RDE procedures
- Preliminary views on speed / map based U/R/M categorisation -
- July 8, 2015 – RDE Data Evaluation group

European Commission - Joint Research Centre (JRC)

IET - Institute for Energy and Transport

Background (1)

Annex IIIa defines U/R/M driving conditions using speed based classification [60/90] > BINNING ONLY

Reminder about trip and data evaluation procedures :
- Trip selection: Topography + Mix of urban, rural and motorway driving conditions, defined by their <u>ranges of vehicle speed and driving dynamics</u>. The minimum trip duration and distances to be driven ensure that the amount of data collected is statistically significant.

- Trip verification: Realised trip is in line with the selected one;

- Trip verification for the assessment of the vehicle RDE performance: Ensuring that the vehicles cannot be driven too soft (resp. aggressive) Should this biased driving occur, the verification procedures (additional indicators and/or data evaluation methods) have to invalidate the test.

Background (2)

**Reminder about trip and data evaluation procedures :**

- Step 1 - Verification of the trip characteristics (<u>U/R/M distance shares, urban average speed, minimum stop percentage</u>)

- Step 2 - Minimum and maximum driving dynamics at trip macro-scale, <u>Additional trip indicators</u> as being developed in Appendix 9 (not part of the first RDE package).

- Step 3 - Minimum and maximum driving dynamics as defined under Appendix 5 (at mesoscale, moving window method) or Appendix 6 (at micro-scale, power binning method)

Speed v. Map… a problem?

Potential problem:

- Allocation of low speed urban and motorway to urban operation. For instance, in case of stops at the toll station or when entering on motorway, the corresponding decelerations and accelerations are attributed to the urban operation. The high accelerations often occurring after such stops at the toll station may be higher than under urban conditions and therefore not fully representative for urban driving.

- Implications for the 3 data evaluation steps. In the worst case, this might lead to a biased estimation of the vehicle emissions.

- <u>Effects on trip and emissions evaluation not demonstrated or quantified yet</u>

Shifting from speed to map..

Allocating data points to U/R/M bins (Illustration)
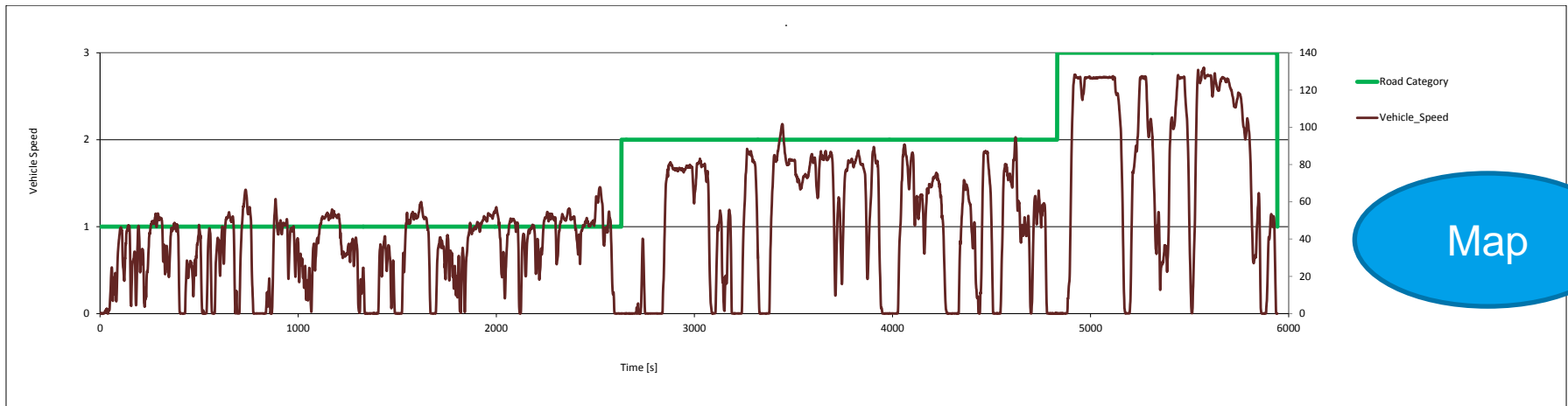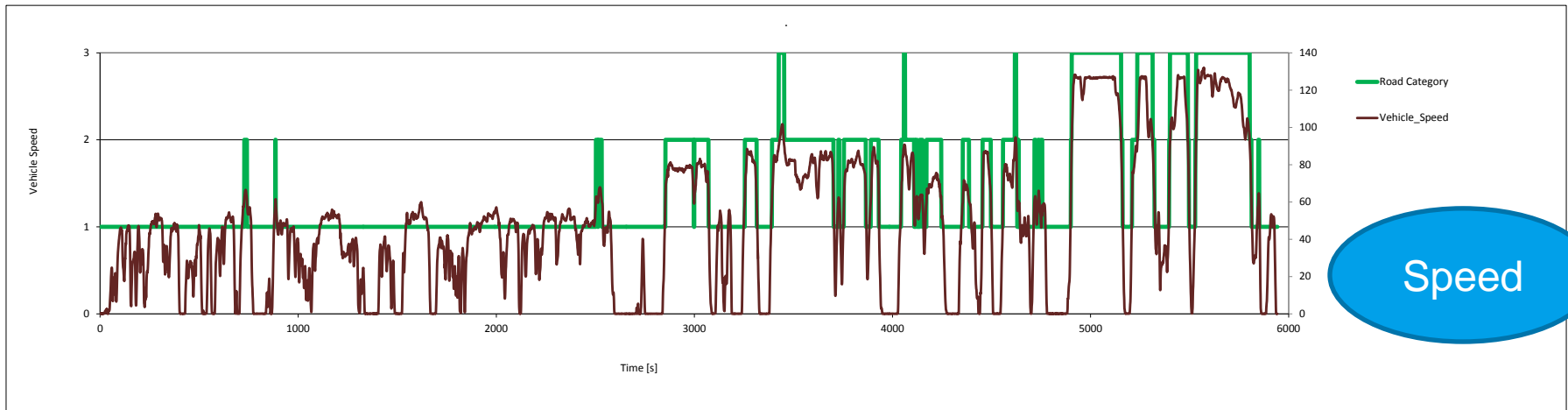
Speed versus map-based calculations: Example – 1 vehicle, 1 route – 2 test repetitions

	Test1		Test2	
	Speed	Map	Speed	Map
Urban distance share (%)	39.1	30.0	42.1	29.9
Rural distance share (%)	30.7	36.5	28.4	36.8
Motorway distance share (%)	30.2	33.5	29.4	33.3
Urban average speed (km/h)	27.6	26.3	27.7	25.5
Rural average speed (km/h)	76.8	47.5	76.9	48.3
Motorway average speed (km/h)	118.3	86.4	117.8	85.8

Speed versus map-based calculations: Example – 1 vehicle, 1 route – 2 test repetitions

	Test1		Test2	
	Speed	Map	Speed	Map
Urban RPA	0.20	0.14	0.20	0.13
Rural RPA	0.12	0.15	0.13	0.16
Motorway RPA	0.08	0.13	0.09	0.14
Urban 95th V.A	12.91	8.59	14.00	8.58
Rural 95th V.A	24.59	17.98	22.54	16.10
Motorway 95th V.A	32.68	37.43	31.97	30.97

Effects for the data evaluation…(Step 2)

Effect on dynamic indicators (95th precentile V.A) – TEST 1
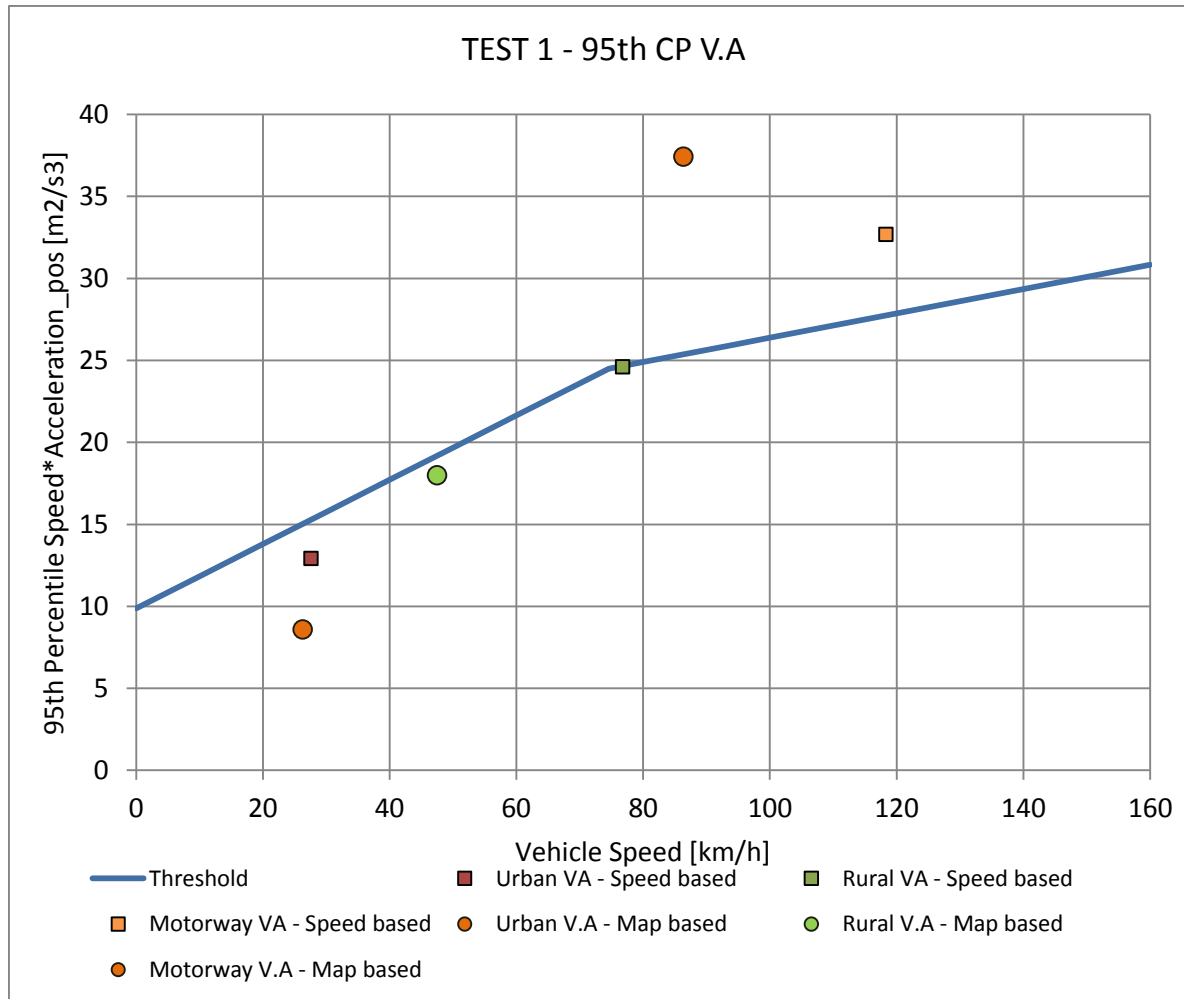
Effect on dynamic indicators (RPA) – TEST 1
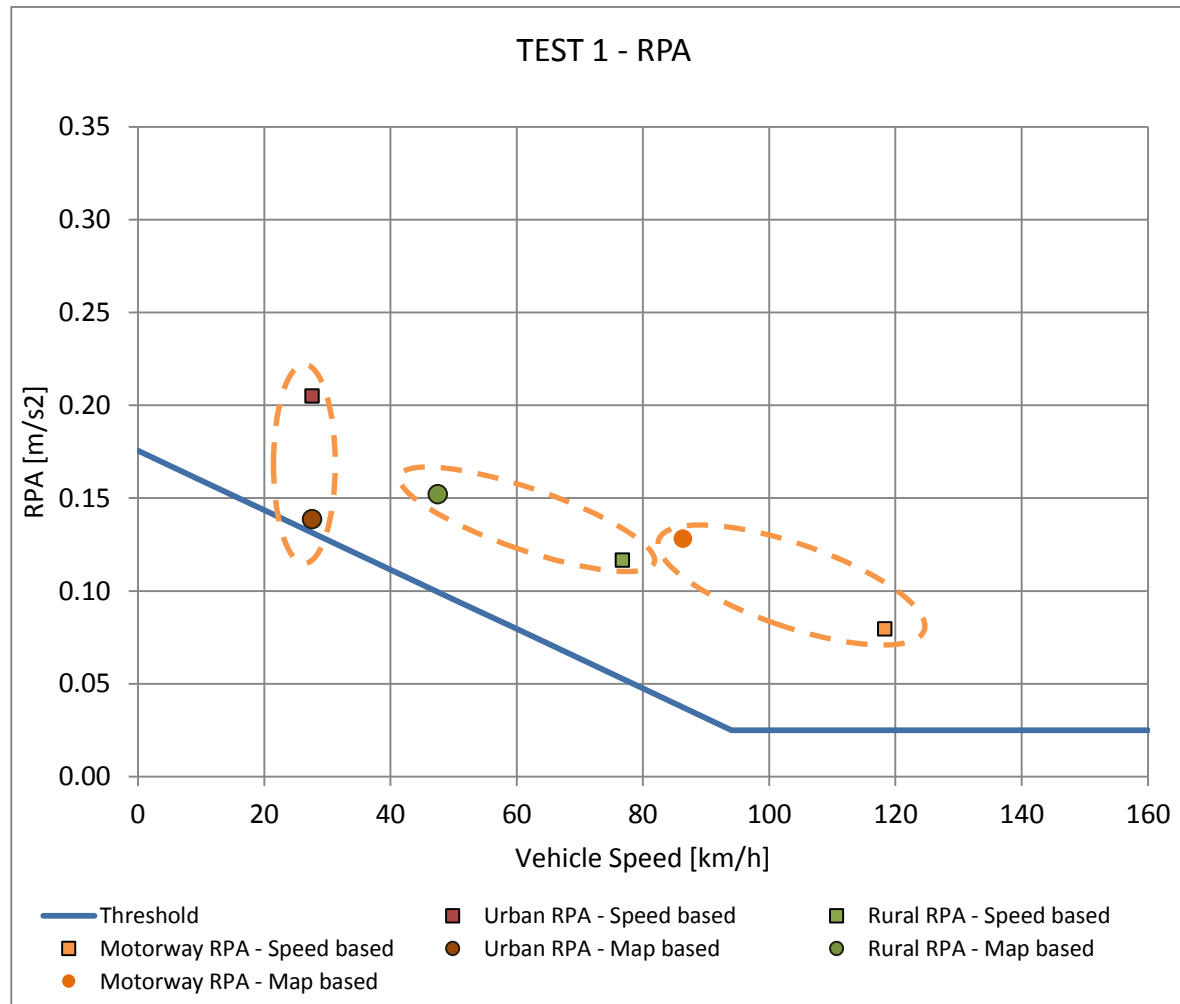
Speed versus map-based calculations: Example – 1 vehicle, 1 route – 2 test repetitions

	Test1		Test2	
	Speed	Map	Speed	Map
Urban NOx Emissions (Unprocessed)	0.46	0.30	0.38	0.27
Rural NOx Emissions ((Unprocessed))	0.55	0.58	0.39	0.38
Motorway NOx Emissions ((Unprocessed))	0.86	0.91	0.80	0.87
Urban NOx Emissions (MAW)	0.24	0.24	0.22	0.22
Rural NOx Emissions (MAW)	0.57	0.56	0.38	0.38
Motorway NOx Emissions (MAW)	0.97	0.97	0.90	0.90
NOx Emissions (MAW)	0.59	0.59	0.50	0.50

Effects for the data evaluation…

Speed versus map-based calculations: Example – 1 vehicle, 1 route (RDE compliant) – 2 test repetitions

Step 1 – Modified U/R/M distance shares

Step 2 - A map based approach shifts low and high (rural, motorway) acceleration events to the urban bin. As a result, the calculation of trip indicators (mainly 95th percentile of the speed per acceleration product) are significantly affected.

Step 3, - The situation depends on the data evaluation methods and the end effect should also be studied carefully (as for step 2) for both methods. Both methods minimize the shift from speed to map (due to their intrinsic principles.

JRC Conclusions and recommendations

- As demonstrated in the case study, shifting from speed to map based classification has significant effects upon <u>all the steps</u> of the data evaluation and would require a revision of the scheme (trip requirements, boundary conditions for indicators).

- The total emissions do not seem to be affected (TBC) but the <u>urban emissions</u> seem to be affected by the shift from speed to map.

- ***The need to develop a <u>reference map database</u> (maintained and updated by an independent body) remains open.***
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- JRC Recommends **to *reinforce the trip selection process and to introduce map-based elements*** (e.g. way points and type of road between 2 way points using the posted speeds to define the U/R/M category). These additional elements – if available – could be used to fine tune the procedures at a later stage (e.g. to better assess urban emissions if required by the regulators)