

## **Wind Tunnel Method – Validation Test Program, Progress Report**

v1, 30.01.2015: Progress on validation program added

v2, 02.02.2015: Detailed analysis for delta cycle energy added

v3, 03.02.2015: Conclusion of Annex 4 subgroup added

v4, 17.03.2015: Correction by native speakers

### **Progress on validation test program**

- In the WLTP Annex 4 meeting in Munich on 12<sup>th</sup> May 2014, Céline Vallade (UTAC) presented the French PFA-initiative for comparison of the road load measurements performed by wind tunnel and chassis dyno and coast down on the road.
- The members agreed to enlarge the validation program with additional tests by VW on a track and with a wind tunnel and flat belt chassis dynamometer.
- In total, 6 cars, 4 tracks, 2 chassis roller dynos and 1 flat belt chassis dynos were involved in the validation test program.
- The results of the PFA-validation program were shown at the 8<sup>th</sup> IWG in Poona on 18<sup>th</sup> November 2014 (see “WLTP-08-23e”).
- The additional tests from VW were shown in the Annex 4 task force telephone conference on the 9<sup>th</sup> of December 2014 (see “Road load comparison\_141209”).
- Detailed analysis of the PFA-validation program show that the difference between the wind tunnel method (performed by wind tunnel and chassis dyno) and the tracks is:
  - o Usually <10 N (apart from N1 vehicle)
  - o Between -6.1 % to +1.8 % (+9.9 % including V3) from the track
- The additional tests from VW (wind tunnel and flat belt chassis dyno compared to an additional track) show similar results. The difference between tracks and wind tunnel method is:
  - o Usually <10 N (bigger difference at higher speed)
  - o In between -5.1 % to +0.9 % (bigger difference at lower speed)
- The results of the performed tests show a better repeatability with the wind tunnel method than with the coast down on the road.
- The results show that decelerations and stabilised speed methods are similar (an average of 0.4% difference).
- The difference between the wind tunnel method and track results (regarding the averages of the tracks) are in the order of magnitude of the bias and the dispersion of the tracks.
- The average results of the wind tunnel + roller /flat belt chassis dyno are very close to the average track results (usually <10N).
- The biggest outliers are found in the coast down of the N1 vehicle with high weight and big frontal area.
- Regarding delta cycle energy demand (WTM-CD) the tested cars show the following results:
  - o The overall average is -0.8 % delta cycle energy demand
  - o The average for each car shows a delta cycle energy demand from -2.0 % to +1.0 %
  - o Regarding the biggest outliers (positive and negative), delta cycle energy demand varies from -4.7 to +2.2 %
- The results of the validation test program were discussed in the WLTP Annex 4 meeting in Brussels on 3<sup>rd</sup> February 2015.
- The task force identified a possible issue on the dispersions of coast down results on the road – even when there is no systematic influence from the test tracks in the PFA-validation program. A discussion on how to reduce the spread of the measured road loads on the road can be open in phase 2. For phase 1b, no further investigations are planned.
- Concluding, the Annex 4 task force confirm that the wind tunnel plus flat belt/roller chassis dyno method is an acceptable method for measuring road loads in the WLTP.