

A preliminary study on test methods of UN regulation No. 51-03 based on CATC



Introduction

China will publish the GB 1495 standard soon in [2019], whose test methods are similar to UN Regulation No.51-03 (without ASEP) and ISO 362-1.

Research on relationships between environmental noise problems, test cycles, test methods, limit values and environmental influences of new systems was carried out in China.

With the data collection and analysis of China Automotive Test Cycles (CATC), more proofs show that the test methods of UN Regulation No.51-03 need to be **re-searched**.

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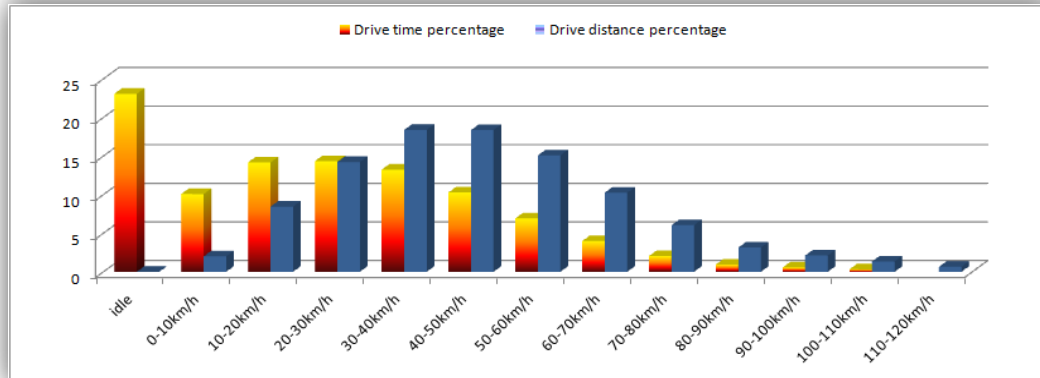
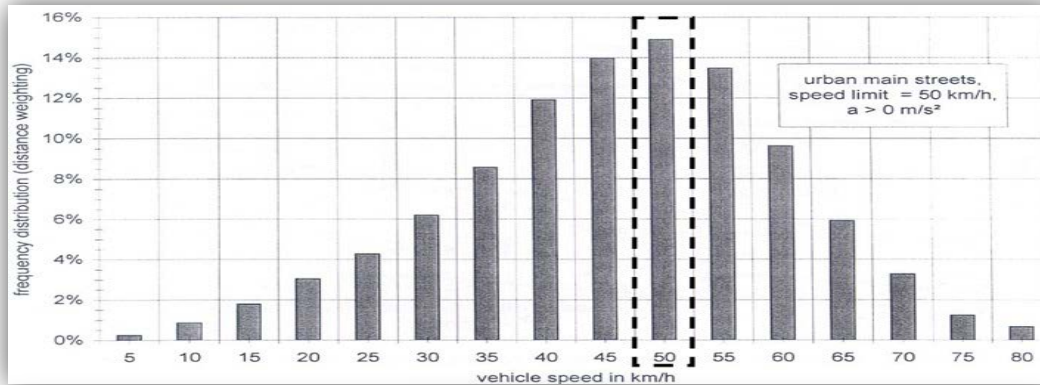
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China Automotive Test Cycles



From 2015 to 2018, 5048 vehicles real driving behaviors were collected in 41 cities of China on time, for purpose of setting proper test methods for fuel consumption, emission and also development of EV.

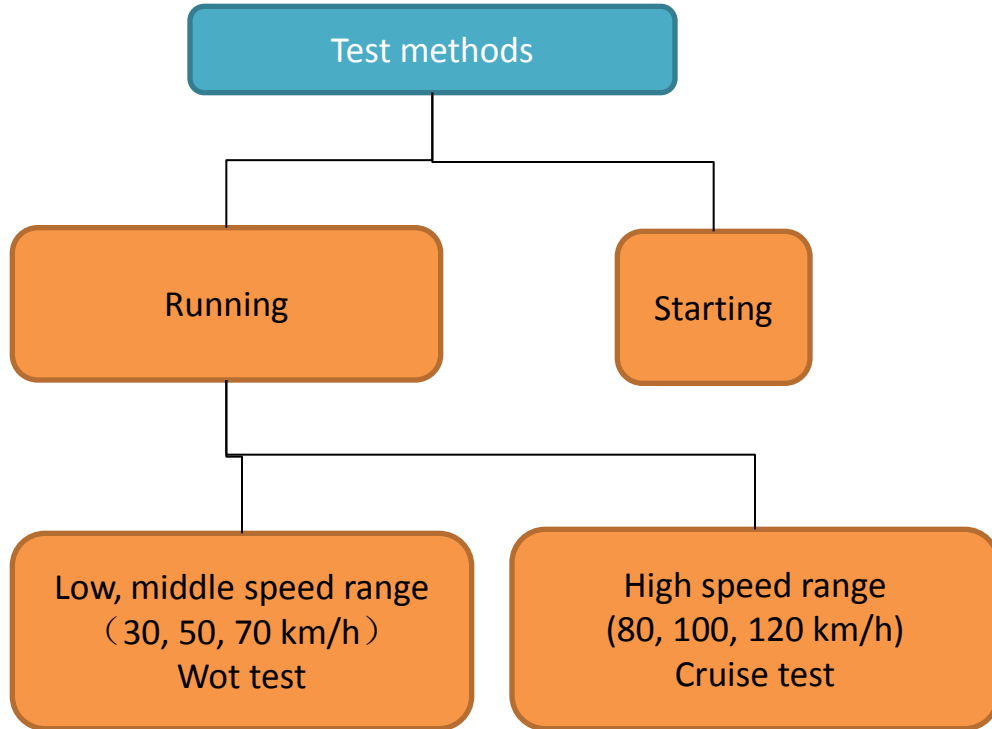
Using CATC in the noise test methods



*Figure from: ASEP-04-11 (China) Road conditions and conclusion of China on ASEP test method.

- CATC has collected more than 20 parameters for each vehicles, including the vehicle speed, vehicle acceleration, engine speed, and gears distribution.....
- We realized in the year 2017, that all the data can be used to design the noise test methods like ISO 362-1.
- Several cases study on noise problems, driving behaviors, test methods design and proof tests were carried out from the summer of 2017.

Test method design



New tests created

- Starting noise
- Wot noise at fixed gears and fixed speed
- Cruise noise at high speed
- Tyre noise (OICA)
- Engine noise (OICA)
- Partial load noise (OICA)

Other traditional tests

- Method B of R51-03
- ASEP of R51-03

Example 1

	Acceleration procedure during summer			Acceleration procedure during winter		
	25~35km/h	45~55km/h	65~75km/h	25~35km/h	45~55km/h	65~75km/h
1 st gear	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
2 nd gear	1.89%	0.00%	0.00%	0.69%	0.00%	0.00%
3 rd gear	41.88%	0.97%	0.02%	31.10%	0.39%	0.00%
4 th gear	44.68%	32.28%	3.32%	54.50%	22.16%	1.76%
5 th gear	11.22%	66.52%	96.59%	13.04%	77.42%	98.18%

Test Gear designed for 30km/h: $(1+X/2)/2$; for 50km/h: $X/2$; for 70km/h: $(X/2+X)/2$
 ("X" means the total gears number)

Engine speed percentile	Summer time			Winter time		
	25~35km/h	45~55km/h	65~75km/h	25~35km/h	45~55km/h	65~75km/h
50%	1571	1935	2544	1481	1886	2545
90%	2126	2348	2714	1990	2257	2703
95%	2268	2442	2764	2140	2380	2731
99%	2688	2762	3121	2418	2552	3024

Method B: 3rd gear, engine speed 3450 r/min.
ASEP: 2nd and 3rd gears, speed range 20-80km/h
Conclusion: method B is already 99% percentile for this vehicle.

Example 2

	Acceleration procedure		
	25~35km/h	45~55km/h	65~75km/h
1 st gear	0.00%	0.00%	0.00%
2 nd gear	2.22%	0.00%	0.00%
3 rd gear	48.81%	0.32%	0.00%
4 th gear	43.30%	16.22%	0.26%
5 th gear	4.02%	47.26%	3.89%
6 th gear	0.15%	36.11%	95.85%

Test Gear designed for 30km/h: $(1+X/2)/2$; for 50km/h: $X/2$; for 70km/h: $(X/2+X)/2$
 ("X" means the total gears number)

Engine speed percentile	All time		
	25~35km/h	45~55km/h	65~75km/h
50%	1288	1502	1781
90%	1604	1771	1919
95%	1672	1859	1945
99%	2018	2018	2224

Method B: 3rd gear, engine speed 2760 r/min.
ASEP: 2nd and 3rd gears, speed range 20-80km/h
Conclusion: method B is already 99% percentile for this vehicle.

Example 3

	Acceleration procedure		
	25~35km/h	45~55km/h	65~75km/h
1 st gear	0.01%	0.00%	0.01%
2 nd gear	2.74%	0.01%	0.02%
3 rd gear	76.20%	0.77%	0.01%
4 th gear	20.59%	26.18%	1.29%
5 th gear	0.33%	65.44%	25.57%
6 th gear	0.00%	7.60%	56.67%
7 th gear	0.00%	0.00%	13.12%

Test Gear designed for 30km/h: $(1+X/2)/2$; for 50km/h: $X/2$; for 70km/h: $(X/2+X)/2$
 ("X" means the total gears number)

Engine speed percentile	All time		
	25~35km/h	45~55km/h	65~75km/h
50%	1386	1424	1515
90%	1631	1757	1921
95%	1689	1848	1988
99%	2086	1978	2359

Method B: not carried out

Conclusion: good performance vehicles have very low engine speed during real driving. What is the difference between the vehicles can be loudly and the vehicles are loudly? How to check?

Conclusions

- What is the purpose of method B? The real driving conditions or extreme conditions? If it is extreme conditions, what is the “**additional**” of ASEP means? What is the real traffic noise problems?
- For low and normal performance vehicles, this test conditions of method B is not easy.
- The ASEP test methods now seem to make no sense for at least normal vehicles, it is a test at wrong gears, an engine noise regulation are suggested if the noise at different engine speed are interested.
- China wants to analyze CATC and **re-search** the test methods of GB 1495 and R51-03 method B and ASEP, combined with the real traffic noise problems.
- More vehicles are needed to be analyzed like the high performance vehicles.



Thanks for your attention



Web site: www.catarc.org.cn

