

The European Commission's science and knowledge service

Joint Research Centre



EU Real Driving Emissions Regulation

Fine tuning of data evaluation in the “RDE4” Package

European Commission – Joint Research Centre

November 2018

RDE Reg. References

- **First 3 packages = Regulations 2016/427, 2016/646, 2017/1151 = “RDE3” requirements**

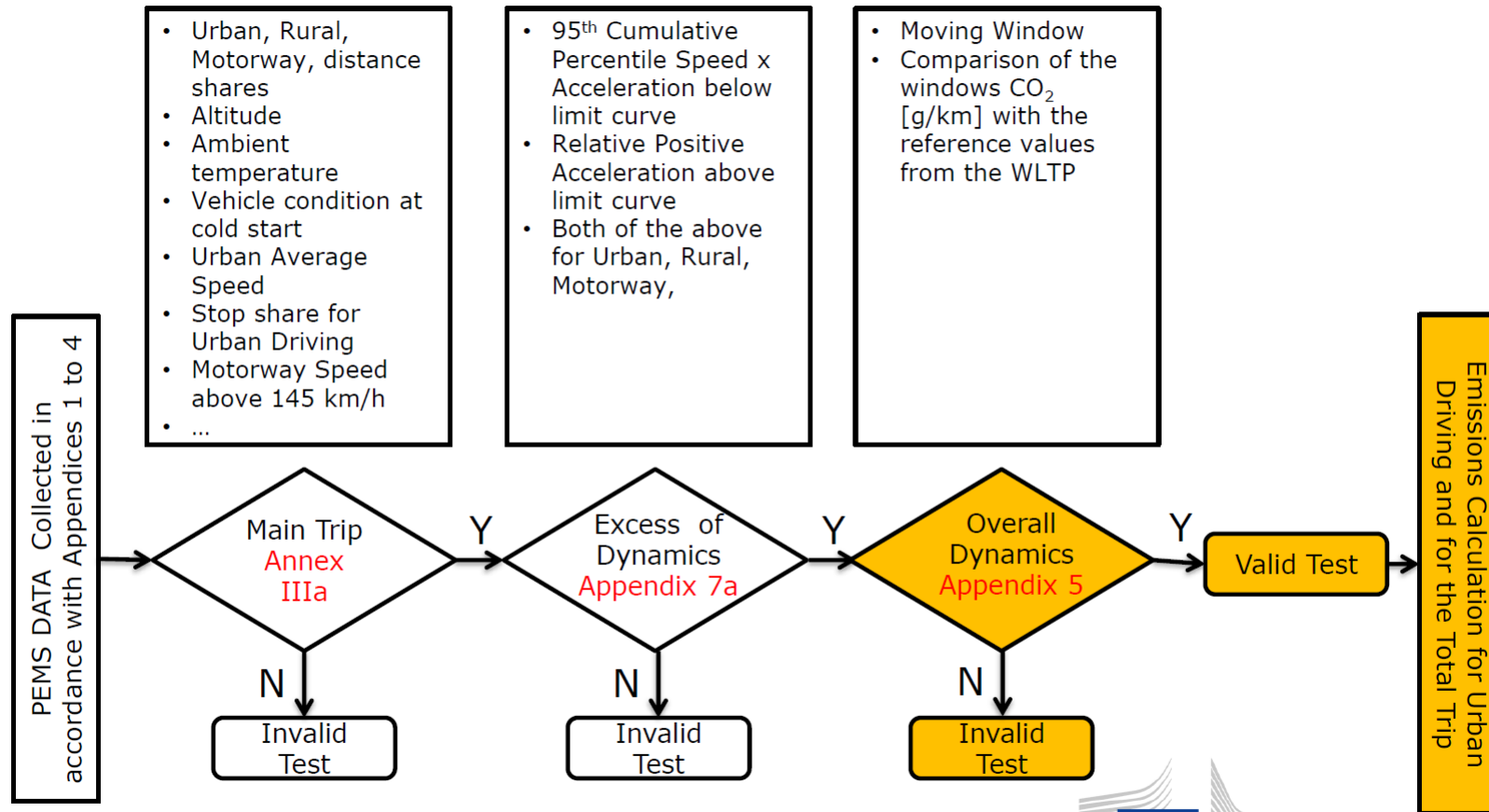
- **“RDE4” = 2018/1832**

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2018:301:TOC>

Background

- **RDE3 monitoring data**
- **2 Data evaluation methods (Moving Window, Power Binning) used to both assess the trip validity and to calculate the final emissions**
- **(TNO) Assessment of the methods using the RDE3 data: inconsistent trip validity assessments (too many invalidations) and emissions calculations**

Elements improved in RDE4



Elements improved in RDE4

Reference CO₂ curve from the WLTP test

Baseline CO ₂ Reference (RDE3)	Modified CO ₂ Reference (RDE4)
The reference curve was meant to represent the mean MAW CO ₂ during RDE tests (Symmetric tolerances tol1/tol2)	The reference curve represents the WLTP CO ₂ . On-road CO ₂ emissions are depicted by the MAWs <i>N.B. Possible asymmetric tolerances</i>
Scaling factors 1.2/1.1/1.05 for the WLTP CO ₂ [g/km] phase values	No scaling factors (i.e. 1/1/1)

Elements improved in RDE4

The reference CO₂ values are from the WLTP.

The on-road CO₂ variability in the windows caused by different factors shall be captured by the “tolerances” tol1/tol2 around the reference.

Factors causing the differences between the reference CO₂ values and the on-road MAW CO₂ values (non exhaustive):

- **Vehicle speed-acceleration**
- **Vehicle payload**
- **Ambient temperature**
- **Road grade**
- **Vehicle systems consuming and/or recovering electric power**
- **Etc...**

Reference data set

Normal Tests:

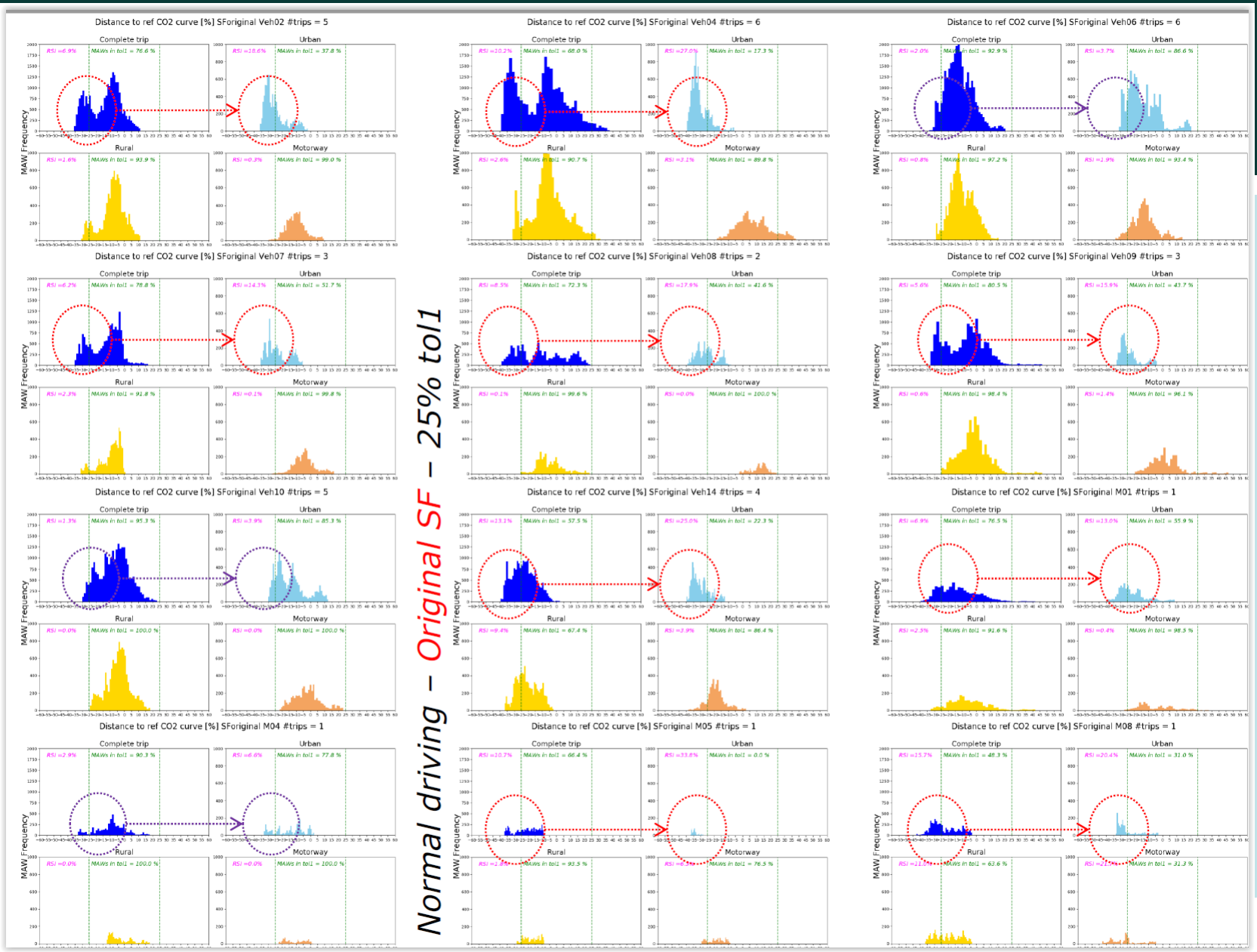
- TUG (TUG01, TUG02: Ries trips)
- JRC (11 vehicles, ~ 50 trips)
- Monitoring (10 vehicles, 10 trips)

Fulfillment Annex IIIA, Appendix 7a, Appendix 7b

Invalid Tests

- TUG Biased driving
- TUG01: Azberg tests (T4, T5, T6)
- TUG02: Azberg tests (T5, T6, T7), DLBG tests (T1, T2)

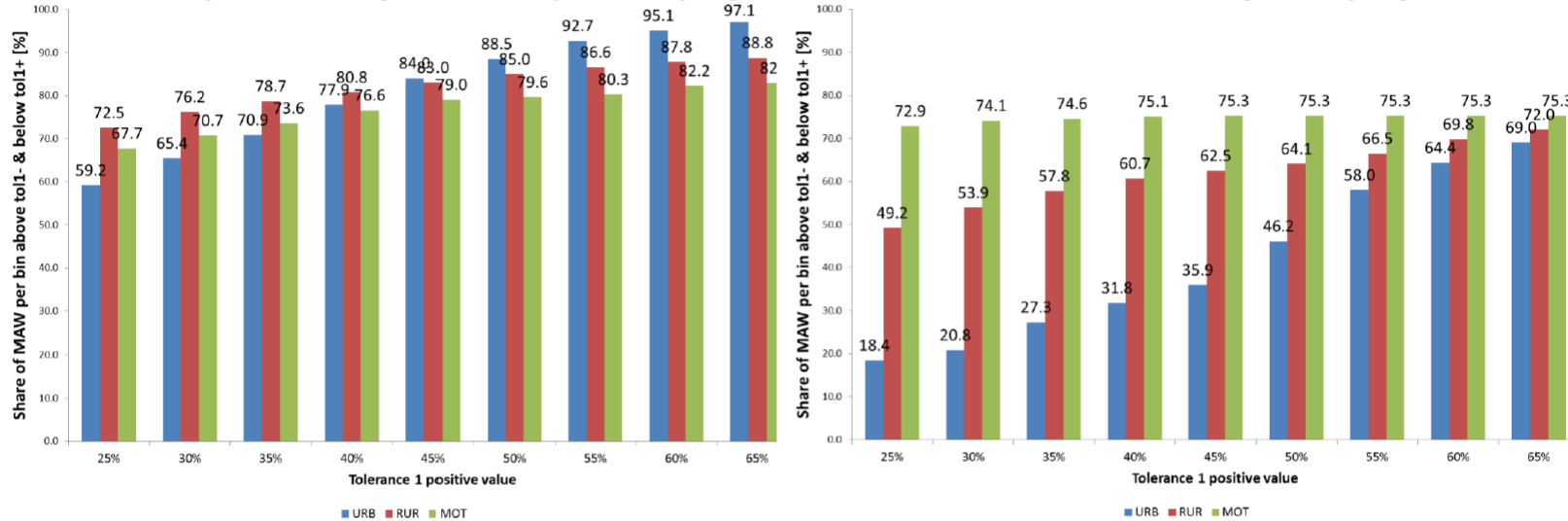
Fulfillment Annex IIIA, Appendix 7a, Appendix 7b



TUG dataset [SF111; tol1- -25%]

Hilly drive (Normal, 9 trips)

EPD (8 trips)



Optimization of tol1+ value using EPD (Emissions Provoking Driving) tests.

- For any tol1+ value between 25% and 50%, the hilly driving tests will fulfill the normality criterion and all the emission provoking driving will not reach 50% normality (in the urban bin). Beyond 50%, EPD will be considered as normal. Note that AZB_T6 & AZB_T7 have > 50 normal MAWs already when tol1+ = 45%
- **tol1+ = 40%** will allow more tests to be considered normal than **tol1+ = 35%** (reduce test burden) but might be too relaxed to identify EPD and viceversa

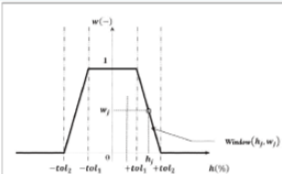
- Reminder: Completeness check as in Annex IIIa for U/R/M distance shares
- Options to check the normality

Share of windows within tol1 (RDE3)	Options for RDE4:
50% of MAWs inside tol1	<div style="border: 1px solid red; padding: 2px;">- 50% of MAWs inside tol1</div> - Relative Severity Index (RSI)
Issues identified during the R&M: <ul style="list-style-type: none"> • Tests with balanced shares of "normal" windows and "extreme" windows (e.g. 51%/49%) result as normal • Subsequent emissions corrections with the weighing function unclear 	The RSI addresses the overall position of the windows with respect to the WLTP reference but adds complexity

Selected

Final Emissions Calculation

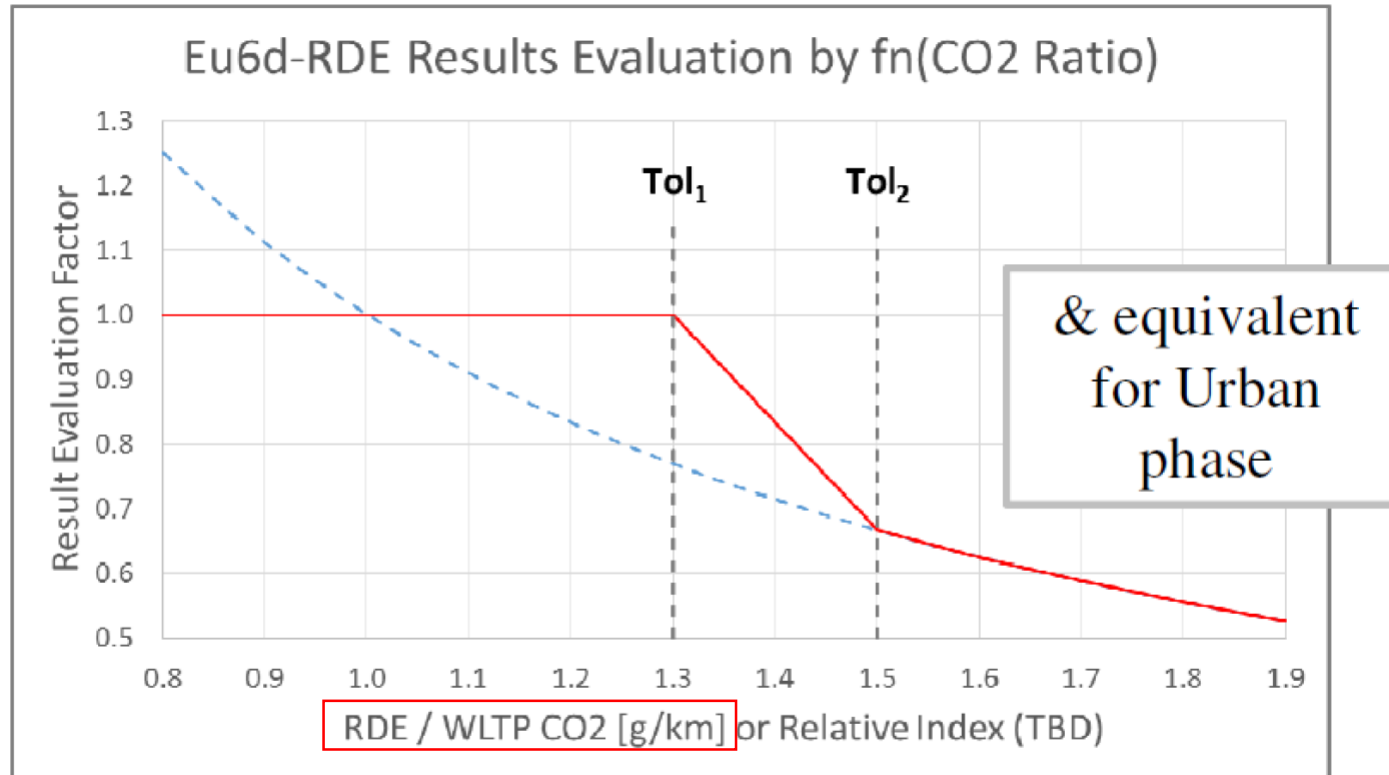
- For trips identified as « normal » after Step2:

MAW Weighing Function (RDE3)	Options Envisaged for RDE4
<p>Weighing Function as in Appendix 5, CO₂ based correction outside the tol1 band.</p> 	<ul style="list-style-type: none"> - Raw emissions - Raw + CO₂ Based corrections
<p>Issues identified during the R&M:</p> <ul style="list-style-type: none"> Emissions corrections with the weighing function unclear 	<p>No "Cross pollution" of urban emissions from rural and motorway emissions with:</p> <ul style="list-style-type: none"> - new U/R/M definition - Urban definition on WLTC (Phases 1&2)

Selected

Final Emissions - CO2 based correction

- ACEA Proposal on 8/11/2017



Selected

Main Points

- **CO₂(g/km) versus Average speed used as a metric to assess the overall dynamics**
- **Assessment conducted at the intermediate scale (MAW) with respect to the reference certification cycle which provides $CO_2=f(\text{Average Speed})$ and the reference quantity for averaging (half WLTP CO₂ for the EU)**
- **Final emissions calculations now decoupled from the MAW assessment in the EU (NB: for light-duty!)**



Any questions?