

AVERE Input

Modern ADAS, use-cases and compatibility with R79

Introduction

ADAS readiness

- Both ADAS and ADS systems are continuously in development. Though ADS may become more widespread in the future, ADAS will continue to play an important role in areas where ADS is limited.
- Especially for rural, urban and interurban environments, ADAS systems are appearing or will appear on the market very soon. ADS, which have to deal with the complexity of a driver out of the loop, will possibly take more time.
- ADAS systems that go beyond R79 requirements are ready to hit the market and have already been introduced in some regions
- More capable ADAS systems will require specific attention to driver understanding of the system and HMI

Introduction

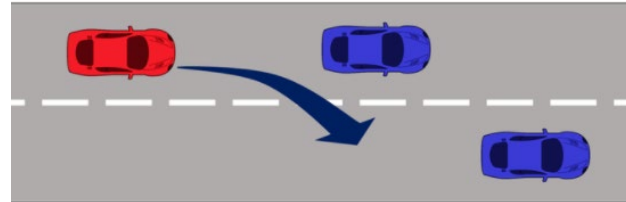
Use-cases

- We have provided a preliminary indication of use-cases that are already available or expected to appear on the market on the short-term
- The examples in the following slides are by no means complete

Systems that perform lane changes

Permitted by R79 – Lane Changes

User-initiated lane changes in low traffic conditions
(Highways & Controlled Access Roads)



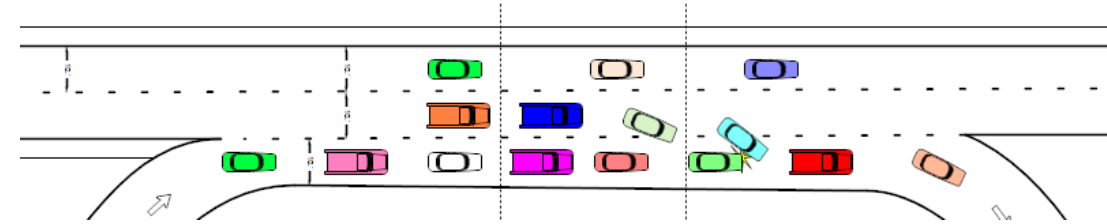
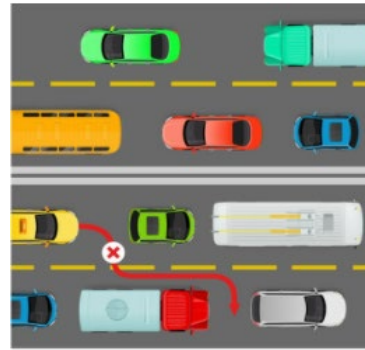
Ego-vehicle merges into a lane without traffic due to road mergers



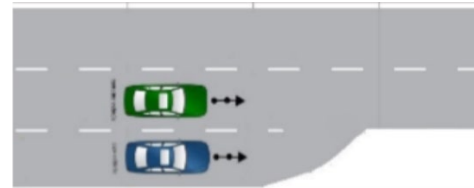
Systems that perform lane changes

Challenging/often fails under R79 – Lane Changes

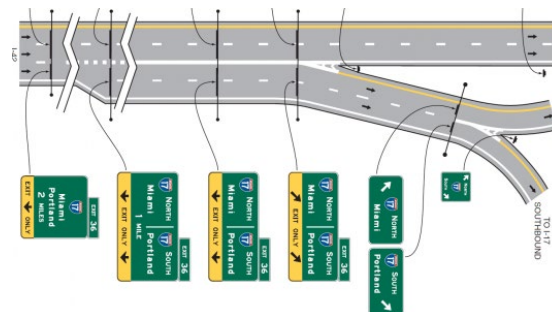
User-initiated lane change in busy traffic situations, or where a vehicle currently blocks the target lane



Ego-vehicle is driving in a lane merging into target lane where the target lane traffic has right of way.
(There may or may not be merge lane marking)



(User-initiated) Lane changes on successive forking roads
(Minimum timer will not allow the vehicle to complete the procedure in time)



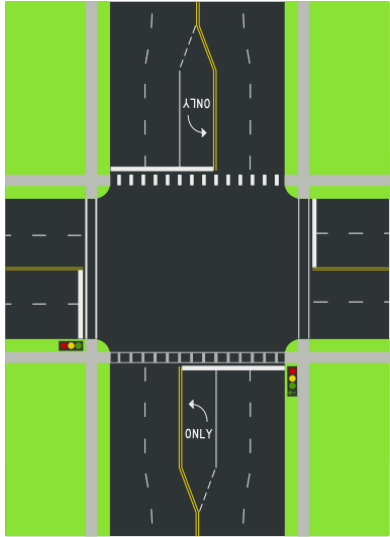
Systems that perform lane changes

Not permitted by R79 – Lane Changes

Driver triggers a lane change at locations where the lane marking conditions cannot support the fulfillment of the lane change. (i.e. the lane marking quality is bad, the lane marking is missing in the view)



The vehicle has to lane change into a fork or double-fork ahead of an intersection.



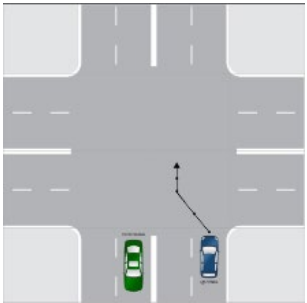
Ego-vehicle is driving in a lane merging into target lane where the target lane traffic has right of way. At the merging section, there may or may not be merge lane marking.



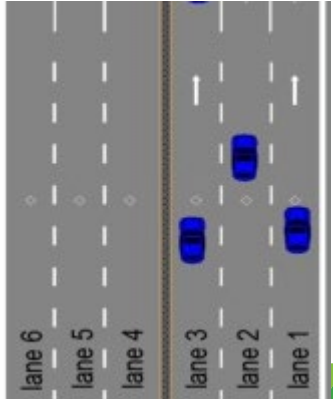
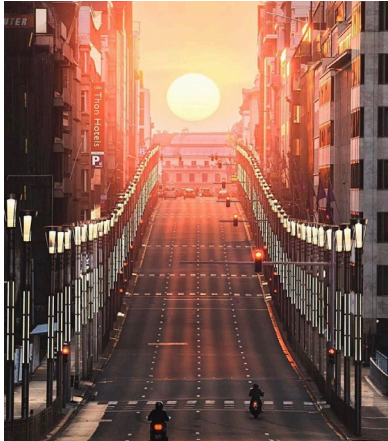
Multiple lane changes are required ahead of an intersection or while interchanging between roads. Characteristics of these roads may not be in line with highways or controlled access roads.



Driver triggers a lane change inside an intersection, or close to the entrance of an intersection where a lane change cannot be finished before entering the intersection.



Lane changes in other areas than currently allowed by R79, such as uncontrolled access roads and (inter)urban roads. More complex traffic situations should be considered



Systems that perform lane changes

Unclear or not permitted under R79 – Lane Changes

Assisted Lane change initiated by the driver upon
indication of the lane change by the system
(ACSF D)

Assisted Lane Change initiated by the system
(ACSF E)

Use-cases and limitations under R79

Lane travel – Use-cases

Ego-vehicle is driving in a lane with two lane markings on each side. The lane marking on either side becomes unclear and undetectable.



Ego-vehicle is driving in a lane with two lane markings on each side. The lane marking on either side disappears and is replaced/covered by physical barriers (e.g. concrete barriers, cones).



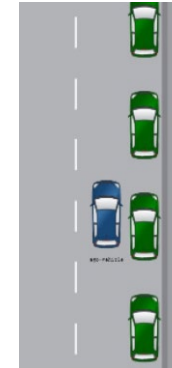
Ego-vehicle is driving in a lane with two lane markings on each side. A new set of lane markings is spawned and diverges from the old ones while the old ones are not removed/cancelled. The new lane markings may be visually distinguishable from the old ones (e.g. yellow solid lines on top of white broken lines).



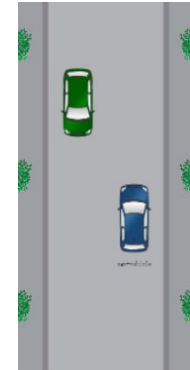
Ego-vehicle is driving in a lane on a local road, the left lane boundary is a clear lane marking, and the right lane boundary is the road boundary (e.g. curbs).



Ego-vehicle is driving in a lane on local road, the left lane boundary is a clear lane marking, and the right lane boundary is the road boundary. The lane is wide or small. However, there are parked vehicles or trash containers alongside the road.



Ego-vehicle is driving on a residential road with no lane marking at all. The road boundary is visually clear or can be determined by the system.



Ego-vehicle is driving in a lane where another lane is merging into the ego-lane. During the merging section, the lane marking on the merge side disappears.



Ego-vehicle is driving in a lane where it forks one or more new lanes, and there is no lane marking separating these lanes in the split section. Only one side of the original lane has an adjacent lane (can be opposing traffic), which defines the side of "main road".



Ego-vehicle is driving in a lane traversing an intersection. The lane has no lane marking on either side though the intersection. The path through the intersection may be straight.



Use-cases and limitations under R79

Lane travel – Problematic

Lateral support through highway intersections at an appropriate speed (higher lateral acceleration)



Driving around obstacles & objects (e.g. parked vehicles, trash cans, speed redundancy, branches, poles, etc.) by leaving the lane



The vehicle navigates a single-lane S-bend or bend in the road at road-legal speeds which induces higher than $>3m/s^2$ lateral acceleration



The vehicle drives on a lane where the road narrows, or merges into a single lane used by ego and oncoming traffic. The vehicle will negotiate with oncoming traffic and adjust its lane position.



Lane keeping function detects and navigates around construction zone based on cone/sign markings or roadmarkings, or driveable path. May require the system to ignore irrelevant road markings



Lane keeping assist hands-off



Rural/mountain/off-road roads



Use-cases and limitations under R79

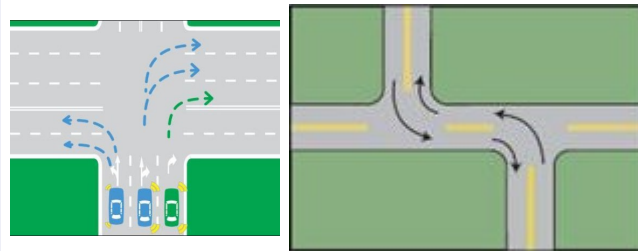
Manoeuvres not considered, compatible or defined

Manoeuvre Assist (OICA proposal)

Risk Mitigation Function in lane (OICA proposal)

Risk Mitigation Function with lane change

Turning at an intersection or junction, or forked lane
(System-initiated based on entered destination or driver-requested)



Unprotected turns
(System-initiated based on entered destination or driver-requested)



Roundabout entry, navigation and exit by the system based on entered destination or driver instruction



Vehicle arrives at a multilane roundabout with a multi-laned entry and exit by the system based on entered destination or driver instruction. The vehicle has to lane change or cross a lane to exit the roundabout. The roundabout may have lane markings or predefined paths.



Use-cases and limitations under R79

Manoeuvres not considered, compatible or defined

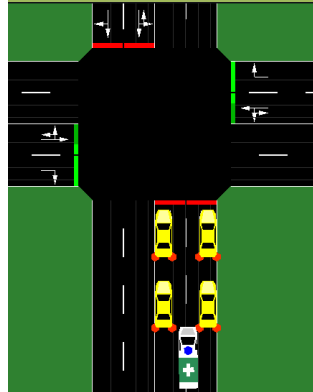
U-turn
(System-initiated based on entered destination, or driver commanded)



Diamond interchanges



Emergency vehicle approaches
(May require off-centering, lane change or other manoeuvres)



Parking lots navigation and on-road parking manoeuvres
(Find a parking spot command, driver in vehicle)



Recognition & response to human instruction
(i.e. police)



Medium-distance Remote Controlled Parking and Valet
(Driver visual and/or Smartphone supervision)

