# Automated Lane Keeping Systems

Examples for system reaction on different driver input

Supporting presentation to document ACSF-22-07

# Principles for the proposal for regulatory provisions in doc ACSF-22-07

- A driver override of an activated system shall always be possible using the conventional controls (pedals and steering wheel)

- Any input of the driver to the conventional controls leads always to either automatic deactivation or a transition demand depending on if the driver has taken over manual control or not.

- The driver input…
  - to the steering control may be suppressed or mitigated by the system if it could lead to a critical situation
  - to the braking control shall be suppressed if it would result in a lower deceleration than that induced by the system
  - to the accelerator control shall be suppressed if it would prevent the system from meeting the requirements of this regulation.

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# Definition of “Manual Control”

2.2.y. The driver is deemed to have “taken over manual control” if one or more of the following conditions are met:

- The driver manually deactivates the system.
- The driver maintains the vehicle stationary by any braking system.
- The driver provides an input to the brake or accelerator control and is holding the steering control.
- The driver provides a steering input which
  Option 1 = [led the vehicle to cross a lane marking]
  Option 2 = [alters the vehicle’s path].
- The driver follows a transition demand by grabbing the steering control.

**Reminder “monitoring by the driver availability recognition system“**

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- ~~The driver follows a transition demand by grabbing the steering control.~~

**Reminder “monitoring by the driver availability recognition system“**

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# ALKS examples – Definitions and Symbols

| | |
|---|---|
| ACTIVATED | System is active and performing the driving task |
| DEACTIVATED | System is not active and not performing the driving task<br>Driver is in manual control |
| OVERRIDE | The driver input forces the vehicle to a change of the lateral or longitudinal movement other than the system would do by performing the driving task |
| TRANSITION DEMAND | System is active but due to a driver Input (in these examples only the driver input is considered) the driver is requested to take over the manual driving task again |

System with
no steering input detected

System with
steering input detected

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# Automated Lane Keeping Systems

## Steering override leads to deactivation upon lane departure [Option 1]

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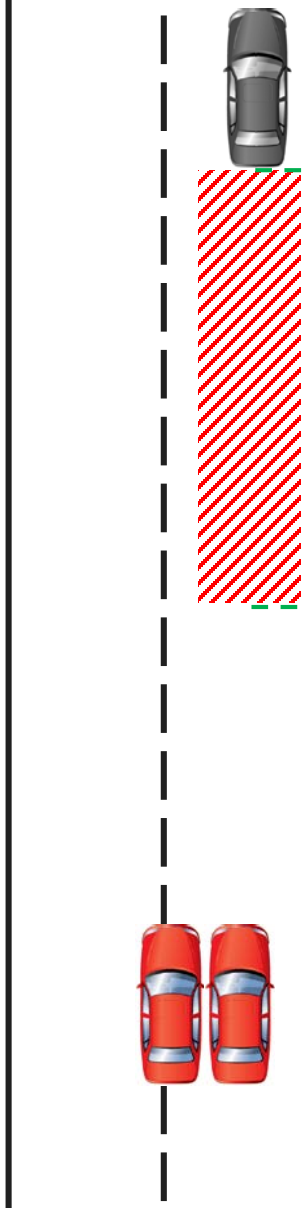
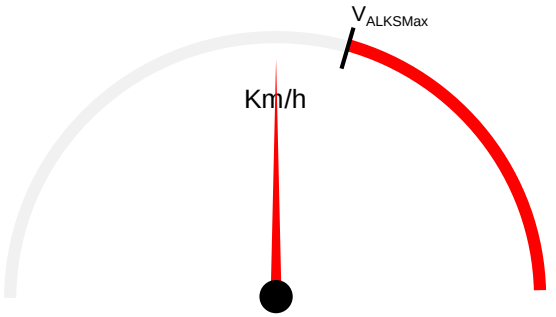
Scenario 1: the driver steers the vehicle out of the lane




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |



Repeat Example

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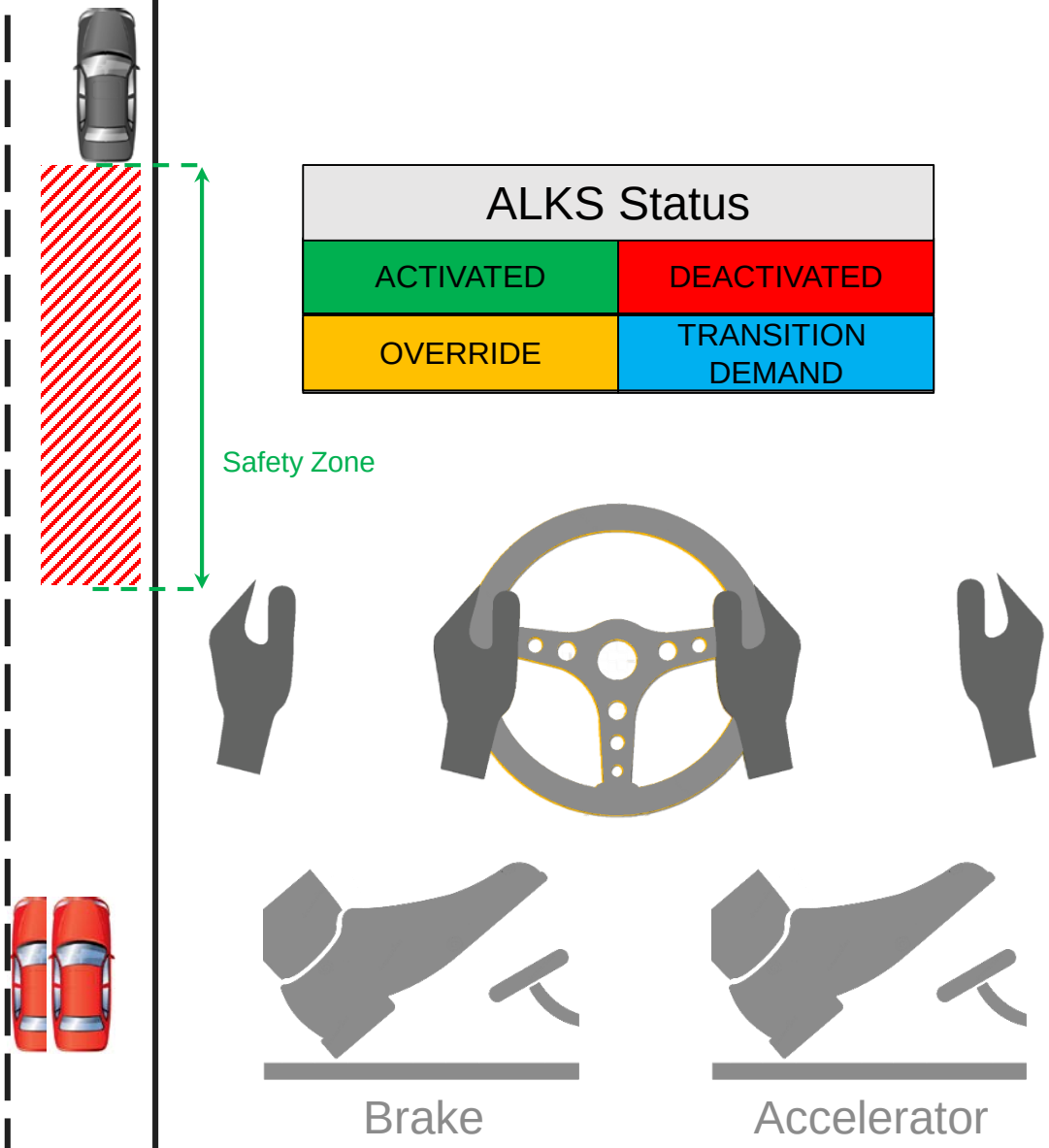
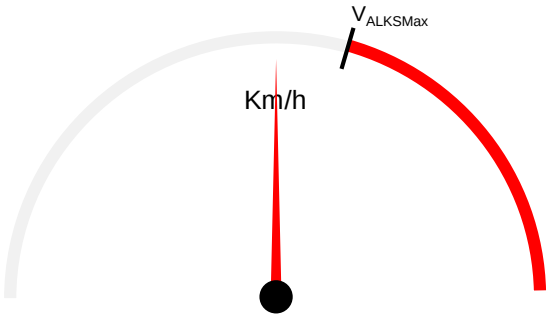
# Steering override leads to deactivation upon lane departure [Option 1]

Scenario 2: the driver steers the vehicle inside the lane




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |







Repeat Example

# Automated Lane Keeping Systems

## Steering override leads directly to deactivation [Option 2]

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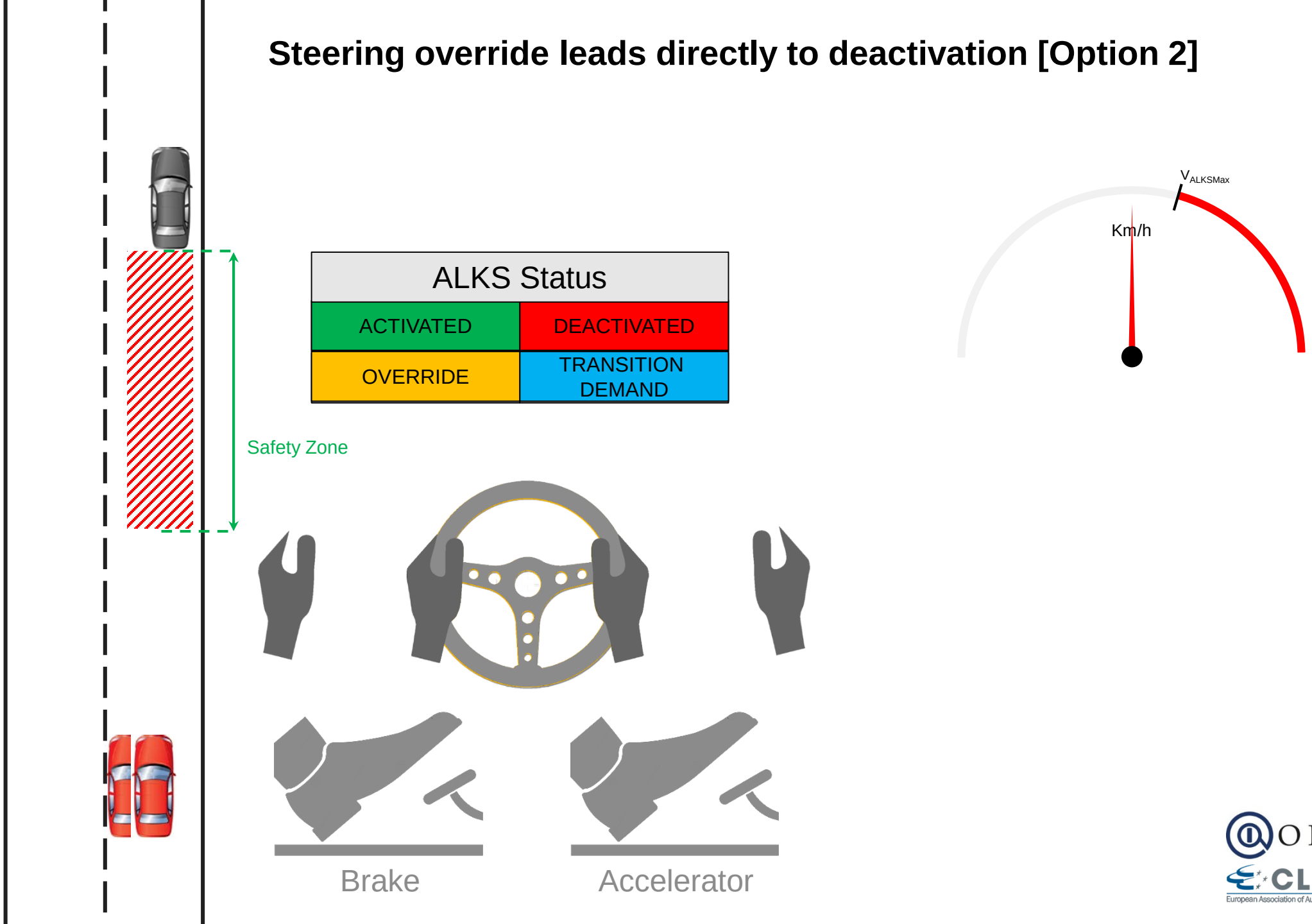



Repeat Example

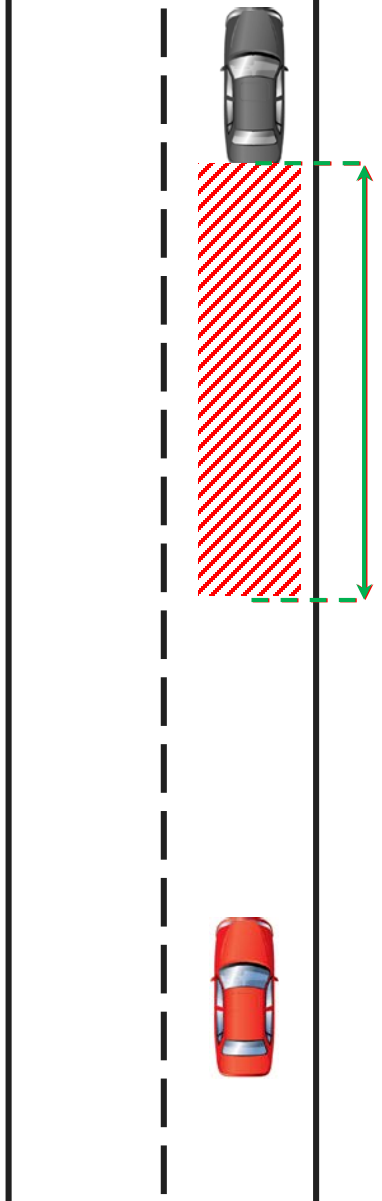
# Automated Lane Keeping Systems

**Acceleration override while driver is not holding the steering wheel**

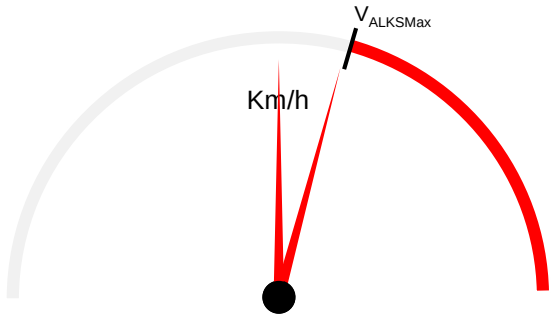
*(layout 1: accelerator control does have priority)*

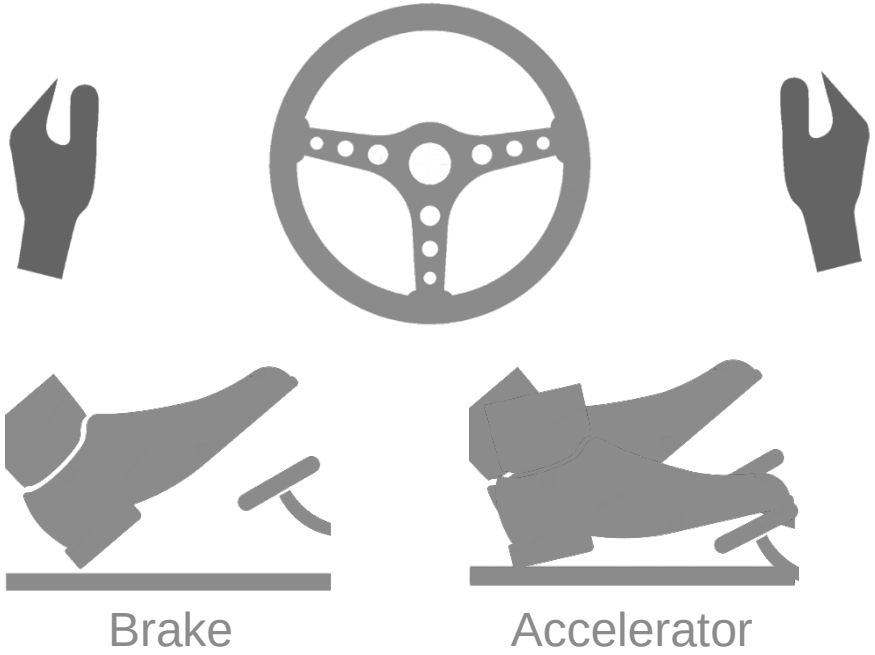
# Acceleration override while driver is not holding the steering wheel

*(layout 1: accelerator control does have priority)*




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |




Repeat Example

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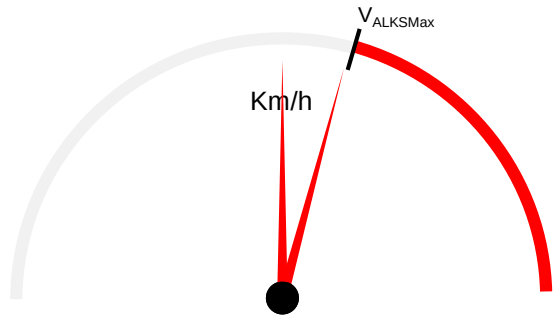
# Automated Lane Keeping Systems

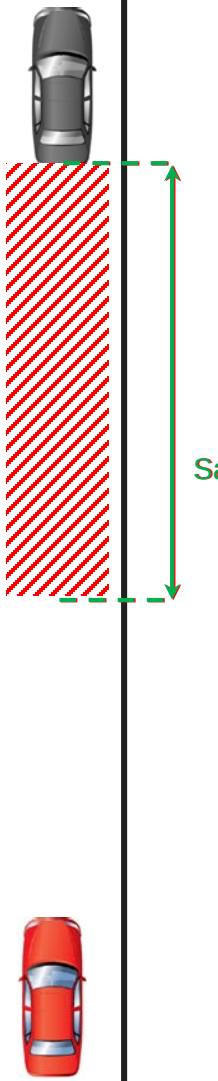
**Acceleration override while driver is not holding the steering wheel**

*(layout 2: accelerator control does not have priority)*

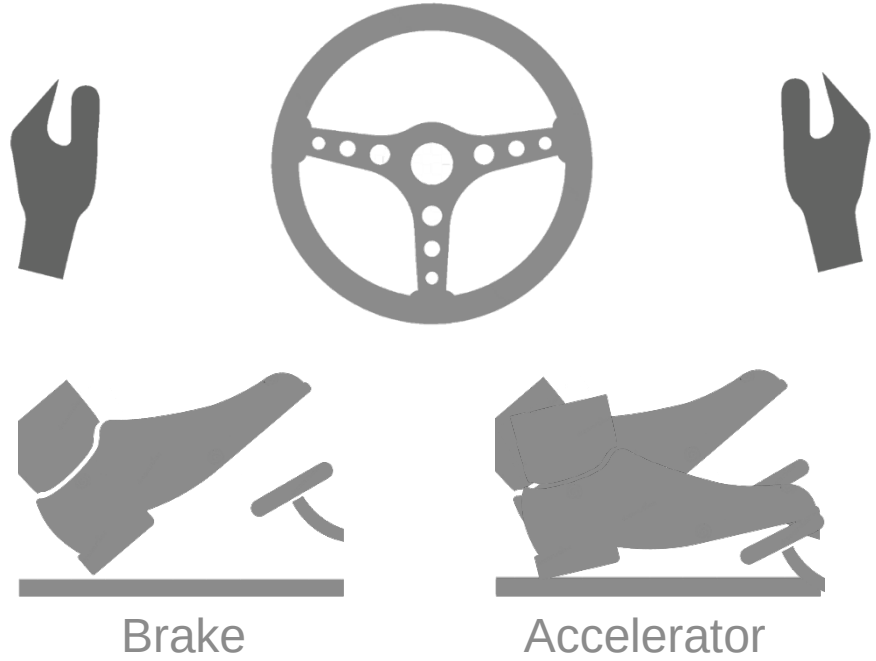
# Acceleration override while driver is not holding the steering wheel

*(layout 2: accelerator control does not have priority)*




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |




Repeat Example

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# Automated Lane Keeping Systems

## Acceleration while the driver is holding the steering wheel

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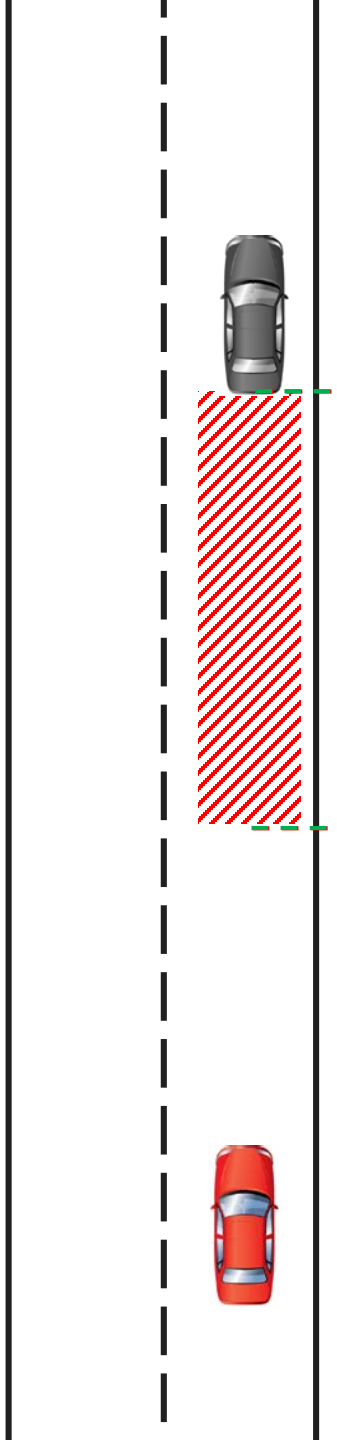
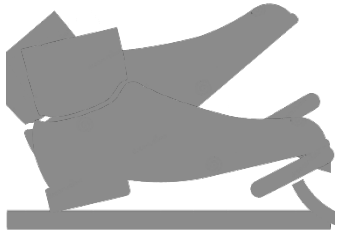
# Acceleration while the driver is holding the steering wheel



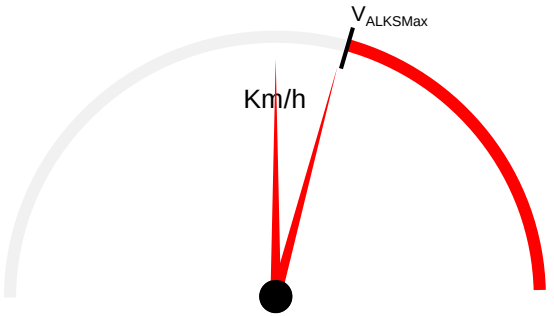
Safety Zone

| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |

Brake



Accelerator




Repeat Example

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# Automated Lane Keeping Systems

## Brake while holding the steering wheel

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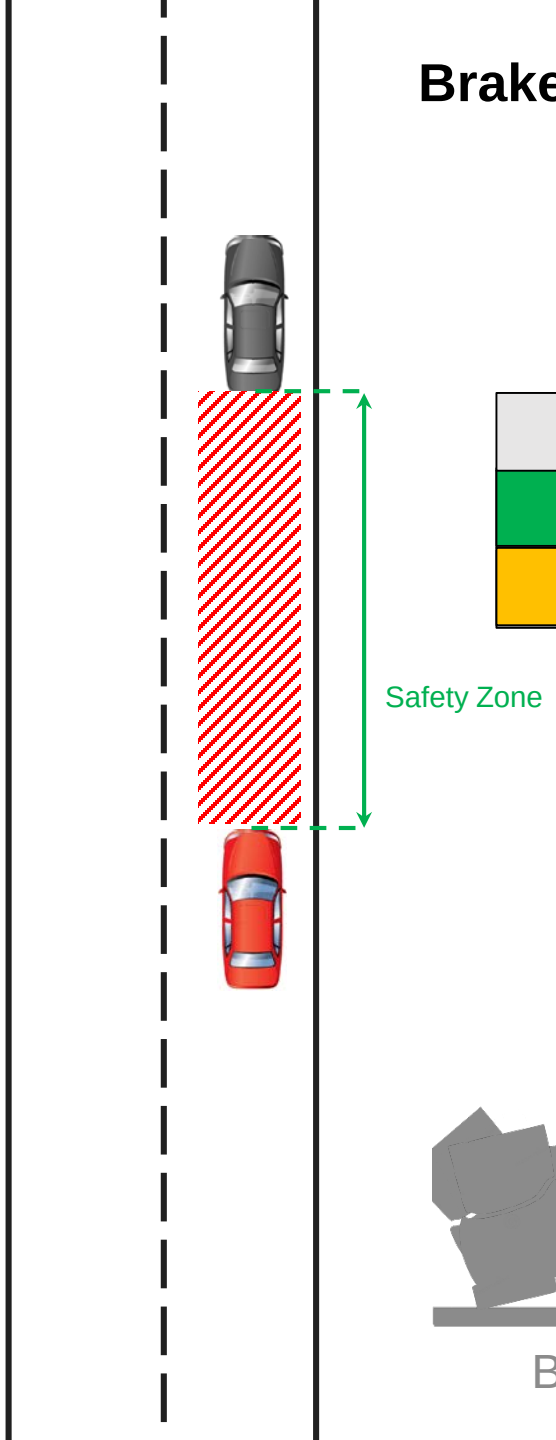
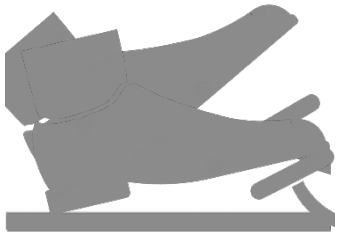
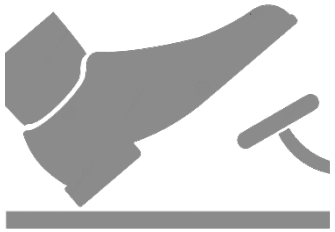
# Brake while holding the steering wheel



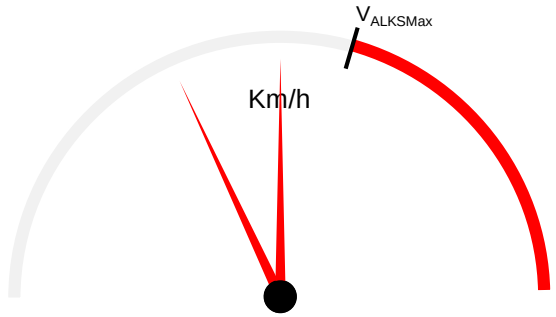

| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |



Brake



Accelerator




Repeat Example

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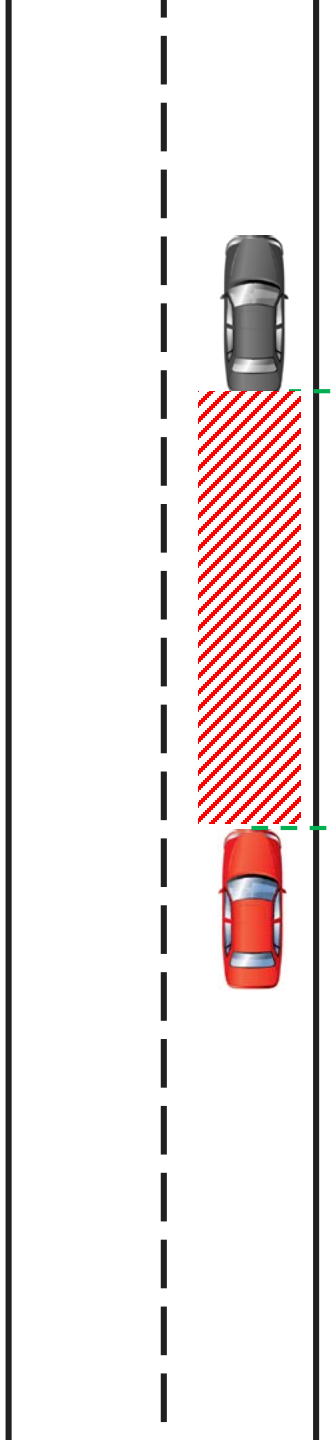
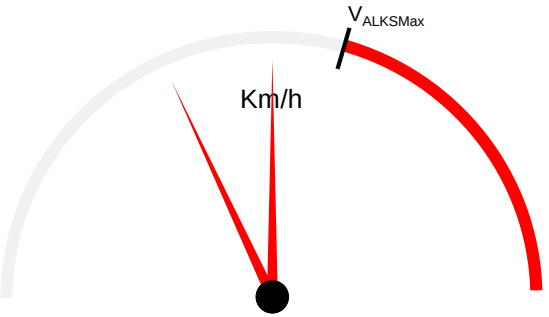
# Automated Lane Keeping Systems

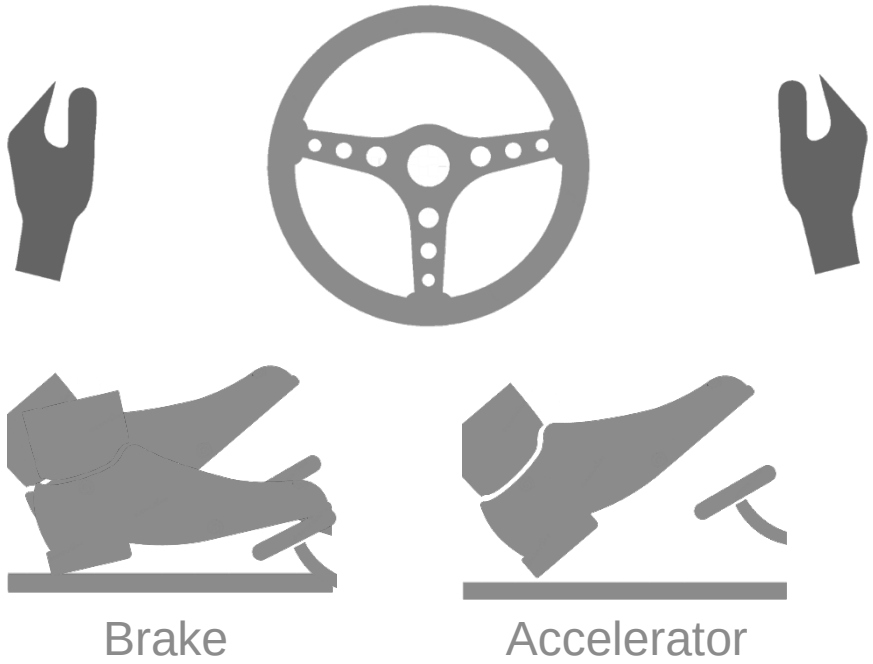
## Brake while not holding the steering wheel

# Brake while not holding the steering wheel




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |




Repeat Example

# Automated Lane Keeping Systems

## Two channel takeover to manual control

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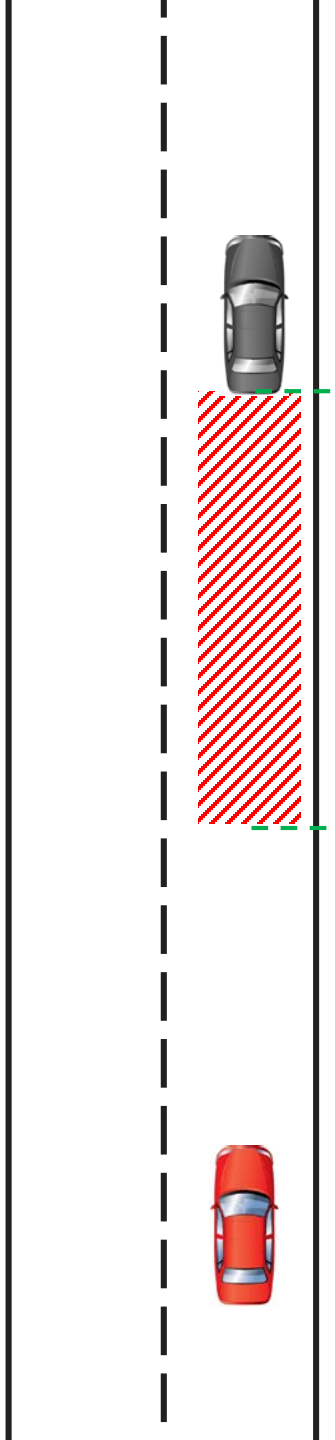
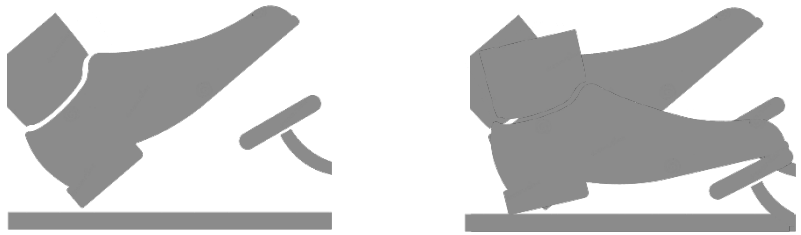
# Two channel takeover to manual control

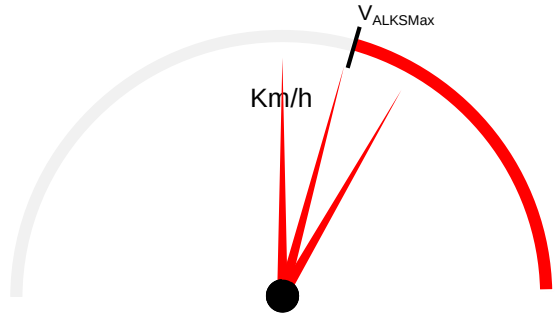


Safety Zone

| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |



Brake Accelerator




Repeat Example

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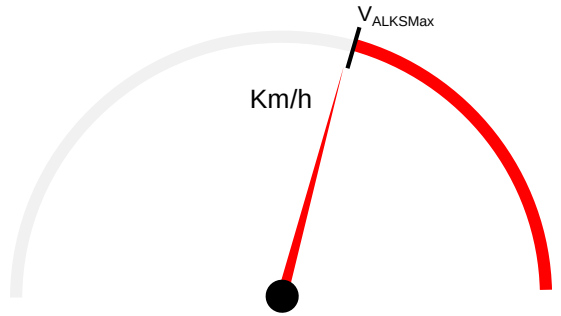
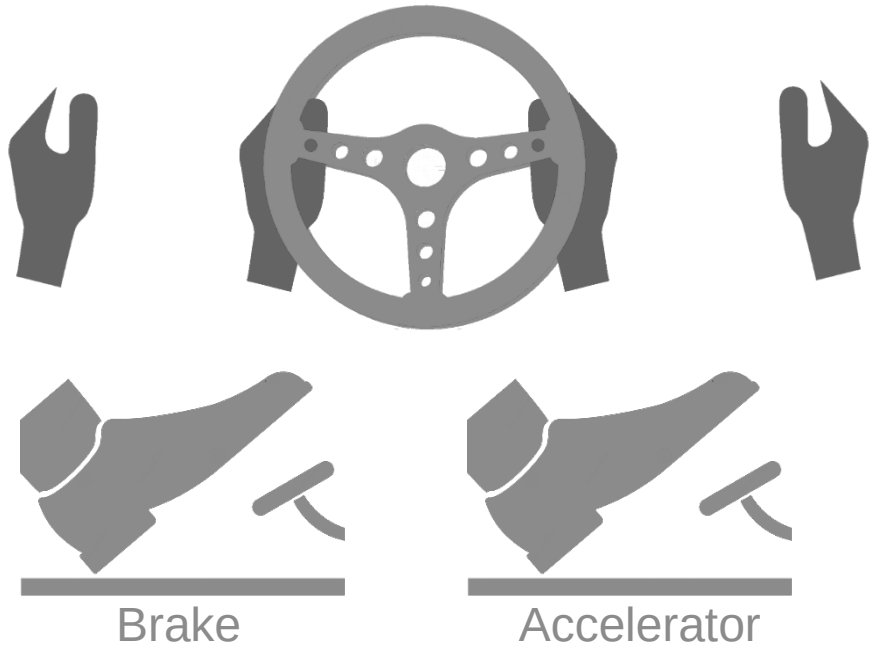
**The driver follows a transition demand by grabbing the steering control.**




| ALKS Status | |
|---|---|
| ACTIVATED | DEACTIVATED |
| OVERRIDE | TRANSITION DEMAND |




Repeat Example

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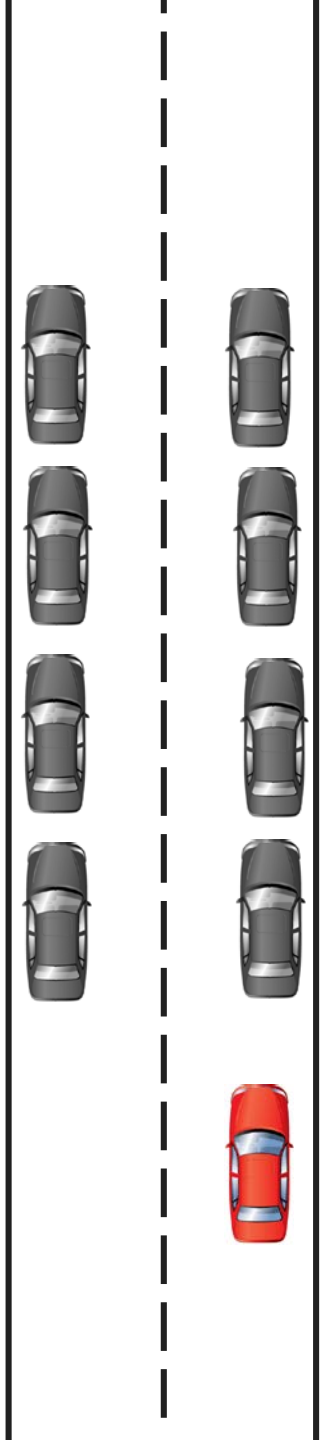
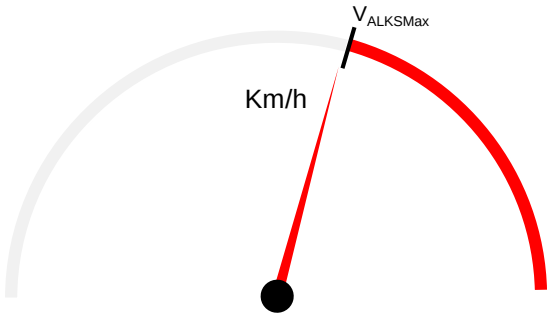
# The driver maintains the vehicle stationary by any braking system



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|---|---|
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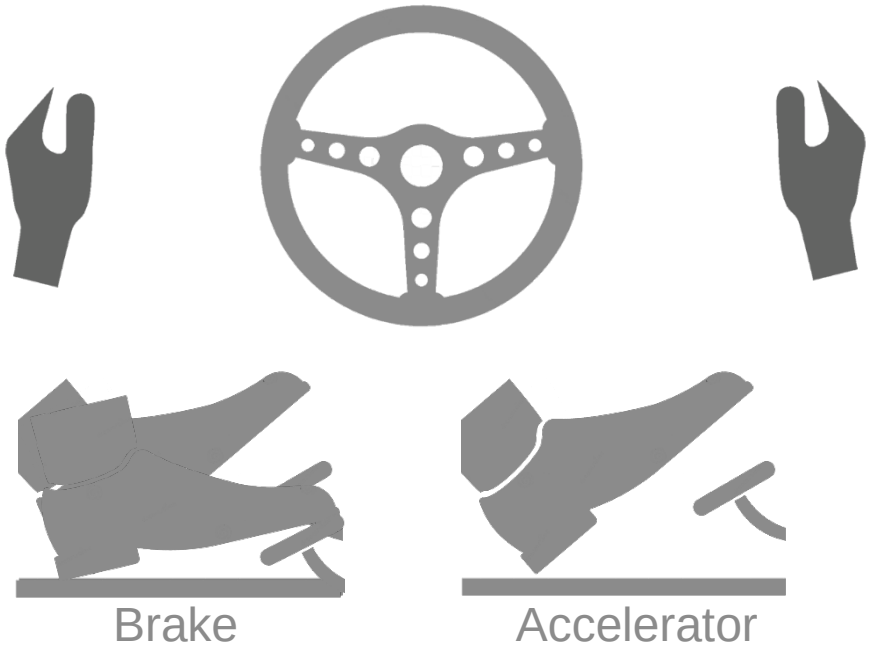


Repeat Example

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# Thank you

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