# Test Program for a Single Vehicle for the Development of ASEP (Revision 3)

**Target of the test program:**

The test program below follows two aspects for the revision of ASEP:

1. Create a data pool which can be used to investigate the impact of the ASEP revision on current vehicle technology

2. Deliver data to support the validation of design parameter for the ASEP assessment model

**Vehicle selection:**

1. Any vehicle is suitable for testing. It can be a regular vehicle from the market, a development vehicle with no type approval or even a prototype. Preferably, the vehicle should at least comply with Regulation R51.

2. In the selection of vehicle, the transmission and power train design should be also future oriented.

3. The focus should be on vehicles with an automatic transmission or CVT or hybrid vehicles.

4. In addition, 20 years old sport cars and special designs are welcomed which includes BEVs (although they are exempted from the test), super sports cars, vehicle with aftermarket treatment or sound enhancement systems and not to forget the delivery vans.

5. It is necessary to create a pool of data that reflect the whole range of products (luxury cars, low-cost vehicles, young boy challenge cars, aggressive behavior, flexible design …), which are falling under the scope of ASEP. This general classification shall be fulfilled in the column in the datasheet accordingly.

**Tests for the ASEP Assessment:**

1. *Type Approval Test according UN R51.03 Annex 3 and GB1495-201x Annex C*

    a. ~~UN R51.03 and GB1495-201x are basically the same, with one important difference: In GB1495-201x the maximum acceleration is not 2 m/s² but a function dependent on the PMR:~~
    ~~$\alpha$wot max = $\alpha$wot ref + 0.5 with 1.7 ≤ $\alpha$wot max ≤ 2.2~~

    b. It is as well important to carry out for each gear / gear ratio the acceleration AND the cruise tests

    c. Parameter to be reported for any test condition (acceleration, cruise, gear / gear ratio):

        i. Sound levels left and right side ➔ report to the 1st decimal

        ii. Vehicle Speeds $v_{AA}$, $v_{PP}$, $v_{BB}$ and v@Lmax ➔ report to the 1st decimal

        iii. Engine Speeds $n_{AA}$, $n_{PP}$, $n_{BB}$ and n@Lmax ➔ report to a full integer

        iv. Accelerations $a_{AABB}$, $a_{PPBB}$ ➔ report to the 2nd decimal

        v. Point of depressing the accelerator relative to AA' (pre-acceleration) ➔ report in m to a full integer

    Any parameter above is the average of four runs.

2. *ASEP Tests*

    a. General remark: Any ASEP data that have been collected can be delivered, even when they do not fully cover the control range outlined below.

b. Control range:

   i. Test shall start from ~~standstill~~ the vehicle in motion with the minimum speed possible for the lowest gear ~~(vehicle at standstill with the reference point just before line AA' ➔ pull away in 1st gear with partial load)~~ and for other gears at speeds which deliver at least 1000 rpm, or whatever is the lowest engine speed where a proper testing is possible

   ii. The maximum vehicle speed $v_{BB}$ shall be as high as possible on the test track, but not higher than 90% of rated engine speed S at line BB' in a specific gear / gear ratio

c. Gear / Gear Ratio selection:
   Make a selection so that the whole range of vehicle operation is covered

   i. For vehicles with manual transmission or fully lockable automatic transmission: ~~ANY GEAR~~ As many gears as possible

   ii. For vehicle with automatic transmission, regardless whether they are lockable or not: D

   iii. Special Vehicles:
   Make a meaningful choice of parameter variation
   For example test hybrids, if possible in various conditions like (only ICE mode, only BE mode and in MIX mode)

d. Modes:

   i. If the vehicle has various modes, make a meaningful selection of two modes, if a different sound output can be expected.

e. Acceleration / Engine load:

   i. Carry out the tests from cruise to full load:

      1. for low gears ~~in~~ at least two partial load conditions ~~(e.g. 1m/s² and 1.5 m/s²) and under full load.~~

      2. for high gears at least one partial condition.

   ii. ~~For higher gears, the 1.5 m/s² acceleration might be skipped, if a gear cannot deliver 1 m/s² even under full load, then reduce the acceleration for partial throttle.~~

   iii. Partial load shall be achieve by either mechanical lock of acceleration paddle or electronic lock. When ~~Alternatively~~, the acceleration paddle is ~~can be~~ locked to partial condition, ~~then~~ the acceleration might not be constant throughout the whole operation range. ~~Please indicate this test variant in the test report.~~

**Additional measurements for construction and validation of the assessment model**

3. *Rolling Sound Measurements at various speeds*

   a. Speeds: 20 km/h to 120 km/h (or if not possible, as high as possible) in steps of 10 km/h

   b. Tests shall be performed in coast-down engine OFF if possible

   c. Parameters to be reported:

      i. Sound levels left and right side ➔ report to the 1st decimal

      ii. Vehicle Speeds $v_{PP}$ ➔ report to the 1st decimal

4. *Stationary sound measurement in close proximity of the engine and in far field*

a. Proximity Measurement

i. The proximity measurements shall be made at a position which is close to the engine.

ii. The position can be either in the front or to the side of the vehicle, wherever is best access to the engine WITHOUT interference of other sound sources, such as cooling fan, intake system or exhaust system.

iii. Carry out a run-up of the engine, by SLOWLY increasing the engine speed from idle to govern engine speed. Repeat this measurement 4 times.

iv. Parameter to be reported

1. Distance and location of the microphone to the nearest point of the engine surface

2. Sound Level over engine speed with at least every 50 rpm

a. Sound levels ➔ report to the 1st decimal

b. Engine Speeds ➔ report to a full integer
Any parameter above is the average of the four runs.
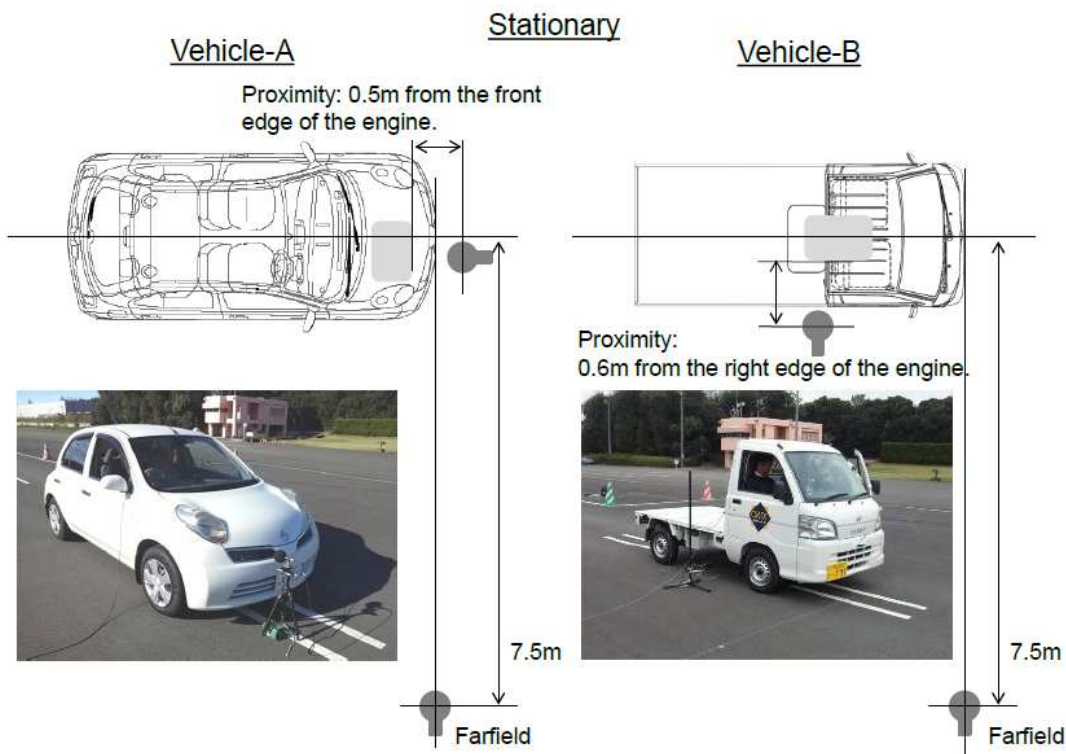


b. Farfield Measurement

i. Repeat the same measurements as under proximity, but in farfield at 7.5 m distance with the reference point according to UN R51.03 at line PP' on one side

ii. The farfield measurements can be carried out in junction simultaneously with the proximity measurements.

iii. Parameter to be reported

1. Sound Level over engine speed with at least every 50 rpm

    a. Sound levels ➔ report to the $1^{st}$ decimal

    b. Engine Speeds ➔ report to a full integer
    Any parameter above is the average of four runs.

**Analysis of the tests for the ASEP:**

At first the IWG for ASEP recommends the following analysis:

- Tyre noise: slope, $L_{50km/h}$ and to be checked with a regression analysis ($R^2 > 0,95$)
- Stationary: slope, $L_{2000rpm}$ and to be checked with a regression analysis
- Any other analysis according to the documents ASEP-05-11 (Japan) and ASEP-05-12 (OICA)