

IMPROVEMENT OF FAMILY DEFINITIONS

WLTP NEW ISSUES TASK FORCE



BMW, Lueglinger | 06.09.2017

**BMW
GROUP**

THE NEXT
100 YEARS 



Rolls-Royce
Motor Cars Limited

IMPROVEMENT OF THE FAMILY DEFINITIONS AGENDA

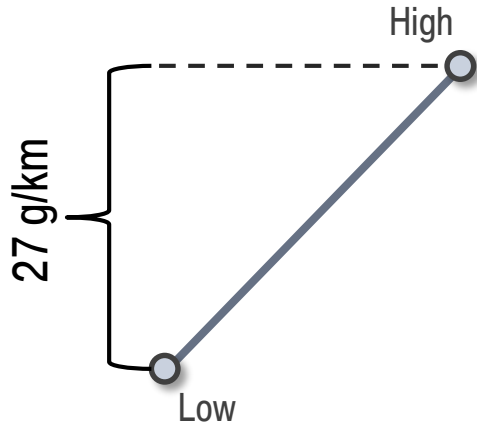
In the context of the interpolation context, the following proposals are presented:

- Extrapolation rule.
- Improvements in family definition.
- Minimum-ranges for road load parameters.

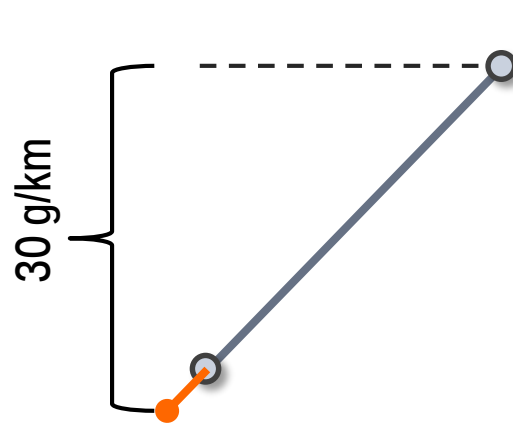
IWG is asked, whether these concepts are supported. If so, they will be further developed in the New Issues Task Force.

A possible adoption would be planned for first half of of 2018.

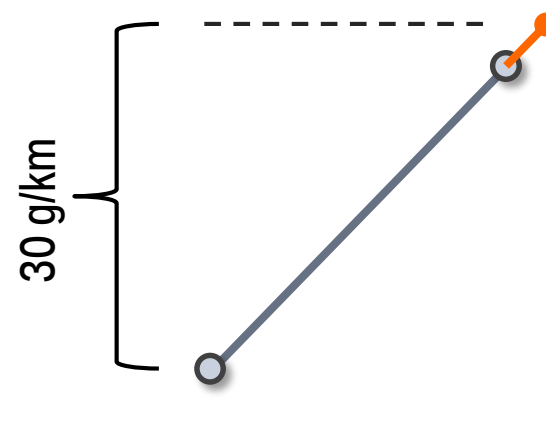
IMPROVEMENT OF THE FAMILY DEFINITIONS EXTRAPOLATION RULE



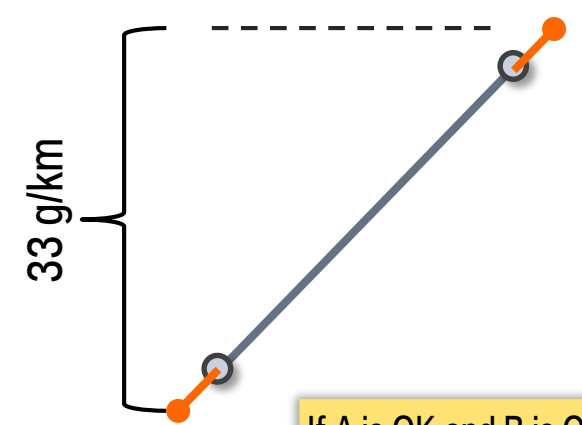
tested



A:
extrapolation to
lower end ✓



B:
extrapolation to
higher end ✓



A+B:
extrapolation to
both ends ✗ → ???

If A is OK and B is OK,
why is A and B wrong?

Proposal: The range between Low and High shall be within 27g/km, and extrapolation is allowed to both ends. The range criterion shall refer to the declared value of High and Low.

Justification / Background: Currently the (necessary) 3 g/km CO₂ extrapolation have to be within the maximum range of 30g/km (or 20%). That is a problem especially for authorities, as they cannot check the fulfilment of that rule. In fact, it is important to care about physics and linearity, which have been demonstrated for up to 40 g/km of CO₂. The proposal keeps the spirit of the initially decided regulation and provides more clarity. It shall also be clarified, that the range criterion is to be applied on the level of the declared value, as it is the basis for the interpolation.

IMPROVEMENT OF THE FAMILY DEFINITIONS

SMALL IMPROVEMENTS OF INTERPOLATION FAMILY CRITERION AND CONCEPT

– Mid vehicle for ICEs

Proposal: If a mid vehicle is tested and fulfils the criteria (see hybrids), the max. range can be extended by 10 g/km CO₂.

Justification / Background: Limiting the range is important, as linearity is necessary for interpolation. To avoid splitting a family (with all its complex consequences) for a few grams, it should be possible to have a bigger family, while linearity has to be demonstrated.

– Full load power curve

Proposal: Full load power curve may be different in an interpolation family, as long as the gearshifting is not affected.

Justification / Background: The reason for that provision was the influence of the full load curve on the gearshift points, especially for MTs. In that context, that provision shall remain unchanged. But there are cases, where the full load curve is not affecting the gearshift points, and therefore emissions or CO₂. In that case, test burden can be reduced.

→ As this a definition issue, it should be done together with the ICCT proposal on improving the definitions of family criteria.

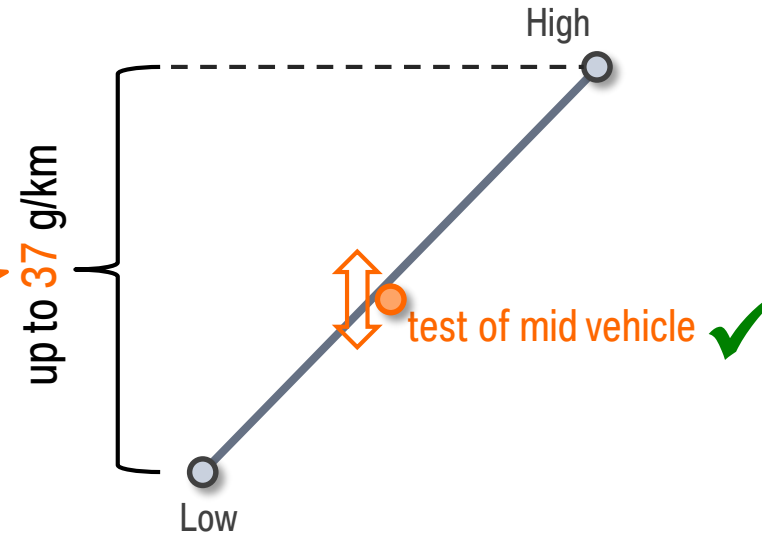
– Functional description

The concept of ICCT, to add a functional description of the family, which allows for checking, whether a vehicle fits into a family, is supported. It should be a tool for the authority to check on demand as well as for the OEM, to prove the membership, in situations, where the family definitions are ambiguous.

IMPROVEMENT OF THE FAMILY DEFINITIONS

EXAMPLE ON MID VEHICLE

If Mid vehicle is tested and check is OK:
Range can be increased by 10 g/km.
Effectively then 37 g/km or 20% plus 10 g/km whatever is smaller.



– Mid vehicle for ICEs

Proposal: If a mid vehicle is tested and fulfils the criteria (see hybrids), the max. range can be extended by 10 g/km CO₂.

Justification / Background: Limiting the range is important, as linearity is necessary for interpolation. To avoid splitting a family (with all its complex consequences) for a few grams, it should be possible to have a bigger family, while linearity has to be demonstrated.

WLTP NEW ISSUES TASK FORCE

MINIMUM RANGE OF ROAD LOAD PARAMETERS 1/3

Interpolation criterion	Road Load Family	Interpolation Family
mass	different between H and L	different between H and L
RR	different between H and L	different between H and L
air drag	different between H and L	different between H and L
min. range	5% cycle energy	5 g/km CO ₂
max. range	35% cycle energy	20%/30g CO ₂
extrapolation	unclear	3 g/km CO ₂ (within 30g/km)

If the difference e.g. of $cd \cdot A$ is too small, road load calculation could fail.



Interpolation criterion	Road Load Family	Interpolation Family
mass	Delta _{min} : 30 kg	Delta _{min} : 30 kg
RR	Delta _{min} : 1 kg/t	Delta _{min} : 1 RR class*
air drag $cd \cdot A$	Delta _{min} : 0.050 m ²	Delta _{min} : 0.050 m ²
min. range	5% cycle energy	5 g/km CO ₂ **
max. range	35% cycle energy	20%/27g CO ₂ **
extrapolation	allowed for the purpose of using the class-RR for IP-Family	3 g/km CO ₂ ** (within 30g/km)

Plus additional rules:

- Parameter of "High" has to be higher than the parameter for "Low".
- If difference is not achieved, High vehicle may be worsened artificially.
- If no difference or difference smaller than minimum (RR, $cd \cdot A$ or mass), worst case of family is to be applied.

Information:

All proposed min-ranges are approx. 3 times of the measurement tolerance (10kg, 0.3 kg/t, 0.015m²).

* If the road load family concept is not used, the criteria from road load family is to be applied in addition.

** See separate proposal.

WLTP NEW ISSUES TASK FORCE

MINIMUM RANGE OF ROAD LOAD PARAMETERS 2/3

- The minimum range should solve also many of the identified problems, presented in the New issues task force by Japan or ACEA.
- But still there might be special situations, that cannot be covered. In order to avoid that, there should be an OEM option for increasing the CO₂ and FC values of an individual vehicle, which is not possible in the current gtr.
- **Proposal:** Add a new sentence at the end of paragraph 3.2.3.2.4. of Annex 7 as well as to the appropriate sections in Annex 8:
The individual CO₂-value may be increased by the OEM. In this case:
 - (a) the CO₂ phase values shall be increased by the ratio of the increased CO₂-value divided by the calculated CO₂-value;
 - (b) the fuel consumption values shall be increased by the ratio of the increased CO₂-value divided by the calculated CO₂-value.

WLTP NEW ISSUES TASK FORCE

MINIMUM RANGE OF ROAD LOAD PARAMETERS 3/3

Note for EU: This is especially a problem in the NEDC correlation, where optional equipment is removed. This issue will be forwarded to DG Clima. **This is very urgent!**

Proposal for NEDC correlated for minimum ranges:

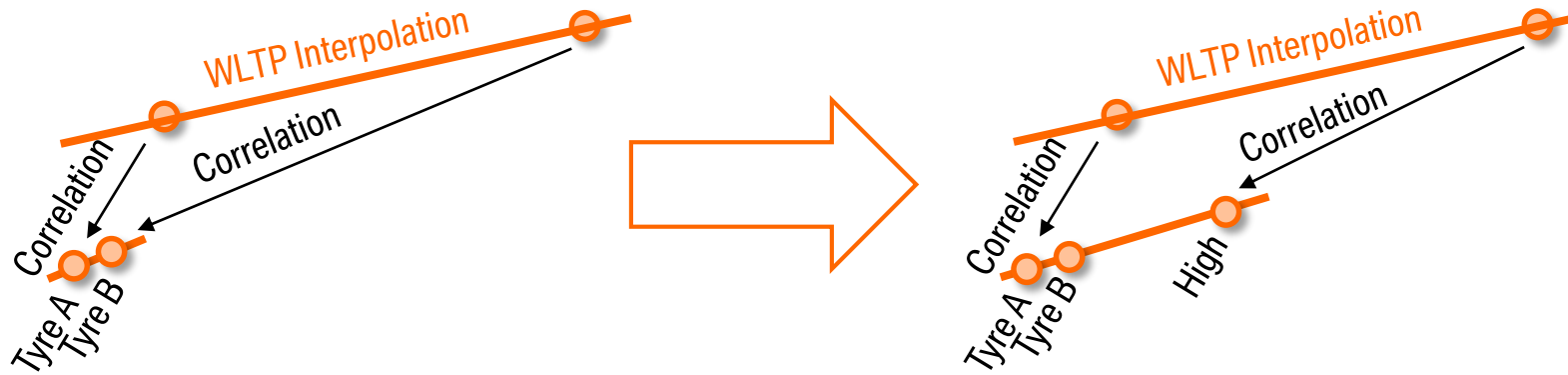
- Two options possible, whatever delivers the higher difference between High and Low has to be chosen:
- cd^*A : Either fulfil min-delta ($0.050m^2$);
or use worst cd^*A of all family members for High and best cd^*A of all family members for Low.*
or worst case of family to be selected and no interpolation of cd^*A .
- mass: Either fulfil min-delta (30kg);
or use worst mass of all family members for High and best mass of all family members for Low.
or worst case of family to be selected and no interpolation of mass.
- RR: Use best RR class for Low and worst RR class for High.
If High and Low same RR class, no interpolation possible.
- CO_2 : Minimum range of 5g/km to be applied as well.
If minimum cannot be achieved, the vehicle High can be worsened artificially. Or CO_2 -value of High applies to all family members.
- This proposal should be complemented by an OEM option, that CO_2 - and FC values of interpolated vehicles may be increased.
- **For already tested families, a different solution is necessary, a proposal can be provided.**

* The reason for that option is, as long as you are not extrapolating (which is ensured by best case / worst case), there is not a problem, if the delta is too small.

WLTP NEW ISSUES TASK FORCE

MINIMUM RANGE OF ROAD LOAD PARAMETERS 3/3

Example for NEDC Correlation:



WLTP NEW ISSUES TASK FORCE

ROAD LOAD FAMILY

Note for EU: The road load family is not strictly bound to an Interpolation Family. So within an IP Family different RL families could apply. That concept is not included in the NEDC correlation, but would be necessary to avoid total confusion and problems. This is less urgent!

Proposal for NEDC correlated for decoupled road load families:

- NEDC road load values of vehicle High and vehicle Low have to be calculated within their road load families as applied in "WLTP".
- For every road load family in the interpolation family, a respective NEDC High and Low road load is calculated for the purpose of interpolation.
- The road load interpolation is done within the road load family.
- The CO₂-inteprolation is done within the Interpolation Family on the basis of the cycle energy.

- It is proposed, to have a meeting on expert level, to further clarify the necessary text changes to the Commission.

WLTP NEW ISSUES TASK FORCE

IMPROVEMENT OF READABILITY WITHIN THE INTERPOLATION

- During the development further requirements have been added to the interpolation method. But the structure was maintained. That results in relatively long paragraphs, that are difficult to read and could lead to misunderstandings.
- It is proposed to re-structure that section (Interpolation method) by adding sub-paragraphs.
- A proposal can be developed until beginning of 2018.

Examples:

- 3.2.3.2.2.2. step, when weighing of RR as applied. Clarify and re-structuring of paragraph required.
- Interpolation of aerodynamics very long, MABP will increase that issue.

IMPROVEMENT OF THE FAMILY DEFINITIONS SUMMARY

- By doing the first WLTP approvals a lot of feedback was provided to the WLTP working groups. The proposals should improve and clarify the family and interpolation concept.

Issue	status
Extrapolation rule: Reduction to 27g/km range and 3 g/km extrapolation to both ends.	presented
Clarification: Range requirements (min and max) refer to declared value.	presented
Mid vehicle for ICEs, to allow for additional 10g/km of range.	presented
Full load power curve is only a requirement, if influence on family (e.g. gearshifting).	presented
Functional description of family.	see ICCT proposal
Minimum range of road load parameters and additional rules.	presented
Increase of calculated individual CO ₂ -values by the OEM.	presented
Minimum range in NEDC correlation.	forwarded to EU Commission
Consideration of road load families in the NEDC correlation interpolation.	forwarded to EU Commission
Improvement of readability in the Interpolation Method in Annex 7	starting note

THANK YOU!

**BMW
GROUP**



Rolls-Royce
Motor Cars Limited