Submitted by the EC

Informal Document - ACSF-25-13

# The European Commission's science and knowledge service

## Joint Research Centre

European Commission

# Speed profile for car following tests

25th ACSF Informal group session

Tokyo, January 21-24, 2020

European Commission

# 5.3.1. Following distance test (current text)

**Current text in ACSF-25-07**

- The vehicle shall be driven in a lane with varying curvatures as specified in the operational design domain, with the automated lane keeping function activated and the vehicle driver having the hands and feet off the vehicle controls, and with a preceding target, for at least [3] minutes per parameter combination.

- The preceding target shall have the characteristics as defined below and shall be driven at the constant speeds and with offsets as defined below, as well as with any instationary speed sequence with a deceleration level below [2] $m/s^2$ for a time longer than [3] minutes (for example the speed sequence “WLTC low” XXX reference).”

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# 5.3.1. Following distance test (proposed modification)

**Proposed modification:**

The preceding target shall be driven according to a realistic speed profile, including accelerations, decelerations and full stops, for a time longer than [3] minutes. The lead vehicle speed profile shall be randomly selected from the [**WLTP reference database***], according to the following algorithm:

- **Filtering** the database of short trips with defined parameter values ($v_{max}$ between [50] and [60] km/h, $a_{max}$ [4] m/s$^2$, $a_{min}$ [-4] m/s$^2$)
- Performing a **weighted random selection** of the short trip from the filtered list, according to a weighting function [$v_{average}$ x $a_{pos, average}$], normalized by the sum of all the values, so that the total probability is 1.
- If the selected short trip has a duration below [3] minutes, more short trips shall be added until the total cycle duration reaches the minimum prescribed value.

# WLTP reference database

**Database of real speed profiles collected worldwide to develop the WLTP**

- ~350.000 short trips with $v_{max}$ < 80 km/h, few minutes duration
- Advantages:
  <u>- Availability</u>
  <u>- Representativeness</u>: applied within UNECE Reg. to derive a real-world speed profile
  <u>- Credibility</u>: use of randomly selected real speed profile.

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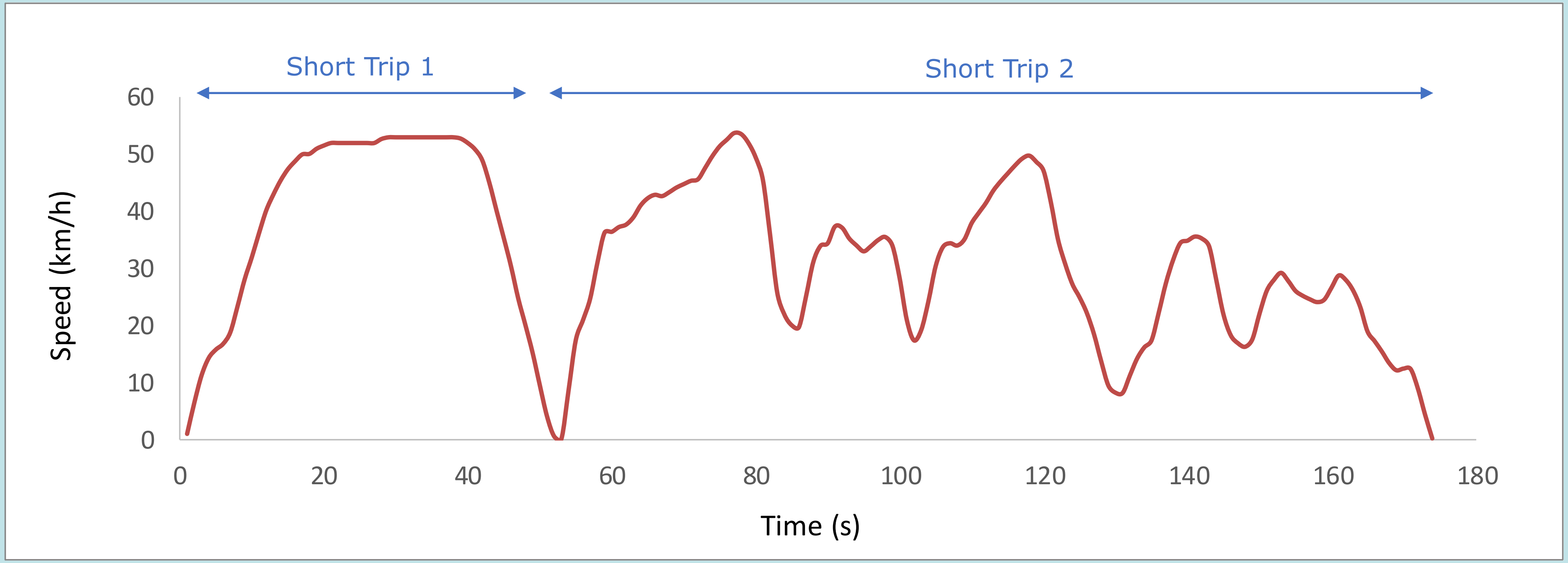
# 5.3.1. Following distance test (example)

**1. Filtering DB** ($v_{max}$ 50 – 60 km/h) → 56.000 Short trips. Average characteristics:
$t_{av}$ **124 s**, $d_{av}$ **1180 m**, $v_{av}$ **34 km/h**, $a_{av}$ = **0.67 m/s²**

2. **Random selection** + combination of 2 short trips



# 5.3.3. Severe braking test (current text)

**Current text**

- The vehicle shall be driven in a lane with varying curvatures as specified in the operational design domain, with the automated lane keeping function activated and the vehicle driver having the hands and feet off the vehicle controls, and with a preceding target, for at least [1] minute, after which the preceding target will perform a deceleration manoeuvre with <u>a mean fully developed deceleration of 6  $m/s^2$ until standstill.</u>

# 5.3.3. Severe braking test (proposed modification)

**Proposed modification:**

The preceding target shall be driven according to a realistic speed profile, including accelerations, decelerations and full stops. At time t0 the preceding target will perform a deceleration maneuver with a mean fully developed deceleration of 6 $m/s^2$ until standstill. The lead vehicle speed profile and the time at which the deceleration starts shall be randomly selected, according to the following algorithm:

- **Random selection of the speed profile** as described in 5.3.1.
- **Weighted random selection** of the time of start of deceleration $\mathbf{t_0}$ (which defines also the corresponding lead vehicle speed and acceleration $v_0$ and $a_0$) from the selected speed profile, according to a weighting function [v x (1 + abs(a)], normalised by the sum of all the values, so that the total probability is 1.

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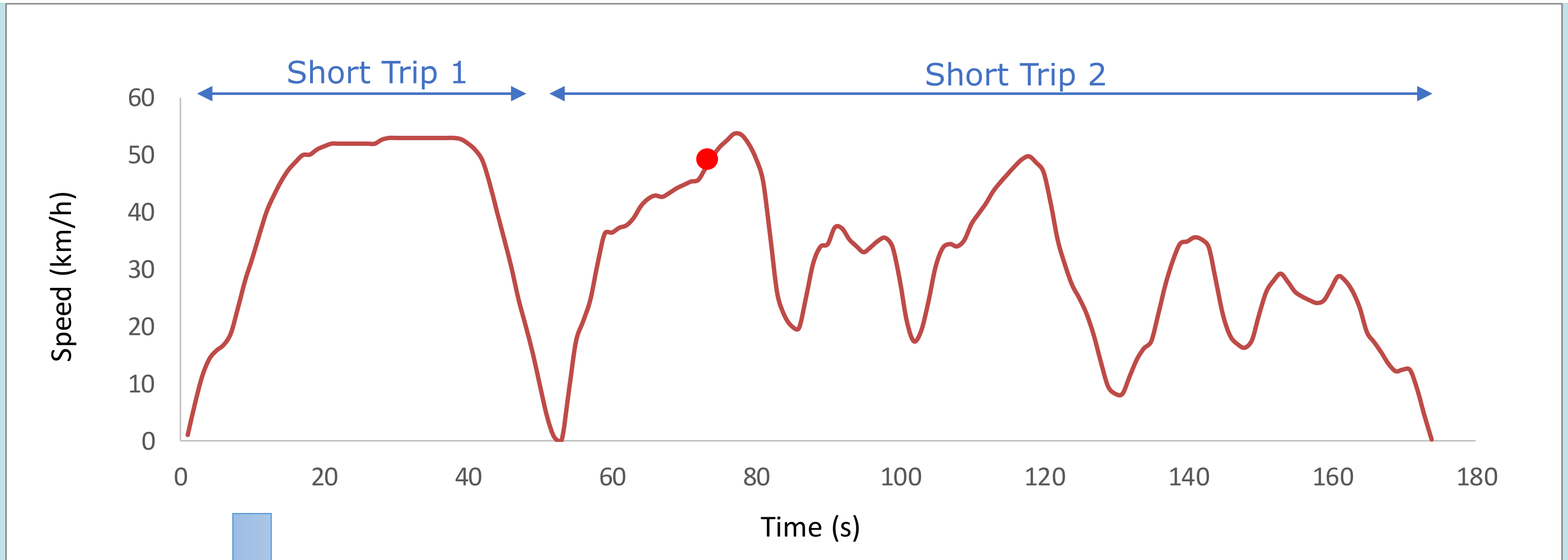
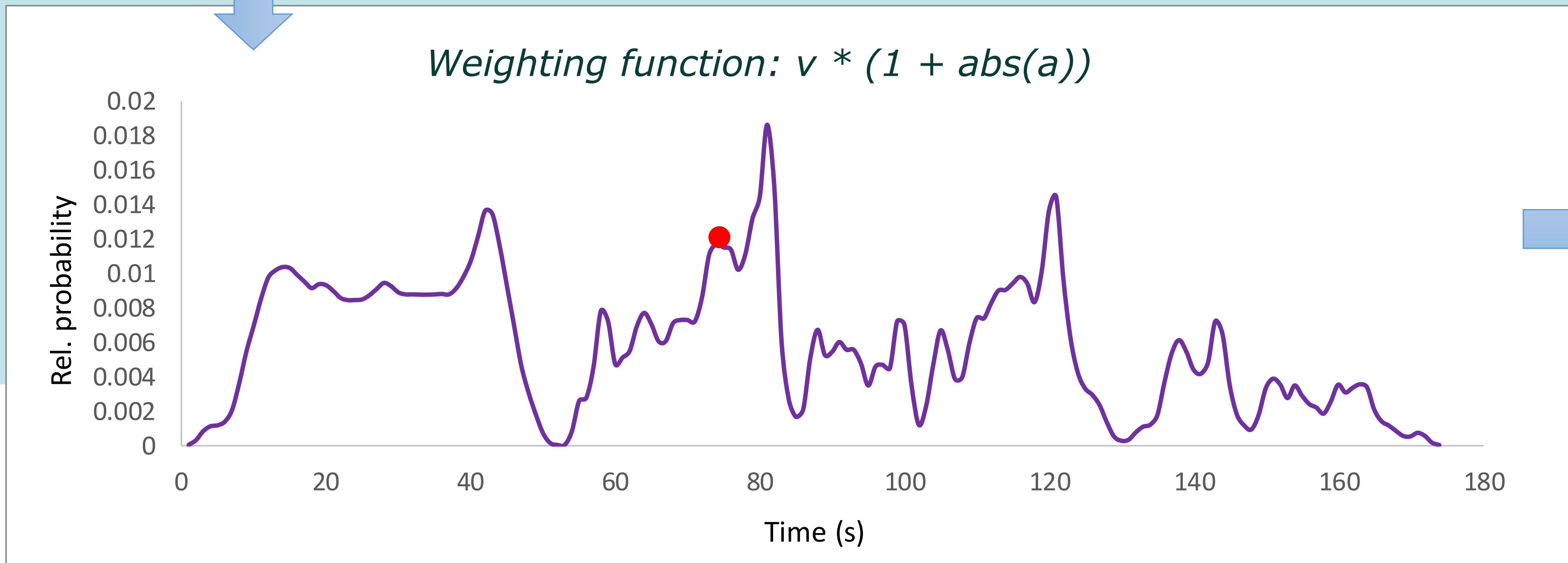
# 5.3.1. Severe braking test (example)




Selected: $\mathbf{t_0 = 73\ s}$

thus

→ $v_0 = 48$ km/h

→ $a_0 = 0.57$ m/s$^2$