



ACSF Test Procedure Draft proposal – For discussion

OICA and CLEPA proposal for the IG Group ACSF
Tokyo, 2015, June 16-17

Objectives of this document

- The objective is to present potential test scenario for the ACSF approval, for discussion.
- The detailed test conditions, criterias will be defined once the principle of the tests will be agreed.
- It should also be considered the influence of different types of vehicles to be approved, e.g. passenger cars, LCVs and HCVs.

ACSF Test Scenario – General Principles

- Define few key test scenario, with specific test procedure and pass/fail criteria
- Since these test scenarii cannot cover all potential situations in an exhaustive manner, the paragraph 4 « verification and test » of the CEL Annex shall be used.
- The informal group on ACSF deals with the steering aspects of ACSF

ACSF Test Scenario – General Principles

The basic tests focus on three major capabilities of the system:

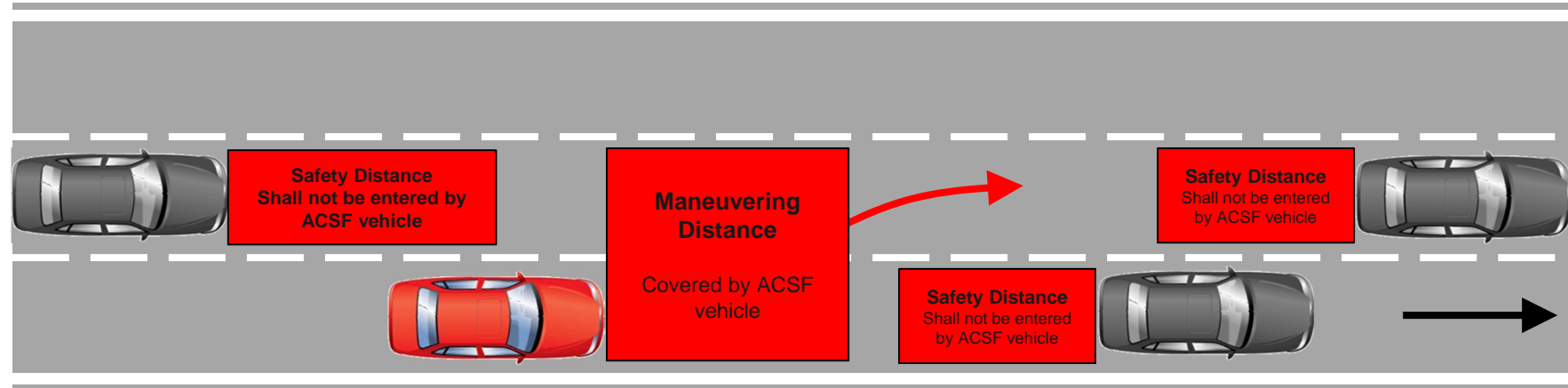
- Lane Change under multiple lane traffic conditions – respecting a safe distance
- Curve Travel – ability of the vehicle to follow a curve
- Transition in case of missing lane markings – testing the specified transition time

During these tests, additional basic capabilities are verified, e.g.:

- Detection of objects/lanes
- Keeping the lane
- Keeping the safe distance

ACSF Test Scenario – General Principles

Safe Distance Parameters



Safety Distance shall not be entered by ACSF vehicle at any time. Distances are based on the rules

- Safe travelling distance = $[2s]$ at travelling speed
- Typical driver reaction time $[1.0s]$
- Safe uncritical deceleration $[3m/s^2]$

The lane change maneuver may be simplified into two segments of constant lateral acceleration ($1m/s^2$)

For all speed indications, a tolerance of $\pm 5,0km/h$ may be applied

ACSF Test Scenario – General Principles

Scenarios of higher complexity may be assessed according to the methodology prescribed by the Annex 6, Complex Electronic Systems, including:

- Safety concept, (to address system integrity and thereby ensure safe operation even in the event of an electrical failure) § 2.1

- Boundary of functional operation, § 2.8

- Safety Analysis

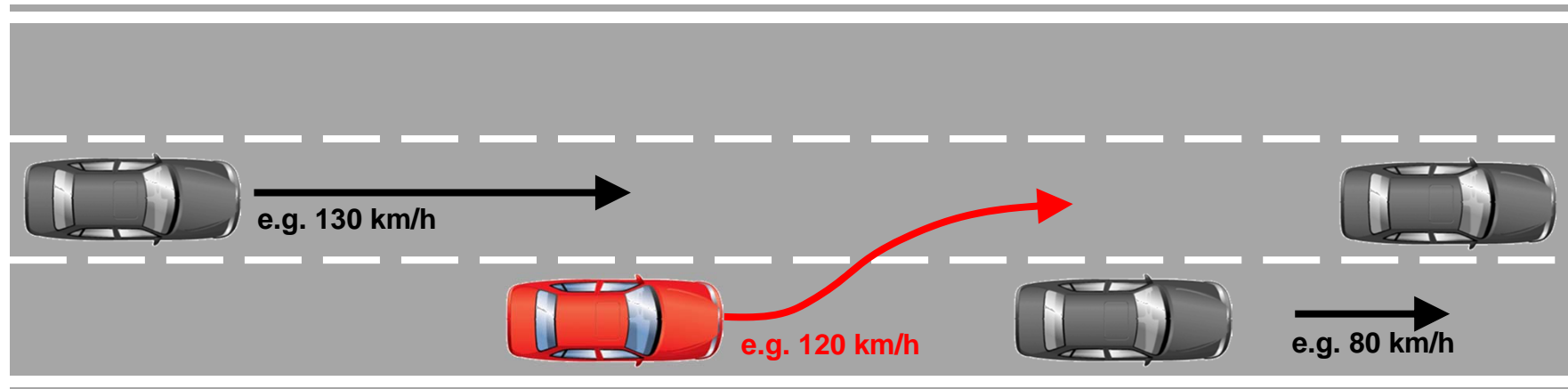
“3.4.4. The documentation shall be supported, by an analysis which shows, in overall terms, how the system will behave on the occurrence of any one of those specified faults which will have a bearing on vehicle control performance or safety.

This may be based on a Failure Mode and Effect Analysis (FMEA), a Fault Tree Analysis (FTA) or any similar process appropriate to system safety considerations. The chosen analytical approach(es) shall be established and maintained by the Manufacturer”

- Limits defining the boundaries of functional operation (paragraph 2.8.) shall be stated where appropriate to system performance

These potential extra-test shall be conducted following CEL Annex paragraph 4 requirements on “Verification and testing”

ACSF Complex Test Scenario – Lane Change

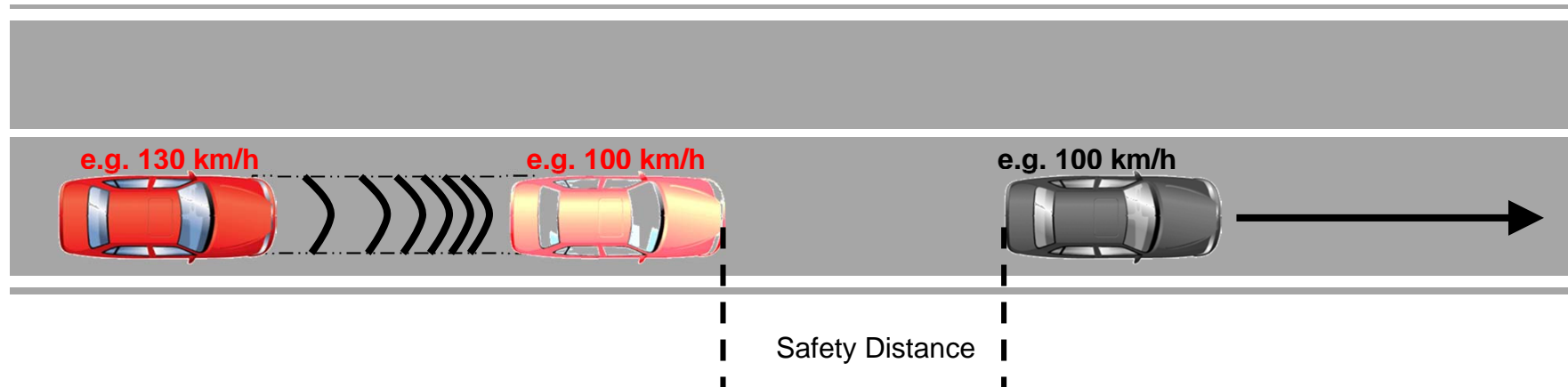


- Safety distances have to be respected
- Vehicles on the adjacent lane shall not be forced to brake stronger than 3m/s^2
- Test condition: e.g. $[V_{\text{back}} = 130 \text{ km/h}]$, $[V_{\text{ego}} = 120 \text{ km/h}]$, $[V_{\text{front}} = 80 \text{ km/h}]$
- Problem:
It is very difficult to synchronize three or more vehicles with respect to speed and distance on a test track

ACSF Test Scenario – Approaching a Vehicle

Test 1: Recognize solid marking

Initial test conditions: all vehicle speeds are constant



Pass/fail criteria:

Cat 2: the ACSF does not change lane even under driver's request

Cat 3: the ACSF does not change lane and shall not propose lane change

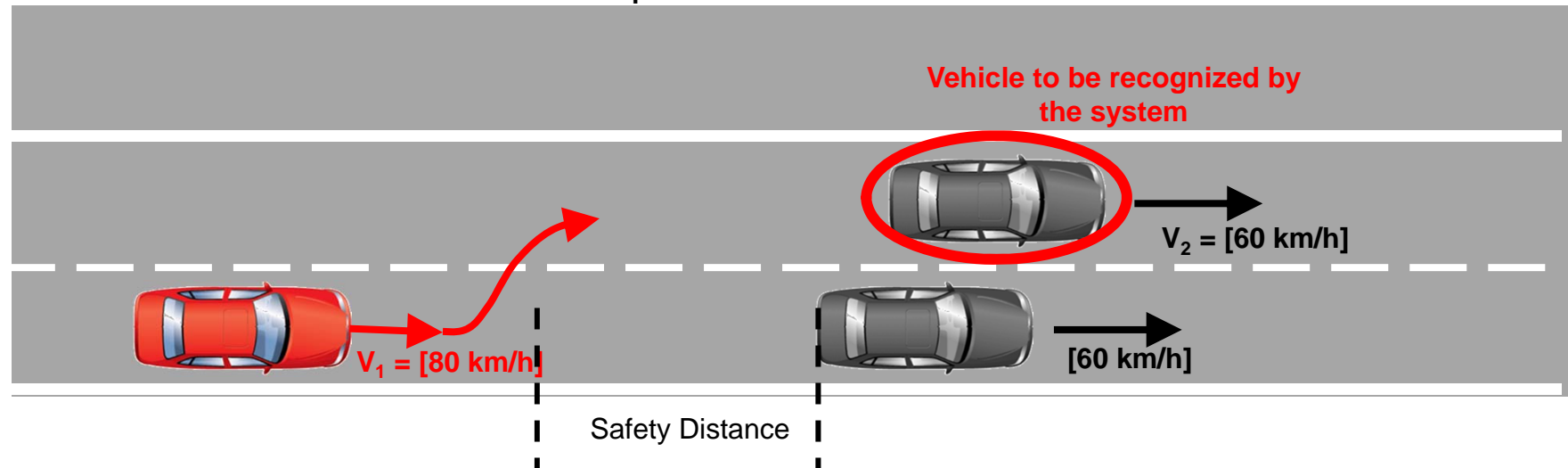
Cat 4: the ACSF does not change lane

Note: For ACSF with only LK capability, the ACSF shall keep lane

ACSF Simplified Test Scenario – Lane Change

Test 2: Recognize occupied lanes in congestion conditions → lane change should not be performed

Initial test conditions: all vehicle speeds are constant



Safe travelling distance

$$d_t = (v_2 - v_1) t$$

$[t = 2 \text{ s}] \rightarrow$ as required in traffic regulation

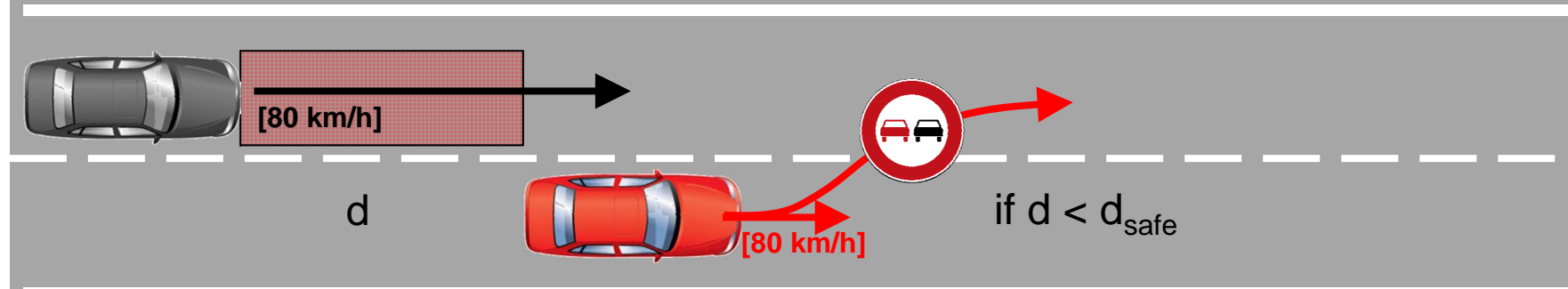
A short ($t < [0,5] \text{ s}$) diving-in into this area is acceptable

Need for specific values for heavy vehicles

ACSF Simplified Test Scenario – Lane Change

Test 3: Keep safety distance of car behind on adjacent lane → lane change should not be performed

Test conditions: all vehicle speeds are constant



Pass/fail criteria:

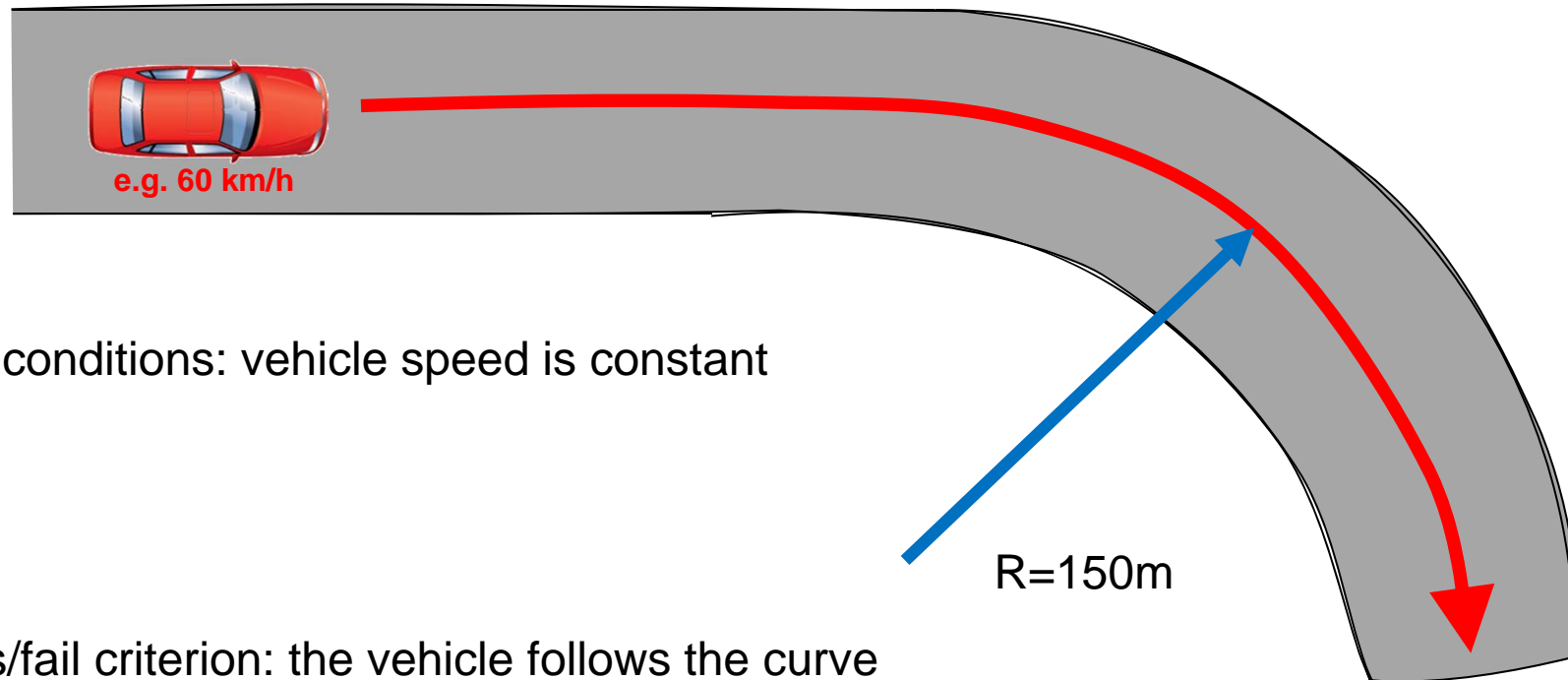
Cat 2: the ACSF does not change lane even under driver's request

Cat 3: the ACSF does not change lane and shall not propose lane change

Cat 4: the ACSF does not change lane

Note: For ACSF with only LK capability, the ACSF shall keep lane

ACSF Test Scenario – Following a Curve



Test conditions: vehicle speed is constant

Pass/fail criterion: the vehicle follows the curve

Question: possible additional test assessing the maximum lateral acceleration permitted for the system?

ACSF Test Scenario – Missing Lane Markings

Test conditions: vehicle speed is constant

