WLTP-10-40-rev1e

Status of Road Load Tolerance Regulation and Evaluation Criteria in KOREA

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(Korea Automobile Testing & Research Institute)

Contents

1. Background

● Background and necessity

➢ Regulation and vehicle preparation etc. are different from each country

		KOREA	USA	EU	ISO-10521
		w/ Anemometer	w/ Anemometer	w/o Anemometer	Multi-segment Method
Regulation	-	Notification	SAE J1263 or J2263 A/C55C	ECE R-83	ISO 10521-1
Vehicle Preparation	Tire selection	RRC	A/C55C	Tire width	-
Vehicle Test Condition	Test mass target	ETW	A/C55C	Unladden mass+100kg	Unladden mass +driver+equipment
	Test mass measurement	After coast down test	After coast down test	Before coast down test	-
Data Processing	Rotatory Inertia (Substitute value)	3% of test weight	3% of test weight	X	3% of curb weight
Etc.	Tolerance	15% (Energy loss diff.)	FTP ≤ 10%(energy loss) HWY ≤ 7%(energy loss)	X	X

➢ Some manufactures conduct self-certification with vehicle not sold to customers (KOREA, USA : Compliance Test based on "Vehicle Self Certificate System")
- Test mass : more lower than curb weight
- Tyre type: more narrower width (not sold to customers)

※ EU : Non-Compliance Test for RL. Just checked by Type Approval

The Needs of evaluation criteria for RL tolerance to protect customer

1. Background

- Example of main differences found during compliance test in KOREA

	Manufacture's self-certification test	Government's compliance test	Remarks
1. Curb weight	1720 kg (Unladen mass)	1860 kg	Diff. : 140 kg
2. Test weight	1820 kg	1960 kg	Diff. : 140 kg
3. Tyre type	225/55R17	245/45R18 (Sales Option spec. : 255/40R19, 255/35R20)	Diff. : width 20mm

EXAMPLE

Difference occurrence between audit's FC and specification's FC due to the different Road-Load values

2. Global RL(Road-Load) Criteria

- Road-Load Tolerance and Evaluation Criteria

  ➢ Country to perform the compliance test for RL Tolerance : Korea, Brazil, USA(draft)

	KOREA(notification)	USA(draft phase)	Brazil	Others
Tolerance	15%	FTP : 10% HWFET : 7%	15%	None
Evaluation Method	Energy loss difference between government's audit and manufacture's specification	Energy loss difference between government's audit and manufacture's specification	Road-load coefficient difference between government's audit and manufacture's specification	None
	Energy loss diff. considering FC test cycles (will be supplemented)	Energy loss diff. considering each FC test cycle	RL coefficient diff. for each f0, f2	None

KOREA generally uses the on-board anemometry test method for Coastdown Audit
– Test procedure is nearly same as SAE J2263

3. Status for Road-Load Evaluation Criteria in Korea

MOLIT Ministry of Land, Infrastructure and Transport

KATRI Korea Automobile testing & research Institute

- Evaluation criteria for the Road-Load tolerance

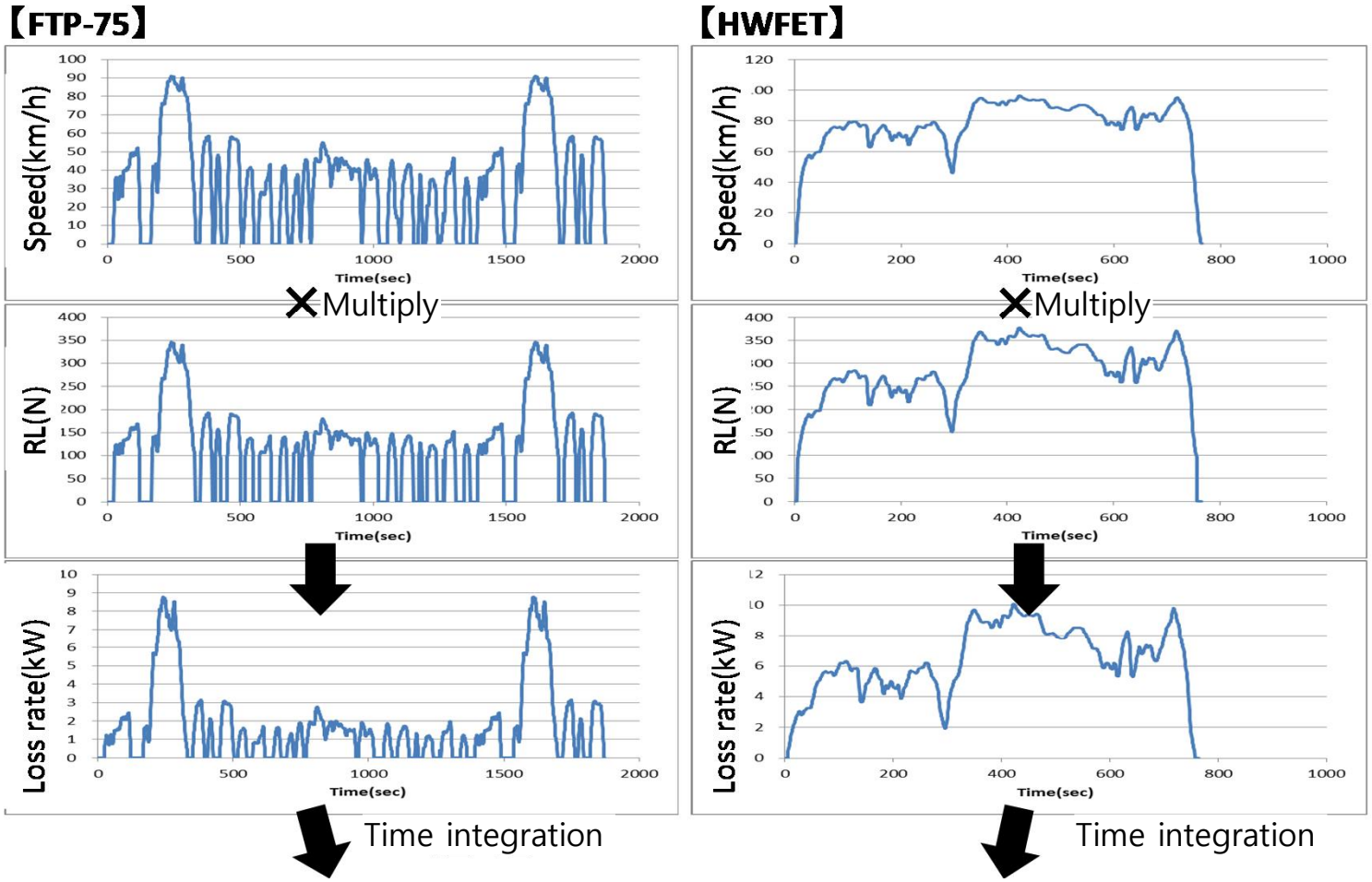
  ➢ Status of RL study in Korea

Under the study for evaluation criteria in KOREA

	brief description	Remarks
1. Energy loss diff. considering each FC test cycle	▪ Each energy loss comparison of FTP-75 and HWFET test cycle by using audit values (measured by Gov.) and target values (submitted by manufactures)	☺
2. Energy loss diff. considering FC test cycles(weighted)	▪ First, each weighted energy loss calculation of FTP-75 and HWFET test cycle by using audit values and target values *weighted energy loss = 0.55*FTP-75 energy loss + 0.45*HWFET energy loss ▪ Finally, weighted energy loss comparison based on the two results	☺
3. RL force diff. considering coastdown velocity range (KOREA compliance test)	▪ First, calculate each RL force based on coastdown speed range by using audit values and target values ▪ At this time, each RL force is calculated based on 5kph intervals within the coastdown speed range ▪ Finally, averaged RL force comparison for 21 points	-
4. RLHP diff. at 50mph (EPA)	▪ RLHP is calculated at 50mph by using audit values and target values ▪ Finally, RLHP comparison for 1 point at 50 mph	-
5. Each RL coefficient diff. (Brazil compliance test)	▪ RL coefficients(f0, f2) comparison by using audit values and target values	Need to be checked

3. Status for Road-Load Evaluation Criteria in Korea

- Energy loss diff. considering FC test cycle (each or weighted)



- Energy loss(each) : FTP-75 energy loss(kJ) HWFET energy loss(kJ)
- Energy loss(Weighted) : 0.55 × FTP-75 energy loss(kJ) + 0.45 × HWFET energy loss(kJ)

3. Status for Road-Load Evaluation Criteria in Korea

- Calculation Example for Road-Load Tolerance

		Brief explanation		RL difference	Remarks
		Target value	Audit value	-	-
Coeffi-cients	f0(lbs)	27.00	35.00		
	f1(lbs/mph)	0.2300	0.2500		
	f2(lbs/(mph)^2)	0.01800	0.01800		
1. . Energy loss diff. considering each FC test cycle		FTP-75 test cycle		15.0 % (14.9 %)	* EPA : Veh. speed is treated as zero at less than 10mph
		HWFET test cycle		10.6 % (10.6 %)	
2. . Energy loss diff. considering FC test cycles(weighted)		0.55*FTP-75 energy loss + 0.45*HWFET energy loss		12.7 % (12.6 %)	
3. RL force diff. considering coastdown velocity range (KOREA compliance test)		After separating each 5kph interval for the coastdown speed range(115kph ~ 15kph), comparison of averaged RL force for 21 points		14.8 %	
4. RLHP diff. at 50mph (EPA)		RLHP comparison at 50 mph		10.8 %	
5. Each RL coefficient diff. (Brazil compliance test)		f0 coefficient		29.6 %	Need to be checked
		f2 coefficient		0 %	

Conclusions

- Road-Load difference occurrence between government's audit and manufacturer's specification as following reasons

  - Different vehicle preparation, test condition, data processing etc.

  - Conducting self-certification with vehicle not sold to customers (Test mass reduction and narrow width tyre etc.)

    ⇒ Resulting in exaggerated fuel consumption and customer disadvantage

- According to the Road-Load evaluation criteria, calculation result differs from audit value and manufacture specification

- KOREA proposes review for the RL Tolerance and evaluation criteria as study item of WLTP phase 2

  - Needed to unify the different evaluation method in each country

  - Needed to confirm the tolerance reliability for the manufacturer's RL specification

Appendix 1. KATRI Proving Ground

● KATRI Proving Ground for Road-Load Test

- ➢ Straight Road
  - Forward direction 1,802m, opposite direction 1,532m, width 8m(2 lanes)
- ➢ Surface : Dry asphalt

Proving ground

Straight Road

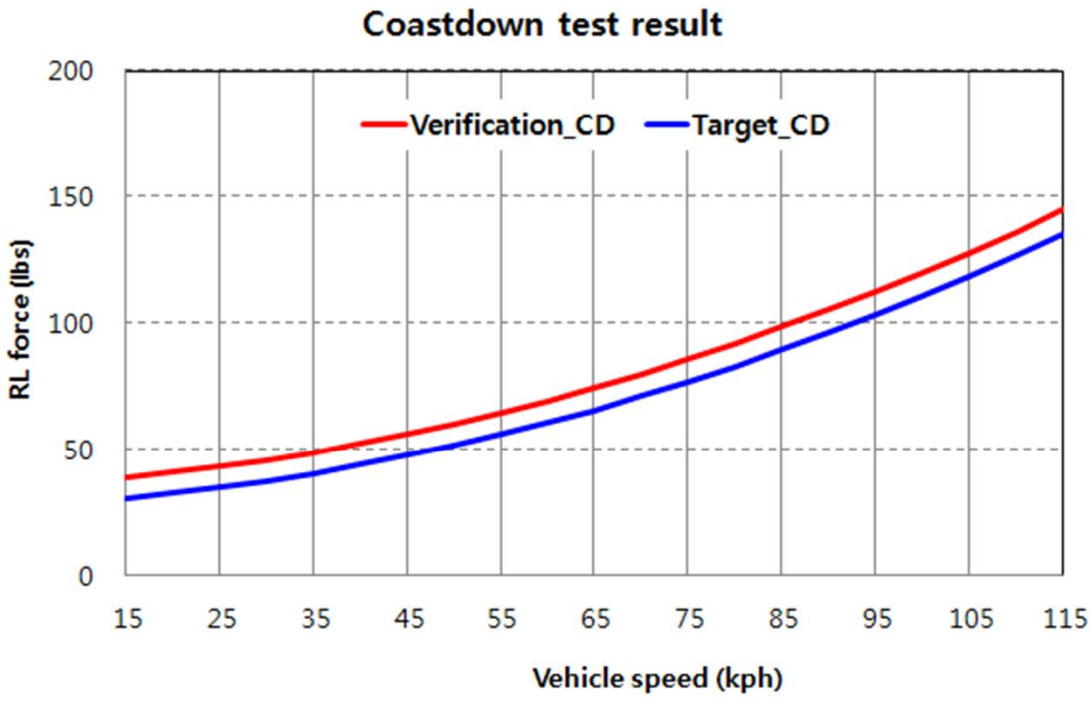
High Speed Circuit

Appendix 2. Calculation Example for KATRI Audit

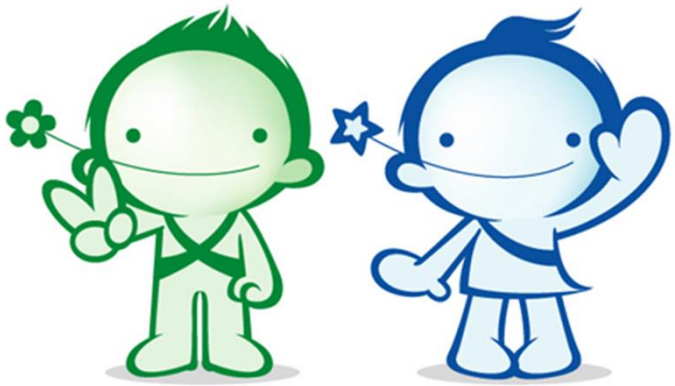
- Road-Load force diff. based on coastdown speed range

Coefficients		Verification_CD	Target_CD	Unit
	f0	35.00	27.00	lbs
	f1	0.2500	0.2300	lbs/MPH
	f2	0.018000	0.018000	lbs/MPH^2

KPH	MPH	Verification_CD	Target_CD	Delta
15	9.3206	38.89	30.71	26.7%
20	12.427	40.89	32.64	25.3%
25	15.534	43.23	34.92	23.8%
30	18.641	45.92	37.54	22.3%
35	21.748	48.95	40.52	20.8%
40	24.855	52.33	43.84	19.4%
45	27.962	56.06	47.50	18.0%
50	31.069	60.14	51.52	16.7%
55	34.175	64.57	55.88	15.5%
60	37.282	69.34	60.59	14.4%
65	40.389	74.46	65.65	13.4%
70	43.496	79.93	71.06	12.5%
75	46.603	85.74	76.81	11.6%
80	49.71	91.91	82.91	10.8%
85	52.817	98.42	89.36	10.1%
90	55.923	105.27	96.16	9.5%
95	59.03	112.48	103.30	8.9%
100	62.137	120.03	110.79	8.3%
105	65.244	127.93	118.63	7.8%
110	68.351	136.18	126.81	7.4%
115	71.458	144.78	135.35	7.0%
				14.8%



Thank you very much ! !



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