Supplemental Document of "Handling of Ki" (OIL#34 & 1b_4)

Prepared by Ki TF Leader
10th WLTP IWG Meeting
14th ~ 16th APR 2015

© : Web. meeting results on 9th FEB 2015

1. Editorial Improvement

| R83	Current WLTP gtr	PROPOSAL
Annex 4a/6.6.9.1. The provisions of Annex 13(Ki determination) shall apply for the purposes of particulate mass measurements only and not particle number measurements.	missing	Insert the statement between Annex 6 -Appendix 1 1.2. and 1.3.
Annex 4a/6.6.9.3. For particulate mass sampling during a test when the regenerating device is in a stabilized loading condition (i.e. the vehicle is not undergoing a regeneration), it is recommended that the vehicle has completed > 1/3 of the mileage between scheduled regenerations or that the periodically regenerating device has undergone equivalent loading off the vehicle.	missing	Add the statement after Annex 6 1.2.4.7.2. (Test Vehicle Preparation)

© : TF member accepted the "PROPOSAL"

2. OIL #36 (Phase Specific Ki)

Current status : Agreed to develop phase specific Ki for CO_2/FC only.
Discussion points : 1. apply whole cycle Ki to each phase Ki*
2. measure each phase Ki**

*) Approximately 0.9% error is observed in NEDC and this error may be expanded in WLTC

**) when regeneration was completed at the middle of cycle, rest of phase specific Ki may have error.
equipment : need two HC analyzer
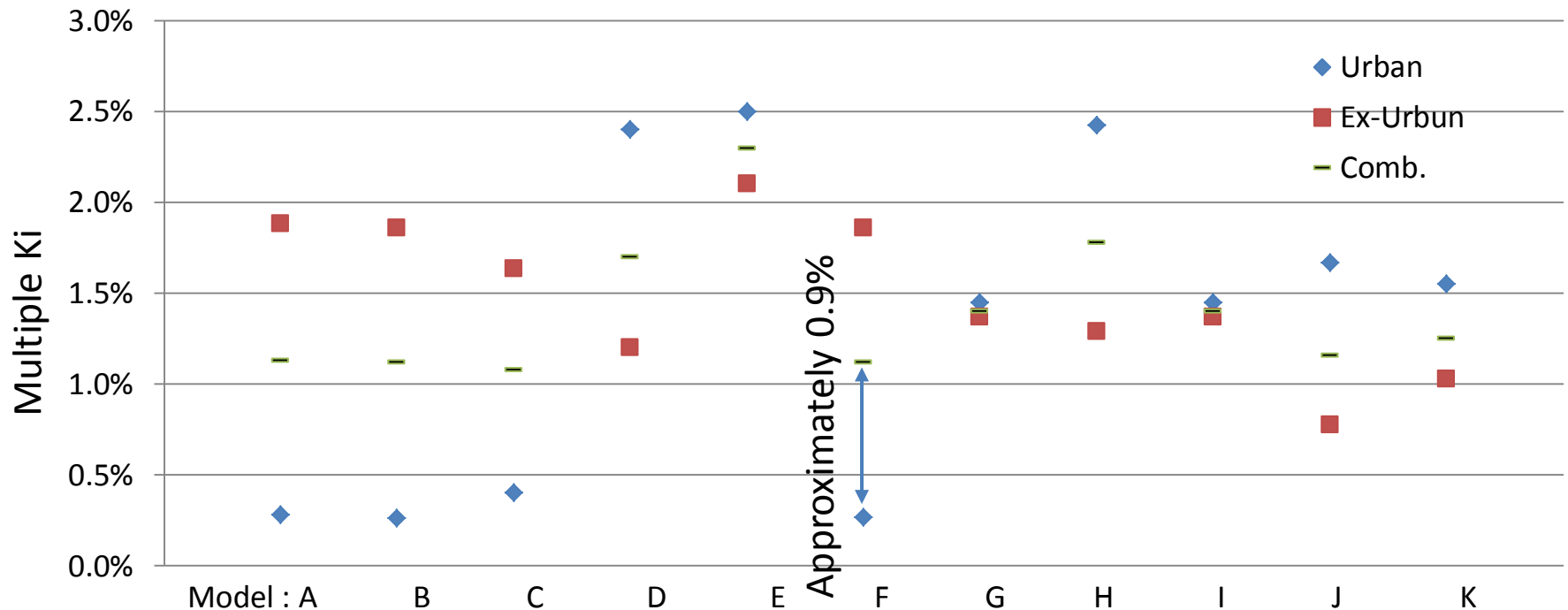
NEDC data indicates that maximum difference between phase(urban or extra-urban)
and combined Ki is less than 1% (correspond to 1~2 g/km in case od additive Ki)
© : TF member decision is "1"
Justification : acceptable error level and equipment availability

3. OIL #1b_4 (Harmonized Ki Development Process)

Current status : no clear procedure when considering the different cycles (3 vs 4 phases).

	Test cycle and data processing		Justification
	4 phases	3 phases	
Emission during loading	4 phases tests and each phase sample		As long as same ECU strategy, phase data of each cycle is also same.
Loading process — Alternative	Accumulate alternative driving cycle and calculate loading distance based on loading amount of each cycle		loading cycle doesn't matter but amount of loading should be ensured up to "regeneration threshold point" (see reference_1)
Loading process — Cycle driving	4 phases	3 phases	Regeneration emission test should be executed separately.
Emission during regeneration	4 phases	3 phases	Even though same ECU strategy, phase data of each cycle is not always same (see reference_2)

© : TF decision is "Require separate test for 3 and 4 phases"
Justification : Phase3 Ki and Phase4 Ki are definitely different
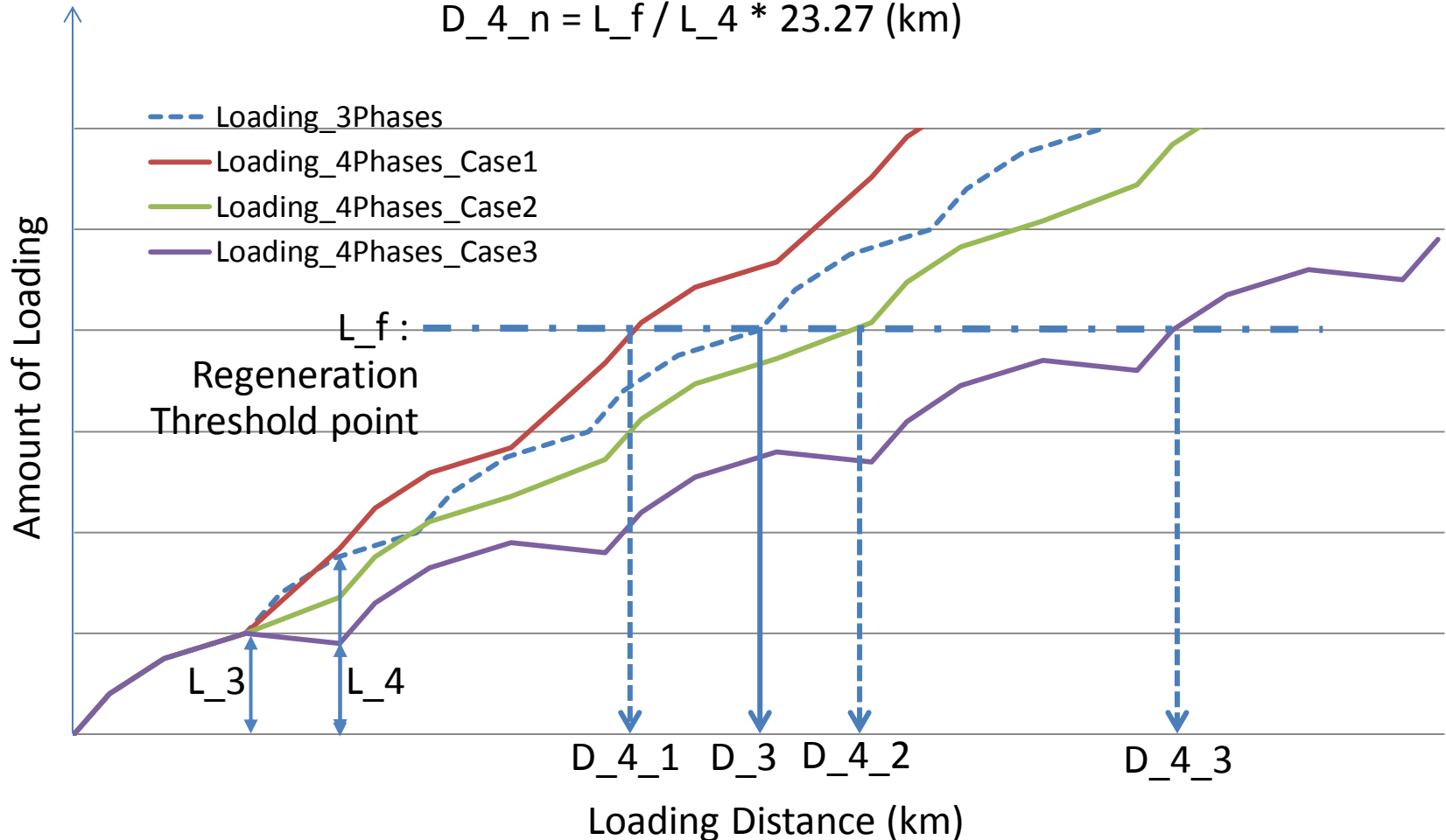Worst Ki case can NOT be defined

Reference_1 : Loading Cycle and Distance

Cycle : loading cycle doesn't matter but amount of loading should be ensured up to "regeneration threshold point"

Distance : obtain based on calculation (D_3 is not always shortest distance)

$$D\_3 = L\_f / L\_3 * 15.01 \text{ (km)}$$
$$D\_4\_n = L\_f / L\_4 * 23.27 \text{ (km)}$$

Legend:
- Loading_3Phases
- Loading_4Phases_Case1
- Loading_4Phases_Case2
- Loading_4Phases_Case3

L_f : Regeneration Threshold point

L_3   L_4

D_4_1   D_3   D_4_2   D_4_3

Amount of Loading

Loading Distance (km)

Reference_2 : Emission Test during Regeneration

Emission during regeneration : depends on purge amount during ExH phase at 2nd and later cycle

→ **Only way to obtain correct data is to execute 3 or 4 phase test separately.**