

PASSENGER-INITIATED EMERGENCY STOP (PES) BEHAVIORS

TITLE: PES Behaviors
Supersedes: None (Version 1.0 – June 2019)

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Introduction and Scope

While riding in an Automated Driving System-Dedicated Vehicle (ADS-DV)¹ dispatched by a commercial enterprise offering a ride hailing service for a fee, a passenger may have a need to request an unscheduled stop due to a perceived hazardous situation the passenger believes necessitates an immediate stopping of the vehicle, such as fire in the cabin, threat of passenger-on-passenger violence, or an external hazardous event/threat (e.g., bridge collapse, earthquake, etc.).² This document describes a passenger-initiated emergency stop (PES) feature to be used in case of an emergency, as determined by the passengers. This feature could be made available to passengers riding in commercially-operated ADS-DVs. Use of this feature outside of emergency circumstances would be presumed as misuse or abuse and should be discouraged by design and/or policy.

There is an opportunity as an industry to align on several principles in order to avoid potential confusion among customers (i.e., future passengers of ADS-DVs deployed as ride-hailing fleets) about proper use of this feature and to help ensure that this capability is implemented safely. The following sections provide recommended practices for ADS-DV behavior in response to a PES request, as well as recommendations to deter inadvertent or improper activation.

Emergency Stopping Behavior

The primary concern of implementing a PES feature is balancing the need to stop the vehicle quickly without potentially introducing other risks, such as stopping unnecessarily in the middle of high-speed traffic, or stopping too quickly. The ADS-DV maintains situational awareness while executing a PES. Therefore it is recommended that upon receipt of a passenger-initiated emergency stop request, an ADS-DV equipped with this feature should first attempt to identify an immediately-available stopping location that would minimize risks and would otherwise minimize the impact to traffic flow so as to come to a stop outside of an active lane of traffic, when possible. If no such location is immediately available, then the vehicle should perform an emergency stop-in-path. This entails the vehicle coming to a controlled stop within its current path (or lane) of travel. It could also entail activating hazard lamps and remaining stopped until given authorization (e.g., by the fleet operator) to resume. If the vehicle is expected to stay at a standstill for an indefinite period of time, the vehicle should have a “standstill management” strategy that does not depend on the ADS-DV maintaining power. The vehicle could also warn the passengers (through text and/or audio) that there could be vehicles passing nearby.

¹ ADS-DV is defined in SAE J3016 (June 2018) as “A vehicle designed to be operated exclusively by a level 4 or level 5 ADS for all trips within its given ODD limitations (if any).”

² An ADS-DV equipped with suitable in-cabin sensing may be capable of detecting a hazardous cabin situation and initiate a stop-in-path maneuver when warranted. This sensing capability could also be supplemented with audio and/or video communication with fleet management personnel.

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User Interface – Emergency Stops

Because a PES feature involves potentially stopping in an active lane of traffic, measures should be put in place that discourage misuse and abuse³. These may include, but not limited to, designing deterrents such as warning labels, two motion activation, and placement. Additional research may be needed to determine the deterrent methods, or combination of methods, that would be most effective and practicable. This research may reveal the need for policy actions which are currently applied to analogous features in other industries (e.g., emergency stops on trains).

It is recommended that developers should also consider the following points:

- Accessibility restrictions that may affect the ability of certain ADS-DV passengers to activate the feature
- Designing the emergency stop feature such that it provides immediate feedback when an emergency stop is requested, such as, via immediate deceleration (i.e., kinesthetic feedback) or verbal feedback that the vehicle is about to stop

Developers may also consider additional methods of initiating an emergency stop, so long as they also provide the aforementioned passenger-initiated emergency stop feature.

Summary

As a consortium within the industry, there is agreement on two principles to help minimize risk associated with emergency stop requests from passengers in an ADS-DV that provides commercial ride-hailing services for a fee.

Principle 1) It is recommended that ADS-DVs providing commercial ride-hailing services for fee include a passenger-initiated emergency stop feature that is reasonably accessible and always available to passengers.

Principle 2) Since stopping quickly may require stopping in an active lane of traffic, it is recommended the PES design should consider foreseeable misuse and abuse and protect against these where possible.

Additional research is needed to determine what measures, or combination of measures, would be most effective and practicable in discouraging misuse and abuse of PES activation. An additional area of potential research is whether passengers should be given the ability to abort a PES after it has been initiated based on the residual risk to the ADS-DV passengers or other road users as a consequence of the PES actions.

³ For the purposes of this paper, “misuse” is defined as incorrect usage of the system by the passengers due to an incorrect/incomplete understanding of the system. The PES feature should consider foreseeable misuse and be designed to protect against it. “Abuse” is defined as an intentional defeat of safety measures implemented by the system designers in order to gain an action contrary to the design intent.