

**OCE GTR**  
**Options for Laboratory Based WNTE Test – EU Perspective**

**A. Key requirements for laboratory based test**

In designing a laboratory based test for the OCE GTR there are a number of starting points to be considered in finalising its design. Some key parameters can be summarised as follows.

***1. The level of technical consistency between use of WNTE on-road and lab based testing.***

The starting point for the design of a laboratory based procedure in the GTR should be that it reflects the character of the WNTE as an in-use, on-road, test procedure.

Key aspects of the WNTE when used on vehicles are as follows:

- Extraction of short sequences of data from the control area.
- The random character of in-use operation results in a semi-random nature to the sequences. (They are not completely random as they reflect vehicle use on the road)
- The duration of averaging period ranging from 30 seconds to 2 minutes.

***2. The fit with existing random points legislation.***

The test procedure should be designed either:

- to be a robust *replacement* of the existing random procedure, or
- to *work with* a random points procedure (that is modified for WHDC).

No decision has been made as to how the random points procedure in EU legislation will be modified to reflect the WHDC procedures. It is possible that a laboratory procedure in the OCE GTR could replace the existing procedure if well designed. Alternatively the OCE GTR procedure could be designed to fit with a modified version of the random points requirements.

## **B. Review of current options for OCE GTR laboratory procedure**

So far, two options have been proposed for the laboratory based OCE test procedure. One was developed by the Commission and Member States and another proposed by OICA.

### *1. EC Proposal*

- This proposal reflects well the concept of the WNTE, testing on short, random emission sequences inside a control area. It therefore fits well with the operation of the NTE concept on-road in the US.
- The ability to test individual points would replicate to a certain extent the random points test.
- The key area requiring further work will be to define in more detail the worst case parameters for the test. Additional work and possibly testing could be required to develop comprehensive requirements.
- The nature of the random point testing could result in problems with the points in the control area with high brake specific emissions and the application of the compliance factor, though the retention of the 30% engine power carve out would reduce this issue.

### *2. OICA Proposal*

- The OICA proposal for ramped cycles averages emissions over a longer time period, so overcomes the problems associated with high brake specific emissions caused by low power operation.
- The 10 minute cycles in the control area do not reflect the nature of the WNTE as it would apply on the road, where WNTE events would be of shorter duration.
- The proposal to connect the points *'in a way representing typical engine behaviour'* reduces the randomness of the test and will be difficult to implement as it could result in lengthy discussion between manufacturers and approval authorities.
- The 20s ramping between test points limits measurement of highly transient engine operation.
- The averaging over a number of points will not provide a similar test to that currently in place with the random points.

A key issue with the EC proposal is that it requires further work to be implemented. The OICA proposal has that advantage of being able to be finalised quickly and avoids issues associated with points that have high brake specific emissions.

However, it is not clear that the OICA proposal adequately reflects the nature of the WNTE as it would apply on the road due the long averaging times. In addition, the transients are limited by the 20s ramping. Similarly, the test does not seem to be replacement for the random points test due to the averaging and the level of stringency could be lower.

### C. Options for OCE GTR laboratory procedure

Three options have been suggested for finalising the laboratory based test procedure. These are as follows.

#### 1. *Random cycles across the control area - Development of the EC/OICA proposals*

- Avoid need for further development work by removing testing using worst case parameters proposed by EC.
- Ensure that transitions between points are random, so remove '*typically representing engine behaviour*' requirement proposed by OICA
- Reduce transit times between points to make cycles more dynamic and reflect real world engine response (e.g. 5 second ramps, considering what is possible with modern dynos)
- Reduce averaging perhaps by considering data from single mode tests or single modes connected by ramps. Consider assessing the data over periods of 30s to 2 minutes.
- Retain 30% engine power carve out to reduce issues with high brake specific emissions.

#### 2. *Random cycles in a grid over the control area*

- Divide the engine torque curve into a grid based on a range of engine test speeds and a range of engine torque values. An initial proposal for a grid based on the WHSC is attached, but could be simplified.
- Randomly select a number of cells of the grid within control area.
- Run random cycles within the selected grid cells. For example, 3 to 4 cycles each with 5 modes, maximum length of 2 minutes per mode.
- Calculate emissions according to WHSC provisions, calculating average emission per cycle in each grid cell.
- Need to examine if cycles in certain lower engine power grid cells result in particularly high brake specific emissions.
- Coverage of high transient ramps is lost with grid approach, could be re-introduced by creating connecting provisions for the randomized established grids.

#### 3. *Revised random points procedure*

- Update the existing random points procedure found in EU and US legislation for NRMM
- Review whether 10% compliance factor in EU legislation is still applicable to Euro VI emission limits due to the low absolute emissions and the levels of measurement accuracy.

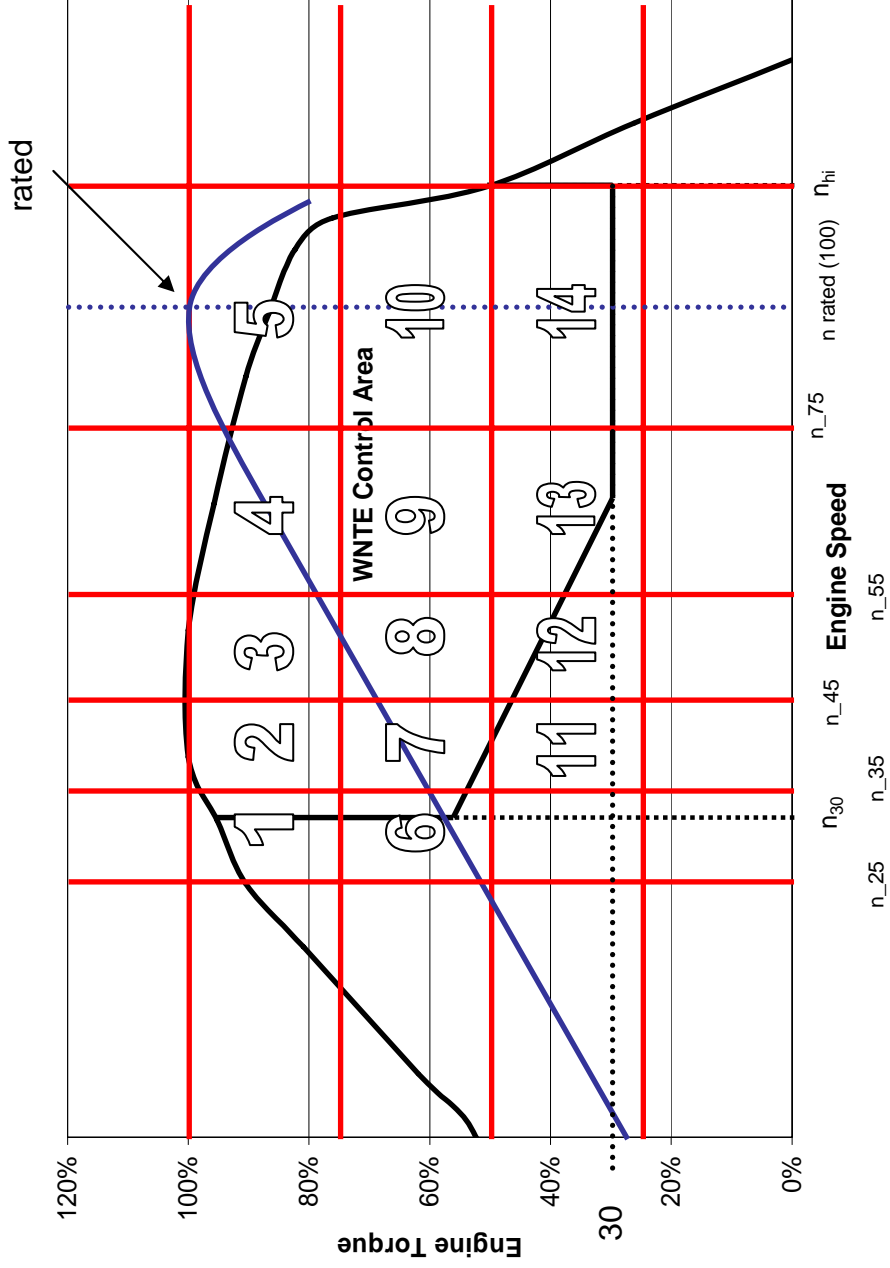
The first option could result in a procedure that reflects the concept of the WNTE as applied to on-vehicle testing. It is not clear that it provides an adequate replacement for random points.

The second option reflects a hybrid of the WNTE and the random points approach. This option has the potential to replace the random points requirements and to fit with the WNTE approach.

The third option provides a direct replacement for random points. It avoids issues with high brake specific emissions, but the actual compliance factor would need to be considered and may need to become a compliance function. It does not reflect WNTTE philosophy very well, though perhaps the WNTTE control area could be applied to the procedure.

Another approach may be to require both option 1 and 3. This however would result in 2 test procedures being used so adding to the approval requirements.

# WHSC Grid over OCE-WNTE



# WHSC load map

Speed [%]	Load [%]
Motoring	-
0	0
55	100
55	25
55	70
35	100
25	25
45	70
45	25
55	50
75	100
35	50