Joint Research Centre

the European Commission's in-house science service

Serving society
Stimulating innovation
Supporting legislation

Random NEDC tests to ensure the robustness of the correlation procedure

B. Ciuffo, G. Fontaras, K. Anagnostopoulos, J. Pavlovic, V. Arcidiacono, V. Valverde, D. Komnos

CO2MPAS Workshop for OEMs

Ispra. December 12-13, 2016

European Commission

Comparable stringency

Legal requirement:

"… ensuring that reduction requirements of comparable stringency for manufacturers and vehicles of different utility are required under the old and new test procedure"

Correlation procedure to ensure that

- **A manufacturer that meets its NEDC based target should also meet its WLTP based target**

Comparable stringency (the other side)

Legal requirement:

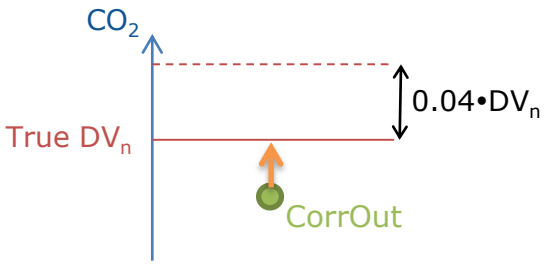
"… ensuring that reduction requirements of comparable stringency for manufacturers and vehicles of different utility are required under the old and new test procedure"

Correlation procedure to ensure that

- **A manufacturer that does not meet its NEDC based target should also not meet its WLTP based target**

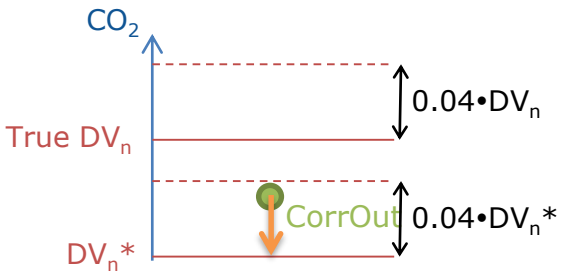
Need for random tests

- The interpretation of simulation results depend on the declaration by an OEM of the NEDC CO_2 emissions
- Possible problems may arise due to a misuse of the declaration mechanism



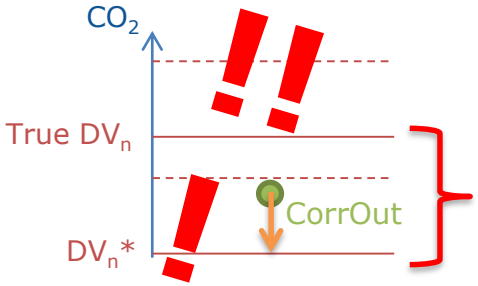
Need for random tests

- The interpretation of simulation results depend on the declaration by an OEM of the NEDC CO_2 emissions
- Possible problems may arise due to a misuse of the declaration mechanism



Need for random tests

- The interpretation of simulation results depend on the declaration by an OEM of the NEDC CO_2 emissions
- Possible problems may arise due to a misuse of the declaration mechanism



Improper OEM advantage due to CO_2MPAS underestimation of NEDC CO_2 emissions

- For this reason the concept of **Random NEDC tests** was introduced

Results of the random tests

- In the cases in which a physical NEDC test is not carried out, the TAA/TS will execute an additional CO_2MPAS function (CO2MPAS DICE) that will randomly sample a number from a uniformly distributed distribution defined in the range [1,100]

- If the number that is generated is in the interval (90,100] the TAA/TS will request that a NEDC test is executed

- At the end of the test, the relative distance between the test result and DV is assigned to the CO_2 interpolation vehicle family

$$De = \frac{RTr - DV}{DV}$$

- The value of De is registered in the CoC of the vehicles of the same family and reported in the CO2 monitoring database

Results of the random tests

- During the random physical NEDC test the TAA/TS shall check the value of three input parameters set in CO2MPAS:
  - Fuel saving gear for automatic transmission
  - Start-stop activation time
  - Presence of Brake Energy Recuperation

- On the basis of random test a **Verification Factor** is defined and assigned to the WLTP interpolation faimly. In particular:
  - If the values used as input in the CO2MPAS model are confirmed by the random test the verification factor is set to **0**
  - If one of the values used as input in the CO2MPAS model are not confirmed by the random test the verification factor is set to **1**

- The value of the verification factor is registered in the CoC of the vehicles of the same family and reported in the CO2 monitoring database

Correction for random test results

- Using the CO_2 monitoring database it is possible to verify, per each OEM, if any misuse of the process has been attempted.

- In particular, in the case that **for one of the random tests**,
  - **De is higher than 0.04**, or
  - The Verification factor is equal to 1

- the average CO_2 emission of the OEM is corrected by multiplying it by the following correction factor

$$\text{Correction factor} = 1 + \frac{\sum_{i=1}^{N} De_{,i} \cdot r_i}{\sum_{i=1}^{N} \delta_{3,i} \cdot r_i}$$

which represents the **registration-based weighted average** of all the deviations De resulting from the random tests executed for the OEM

Summary

- **Random NEDC tests** are introduced to avoid a possible misuse of the NEDC/WLTP correlation procedure to the advantage of vehicle OEMs
- In case the random test shows an attempt to take advantage from CO2MPAS a potentially ***significant penalty is applied to the average CO2 emissions of an OEM***
- For the procedure to work an additional tool (the CO2MPAS DICE) has been developed to ensure the ***unpredictability of the random selection***.

European Commission