiers unique to ADS vehicles raise risks of changes in ORU behaviours that adversely impact road safety. ADS safety requirements ensure predictable ADS behaviours designed to prioritize collision avoidance. Foreknowledge of ADS operation of a vehicle has been shown to alter risk assessments of other road users, resulting in

¹ FRAV defines “other road user” as any entity using a roadway and capable of safety-relevant interaction with an ADS vehicle.

higher-risk behaviours when interacting with these vehicles. ADS responses to mitigate these higher-risk ORU behaviours may result in traffic disruptions that may introduce further road-safety risks.

2. FRAV recommends the use of existing light-signalling devices to signal initiation of an automated fallback response designed to place the ADS vehicle in a minimal risk condition (MRC).

Under certain conditions, an ADS may need to place the ADS vehicle in a stable and stopped condition that minimizes the risk of a crash. Depending upon the ADS configuration, such conditions may include fallback-user incapacitation (e.g., medical emergency), failed fallback-user response to an ADS transition demand, or a condition that prevents the ADS from safely performing the Dynamic Driving Task.

FRAV recommends that ADS signal initiation of a safety-critical automated fallback response to ORU in a manner consistent with similar expectations applied to human drivers (such as via activation of a hazard-warning signal).

3. FRAV recommends the establishment of uniform provisions for a light signal to communicate the operational status of the ADS if fitted on an ADS vehicle and under certain conditions.

While FRAV does not recommend mandatory installation of light-signalling devices unique to ADS vehicles, neither does FRAV recommend a prohibition against the use of light-signalling to indicate the ADS operational status under certain conditions.

As noted above, FRAV does not support ADS-specific light-signalling to all road users; however, FRAV notes instances where signalling to road-safety agents² such as law enforcement may be justified. For example, FRAV notes traffic laws that prohibit human drivers from engaging in certain non-driving-related activities (NDRA). However, FRAV anticipates traffic laws that may permit additional NDRA while an ADS is operating the vehicle. Means to enable law enforcement to determine whether a vehicle is under ADS operation may therefore be justifiable in order to facilitate enforcement of such laws regarding permissible NDRA.

In this regard, FRAV does not exclude the potential usefulness of a light signal to address specific interactions with road-safety agents. FRAV notes that means other than a light signal may address such interactions. For example, telecommunications technologies may enable dissemination of information to designated or authorized recipient(s). [As ADS technologies evolve, it is recommended that GRVA continue to monitor research on the topic of ADS signalling to assess its potential safety benefits for road-safety agents as well as other road users, such as pedestrians/passengers with different accessibility needs.](#)

In the event that Contracting Parties wish to permit the use of a light-signal to communicate the operational status of ADS vehicles, FRAV recommends the establishment of uniform provisions to facilitate harmonization of such devices if fitted on the vehicle. FRAV recommends that such signals avoid confusion or interference with other lighting or light signals and be:

- Activated upon ADS detection of the road-safety agent involved in the interaction,
- Discretely positioned to minimize visibility by other road users, and

² “Road-safety agent” is defined by FRAV as a human being engaged in directing traffic, enforcing traffic laws, maintaining/constructing roadways, and/or responding to traffic incidents.

Commented [CJ1]: Research should take into consideration the vehicle’s use case. There has been some interest raised by an organization representing people who are visually impaired that there may be benefits to additional light signaling functions. This is based off a trial using shuttles for public transportation in Canada conducted in 2020.

Commented [CJ2]: While we understand the intent of this recommendation, discrete and minimized could make it too difficult to see by the target audience. It would be better to have a signal that is sufficiently distinct so that it can be easily recognized and not confused with other lighting. If an ADS would be required to signal to law enforcement that it is operating in automated mode it may not create safety issues with ORUs using this knowledge to interfere with the vehicle’s operations. Trying to eliminate the potential risk that ORUs would interfere with the vehicle’s operations in this regard is more likely to increase the overall risk that the signal is not capable of achieving its purpose.

Submitted by the experts from Transport Canada

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- Illuminated for a duration necessary to meet the relevant safety need.

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List of reference documents

Reference documents in addition to those identified by the AVSR Task Force (see AVSR-05-06 for literature review and especially the 2nd AVSR session for studies).

European Commission, Directorate-General for Mobility and Transport, Montalvo, C., Willemsen, D., Hoedemaeker, M. (2020). Study on the effects of automation on road user behaviour and performance: final report, Publications Office. <https://data.europa.eu/doi/10.2832/431870>.