



Informal document GRB-57-05  
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agenda item 3(b))

## **China is finding common solutions for Sub-categories of M1 and N1 Categories**

***China Automotive Technology and  
Research Center***

## Summary

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- As everyone knows, China has different opinions on the sub-categories of ECE R51.
- The reason is the characteristics of products between Europe, Japan and China are different, especially in the M1, N1, N2, M3 categories.
- China has submitted 40 test data of Chinese special M1 and N1 vehicle type to OICA, and hope can get a common solution.

# M1 category

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- The sub-categories methods of Germany and Japan for M1 category has not considered the mini-bus and light-bus from China.



- The sub-categories methods of China has not considered the high performance passenger car before.



## M1 category (Chinese style mini-bus)

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- The mini-bus is very similar to Kei-car of Japan. China has introduced this vehicle category 30 years ago from Japan.



Length=3.2m, engine power=29kW, The parameter of this kind of vehicle can fulfilled the requirement of Kei-car set by Japan.

The first mini-bus of China in 1984, has stopped production in 2002, and **has disappeared from the road now.** (introduced by Tianjin Auto Company from **DAIHATSU** of Japan).



## M1 category (Chinese style mini-bus)

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- China has developed more new mini-bus products with higher engine power and heavier maximum weight now, and has the same structure with Kei-truck of Japan.
- The new mini-buses always have length between 3.5m-4.5m, GVW between 1.5t-2.0t, has middle engine arrangement, and has a engine displacement of 800ml-1500ml. The rated engine speed is between 4400-6000 and the  $PMR^{(GVW)}$  is within range 20-60 kW/t (some vehicles are higher than 35 kW/t).

## M1 category (Chinese typical mini-bus)

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- The mini-bus always has seats number 5-9, the chassis is the same to the mini-truck of China (similar to Kei-truck of Japan), always use small tires (R13), but has good and is adapt to the mountain or hill roads in the south and west of China.



## M1 category (The acoustic performance of mini-bus)

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**The mini-bus will always have louder voice:**

- The tire size is smaller than passenger car, if get the same speed 50km/h, it must use higher engine speed, especially in the 2<sup>nd</sup> gear.
- The rated engine speed is lower than the ordinary passenger cars, so even with the some engine speed, the mini-bus will have higher engine speed rate during the test.

# M1 category (The acoustic performance of mini-bus)

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- The engine is settled under the seats directly with rear axle drive, and the space is so narrow that engine, transmission and drive shaft must face the ground directly.
- It is very hard to add more noise reduction materials, and the only method is to fit a sound insulation under the engine and transmission, but this will influence the trafficability and thermal performance.





## M1 category (Chinese style light-bus)

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- The light-bus is similar to the Hiace of TOYOTA. China has introduced this vehicle category 15-20 years ago from TOYOTA.
- This kind of vehicle is harder than passenger car to fulfilled the requirement 74dB (A) of R51/02series.



**Volkswagen Caravelle**  
( front or two axles drive )



**Toyota HIACE**  
( rear axle drive )



**JINBEI HAISHI**  
( rear axle drive )

## M1 category (Chinese style light-bus)

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- The light-bus is a kind of vehicle between M1, N1 and M2. They always have length between 4.6-5.5m, and seats number 5-14. if they have 7 8 9 seats, they belongs to M1 category, and M2 category if they have 10 11 12 or 14 seats, and if they disassembly the rear seats, they are N1 category.



**M1 (9 seats)**



**M2 (11 seats)**



**N1 (Cargo)**

# M1 category (Chinese style light-bus)

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- GVW between 2.5-3.5t. the engine is above the front axle and under the seat, with the rear axle driven. The rated engine speed is between 3600-5000.
- They always use a higher transmission ratio than passenger cars to carry more persons and more goods, and has good trafficability and is adapt to the mountain or hill roads in the south and west of China.



# M1 category (The acoustic performance of light-bus)

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- The gear ratio is higher than passenger cars, if get the same speed 50km/h, it must use higher engine speed.
- The rated engine speed is much lower than the ordinary passenger cars, so even with the some engine speed, the light-bus must use higher engine speed rate during the test.
- When we carry out the noise test, the departure engine speed is always very close to or exceed the rated engine speed.



**Chinese light-bus style**



**German Van style**



**Sports car style**

# M1 category (The acoustic performance of light-bus)

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- The engine is settled under the seats directly with rear axle driven, and the space is so narrow that engine, transmission and drive shaft must face the ground directly.
- It is very hard to add more noise reduction materials, and the only method is to fit a sound insulation under the engine, but this will influence the trafficability and thermal performance.





# N1 category (Chinese style mini-truck)

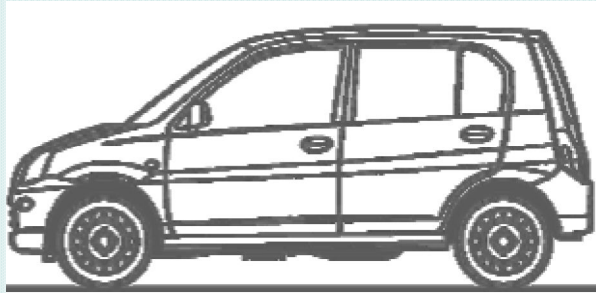


- The Caddy Van of Volkswagen was sold in China in 2005, but disappeared very soon from the website of FAW-VOLKSWAGEN, the reason may be too expensive or carrying so few goods and so on. And generally speaking it's not fit for the market and customers of China.



# ECE-TRANS-WP29-GRB-54-inf15e (Japan)

Light N1 (GVM  $\leq$  2.0t)

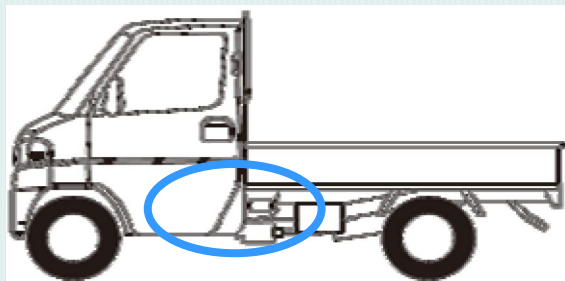


Van type

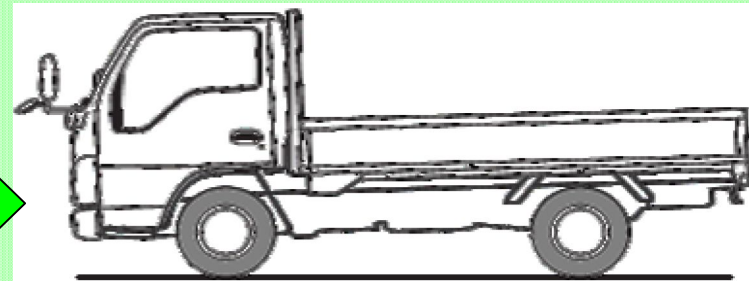
Heavy N1 (GVM  $>$  2.0t)

Same group  
Truck type

Kei N1



Similar



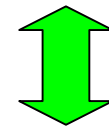
different

Similar

# N1 category (Chinese style mini-truck)



Chinese van and mini-truck: we are all the Kei-truck style but only a little bigger, and with different bodies.



Japanese Kei-truck





## N1 category (Chinese style mini-truck)

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- The mini-truck is similar to the Kei-truck of Japan, with the front or middle engine arrangement and rear axle drive.
- But the engine displacement is always between 800ml-1500ml, with the vehicle length 3.8-4.5m.

## Chinese conclusion for M1 / N1 categories

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- The mini-truck is the mainly N1 category unique vehicles in China, sold 500,000 per year, which is nearly the same but only larger as the Kei-truck of Japan, and is not the European van style.
- The mini-bus is a unique vehicle in China, between M1 and N1 category, it has the same chassis as the mini-truck. It's sold nearly 2,500,000 per year and always been used in the suburb and rural areas by farmers and small traders on agriculture or transportation of goods between villages, it's neither the European van style nor the passenger car style.
- The light-bus, a kind of vehicle between M1 and M2 category, is sold 300,000 per year, is always used for carrying goods or passengers, and can be treated as the bigger mini-bus.

# Chinese suggestions for M1 / N1 categories

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- China supports the flexible treatment of ECE for the M1 and N1 categories, because of the different vehicle characteristics between different regions.
- China sells more than 3, 000,000 mini-buses, light buses and mini-truck per year, and we think they should not be treated as the ordinary passenger cars or the European style vans in the field of noise limit values.
- China will support the suggestion of Japan about the Kei-truck, and also support the ECE to carry out special treatment of Kei-car and Kei-truck of Japan. But we think we should find more common solutions for the vehicles all over the world, which has the same structure to Kei-truck but with a little larger GVW, different vehicle body and with higher engine power than Kei-truck.

## Chinese suggestions for M1 / N1 categories

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- China is trying best to consider all vehicle categories in Chinese market when deciding the sub-categories cause in 2012 China has a complicated market of more than 19,000,000 vehicles sold and various vehicle categories, some areas of China are developed and other areas are developing,
- And we think if the questions of China can be solved, the questions of the world should also be solved.
- China is now not only finding a good solution for all M1 and N1 categories all over the world, but the most importantly the easiest solution about the sub-categories.

# The suggestions of China in the 56<sup>th</sup> session of GRB

Vehicle Category	Sub-category	Limit value (Phase 1 <sup>st</sup> )	Limit value (Phase 2 <sup>nd</sup> )
M1*	GVW < 2 500kg or seats number < 6	72	Reserved
	Others	73	
N1	----	74	

1. All vehicle categories with more than one drive axle, the limit values +1 dB;
2. M1 categories vehicles with the PMR values higher than 120 kW/t, the limit values +1 dB, and with the PMR values higher than 160 kW/t +2 dB;

The problem of the systems:

- The seats number sometimes changes with the same vehicle model.
- Some vehicles with 7 seats like the GL8 of Buick does not need 73 dB(A) limit values, cause it's with passenger car structure.
- The N1 category Van of Europe does not need a limit value of 74dB(A) cause it's with passenger car structure.

## The factors China has considered for limit values now

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- Data base of ECE R51 / 03 series
- Data base of ECE R51 / 02 series
- The implement of ECE R 51 / 02 series
- The relationship between the 02 and 03 series
- The relationship between different vehicle categories within the limit values system of 03 series we have built up.

# Sub-categories China has considered

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The factors China has considered for the sub-categories, and we think we should integrate the factors below and get easier solution for all M1 and N1:

- Seats number (always changes? )
- Maximum weight (the problem of Kei-car mini-bus and Kei-truck? )
- PMR (not the only reason, and the problem of low engine power like Kei-car mini-bus and Kei-truck? )
- PMR(GVW) (easy to confuse with the PMR? )
- Torque (maybe in the database of Europe, there is no information of torque)
- Kei-truck (the problem of bigger Kei-truck?)
- Engine arrangement (difficult to distinguish the front and middle engine arrangement ? )
- Driven mode (front axle drive, rear axle drive or all wheel drive?)

In all the factors we think the most stable factors are the GVW and the drive axle.

# Sub-categories China has considered

M1	Front engine arrangement ( $GVM \leq 2.5t$ )	72
	Front engine arrangement ( $GVM > 2.5t$ )	73
	Middle or rear engine arrangement	

1. Increased by 1 dB(A) for All vehicle categories with more than one drive axle;
2. Increased by 1 dB(A) for M1 categories vehicles with the PMR values higher than 120 kW/t, and increased by 2dB(A) with the PMR values higher than 160 kW/t.
3. Increased by 1 dB(A) for M1, M2 (  $GVW \leq 3.5t$  ) and N1 equipped with a compression-ignition and directinjection internal combustion engine.

The problem of the systems:

- It's very difficult to distinguish the front and middle engine arrangement.
- Some front engine arrangement vehicles with rear axle drive are still more loudly than ordinary passenger cars.



## Sub-categories China has considered

Category Vehicle		Noise limit values	
		Phase 1 <sup>st</sup>	Phase 2 <sup>nd</sup>
M1	GVM ≤ 2.5t	72	71
	GVM > 2.5t	73	72
N1	GVM ≤ 2.5t	72	71
	GVM > 2.5t	73	72

1. Increased by 1 dB(A) for M1 and N1 categories with rear axle drive or more than one drive axle;
2. Increased by 1 dB(A) for M1 categories vehicles with the PMR values higher than 120 kW/t, and increased by 2dB(A) with the PMR values higher than 160 kW/t.
3. Increased by 1 dB(A) for M1, M2 (GVW ≤ 3.5t) and N1 equipped with a compression-ignition and directinjection internal combustion engine.

## Sub-categories China has considered

Category Vehicle		Noise limit values	
		Phase 1 <sup>st</sup>	Phase 2 <sup>nd</sup>
M1	front axle drive	72	71
	rear or two axles drive	73	72
N1	front axle drive	72	71
	rear or two axles drive	74	73

1. Increased by 1 dB(A) for M1, M2 (GVW ≤ 3.5t) and N1 equipped with a compression-ignition and direct injection internal combustion engine.
2. Increased by 1 dB(A) for M1 categories vehicles with the PMR values higher than 120 kW/t, and increased by 2dB(A) with the PMR values higher than 160 kW/t.
  - Within this system, the differences between high performance passenger car, mini-Bus, light-bus, mini-truck, Kei-truck and Kei-car can all be considered.

# Sub-categories China has considered

M1	PMR $\leq$ 120 kW/t	72
	120 < PMR $\leq$ 160 kW/t	73
	PMR > 160 kW/t	74
N1	GVM $\leq$ 2.5t	72
	GVM > 2.5t	73

1. Increased by 1 dB(A) for M1 and N1 categories with rear axle drive or more than one drive axle;
2. Increased by 1 dB(A) for M1, M2 (GVW  $\leq$  3.5t) and N1 equipped with a compression-ignition and directinjection internal combustion engine.

Why it's 74 dB (A) for PMR > 160 kW/t:

- Nearly all the vehicles with PMR > 160 kW/t is with rear axle drive, small numbers of them are with 4WD, and added 1 dB(A)

The problem still exists:

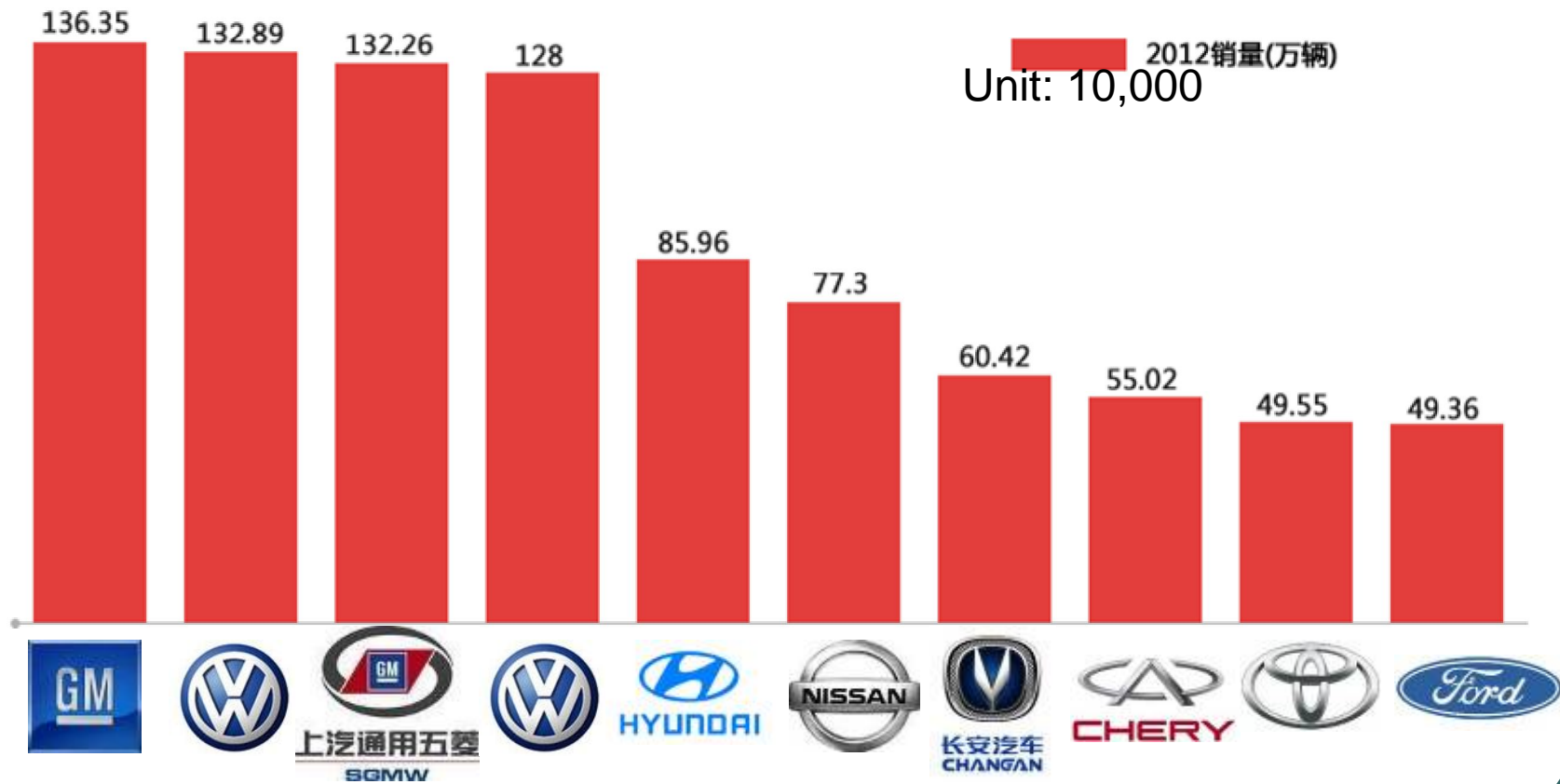
- Within this system, the mini-truck of China and Kei-truck of Japan must fulfill the requirement of 73dB(A).

## **It's time for a common solution**

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- China suggests that we should not only consider the characteristics of our own countries cause we are making a worldwide influence regulation and the automobile industry is a globe business now.
- We should consider all the conditions together and make a proper decision in the 57<sup>th</sup> session, especially the sub-categories, cause the sub-category is the major premise of limit values.
- The main manufacturer countries and main market countries should cooperate together and build up a more quiet and comfortable world.

# Passenger car Market of China (2012) total 15,500,000 M1



# The imagination for the future

- $$F_t = \frac{T_{tq} i_g i_o \eta_t}{r}$$

$$P_e = \frac{T_{tq} n}{9550}$$

The  $P_n$  value is always got at very high engine speed we never use.

$$F_t = \frac{T_{tq} i_g i_o \eta_t}{r} = Gf + \delta \frac{du}{dt}$$

Without consideration of wind force

$$\text{acceleration} = \frac{du}{dt} = \frac{1}{\delta m} \left[ \frac{T_{tq} i_g i_o \eta_t}{r} - F_f \right]$$

$$k = (a_{wot\ ref} - a_{wot\ (i+1)}) / (a_{wot\ i} - a_{wot\ (i+1)})$$

$$k_p = 1 - (a_{urban} / a_{wot\ ref})$$

In the weighting system, the  $L_{urban}$  is calculated from the  $L_{wot\ i}$ ,  $L_{wot\ (i+1)}$ ,  $L_{crs\ i}$ ,  $L_{crs\ (i+1)}$  and the relationship between the acceleration and noise values.

So, can we imagine that in the future we build up a new system according to the torque but not the power? ? ?

$$a_{urban} = 0.63 \lg(\text{PMR}) - 0.09 \text{ and } a_{wot\ ref} = 1.59 \lg(\text{PMR}) - 1.41$$