Informal document **GRB-55-10**
(55th GRB, 7-9 February 2012,
agenda item 3(b))

Japanese proposal on R51 limit values

JASIC

Basic concept of Japanese proposal on limit values with sub-categories

Based on the Monitoring database (856 vehicles) and the Japanese database (184 vehicles), the proposal on R51 limit values is made with the following concepts;

- Stage 1 limit values are chosen from 5% to 15% cut-off levels of the frequency distributions of Monitoring+ Japanese database. Owing to the introduction of the new test method with Stage 1 limit values and ASEP, the reduction of the road traffic noise is expected.
- Stage 2 limit values are chosen from 20% to 30% or more cut-off levels of the frequency distributions of Monitoring+ Japanese database in order to reduce the road traffic noise further.

- Japan basically agrees with the German proposal on the application date of Stage 1 and 2. The application date of Stage 1 should be 2 years after the entry into force of R51-03, while the application dates of Stage 2 should be 4 years after Stage 1 for M1, M2(GVW≤3.5t) and N1(except Small Low Power trucks) and 6 years after Stage 1 for M2(3.5t<GVW), M3, N2 and N3. As the development cycle of Small Low Power trucks is similar to Heavy duty vehicles, the application date of Stage 2 of Small Low Power trucks is 6 years after Stage 1.
- "3 stage" approach, which Germany proposed, is very ambitious but has clear message for enforcing the vehicle noise level. Because of the uncertainty of noise reduction technology advance and other regulations, Japan propose the temporary limit values and entry-into-force dates of Stage 3, which shall be reviewed and fixed until the entry-into-force date of Stage 2.

- As Germany and ACEA proposed three subcategories of M3, Japan has changed from 2 subcategories to 3 and the new threshold is 125 kW, which is same as the threshold of N2 subcategories.

Japanese proposal on R51 limit values

		Stage 1 2 years after entry into force of R51-03	Stage 2		Stage 3[2]	
			4 years after Stage 1	6 years after Stage 1	[4] years after Stage 2	[6] years after Stage 2
M1	PMR≤120kW/t	72	70	-	[68]	-
	120<PMR≤160kW/t	73	71	-	[69]	-
	160kW/t<PMR	75	73	-	[71]	-
M2	GVW≤3.5t	74	72	-	[70]	-
	3.5t<GVW	75	-	73	-	[71]
M3	P≤125kW	76	-	74	-	[72]
	125<P≤250kW	79	-	78	-	[76]
	250kW<P	80	-	78	-	[76]
N1	GVW≤2.5t & PMR(GVW)[1]≤35kW/t	74	-	72	-	[70]
	GVW≤2.5t & 35kW/t PMR(GVW)[1]	72	70	-	[68]	-
	2.5t<GVW	74	72	-	[70]	-
N2	P≤125kW	78	-	76	-	[74]
	125kW<P	79	-	77	-	[75]
N3	P≤250kW	80	-	78	-	[76]
	250kW<P	81	-	79	-	[77]

Off-Road vehicles “G” for all categories +1dB

1 “PMR(GVW)” means PMR calculated by using the maximum authorized vehicle mass.

2 Limit values and entry-into-force dates of “Stage 3” shall be reviewed and fixed until the entry-into-force date of “Stage 2”.

Difference between Japanese and German proposal

● M categories

For high PMR M1s, the limit value and entry-into-force date of Stage 2 is different. Japan has the opinion that the reinforcement gap of high PMR vehicles should be same as the normal PVs.

(Japanese proposal(J), EU Proposal(E) and German proposal(G))

			Stage 1			Stage 2			Stage 3		
			J	E	G	J	E	G	J	E	G
M1	PMR≦75kW/t		72	70	72	70	68	70	68	-	68
	75<PMR≦120kW/t			71			69			-	
	120<PMR≦160kW/t		73		73	71		71※	69		70
	160kW/t<PMR		75		75	73		74	71		73
M2	GVW≦2t		74	72	72	72	70	70	70	-	69
	2t<GVW≦2.5t			73			71			-	
	2.5t<GVW≦3.5t				74			72			71
	3.5t<GVW	P≦150kW	75	74	75	73	72	73	71	-	71
		150kW<P		76			74			-	
M3	P≦125kW		76	75	76	74	73	74	72	-	73
	125<P≦150kW					78			76		
	150<P≦180kW		79	77			75			-	
	180<P≦250kW				78			78			76
	250kW≦P		80		80	78		78	76		76

※ The application date is 6 years after Stage 1.

● N categories

Japan has proposed “Small Low Power truck” sub-categories and the limit values are set based on the cumulative noise level data. And the limit values of N2 and N3 are different.

			Stage 1			Stage 2			Stage 3		
			J	E	G	J	E	G	J	E	G
N1	GVW≤2t	PMR≤35kW/t	74	71	72	72	69	70	70	-	68
		35kW/t<PMR	72			70			68		
	2t<GVW≤2.5t			72			70			-	
	2.5t<GVW		74		74	72		72	70		71
N2	P≤75kW		78	74	77	76	72	75	74	-	72
	75<P≤125kW			75			73			-	
	125kW<P≤150kW		79			77			75		
	150kW<P			77	78		75	77		-	75
N3	P≤150kW		80	77	81	78	75	79	76	-	77
	150<P≤250kW			80			78			-	
	250kW<P		81		82	79		81	77		79

Discussion on M1 & M2

M1

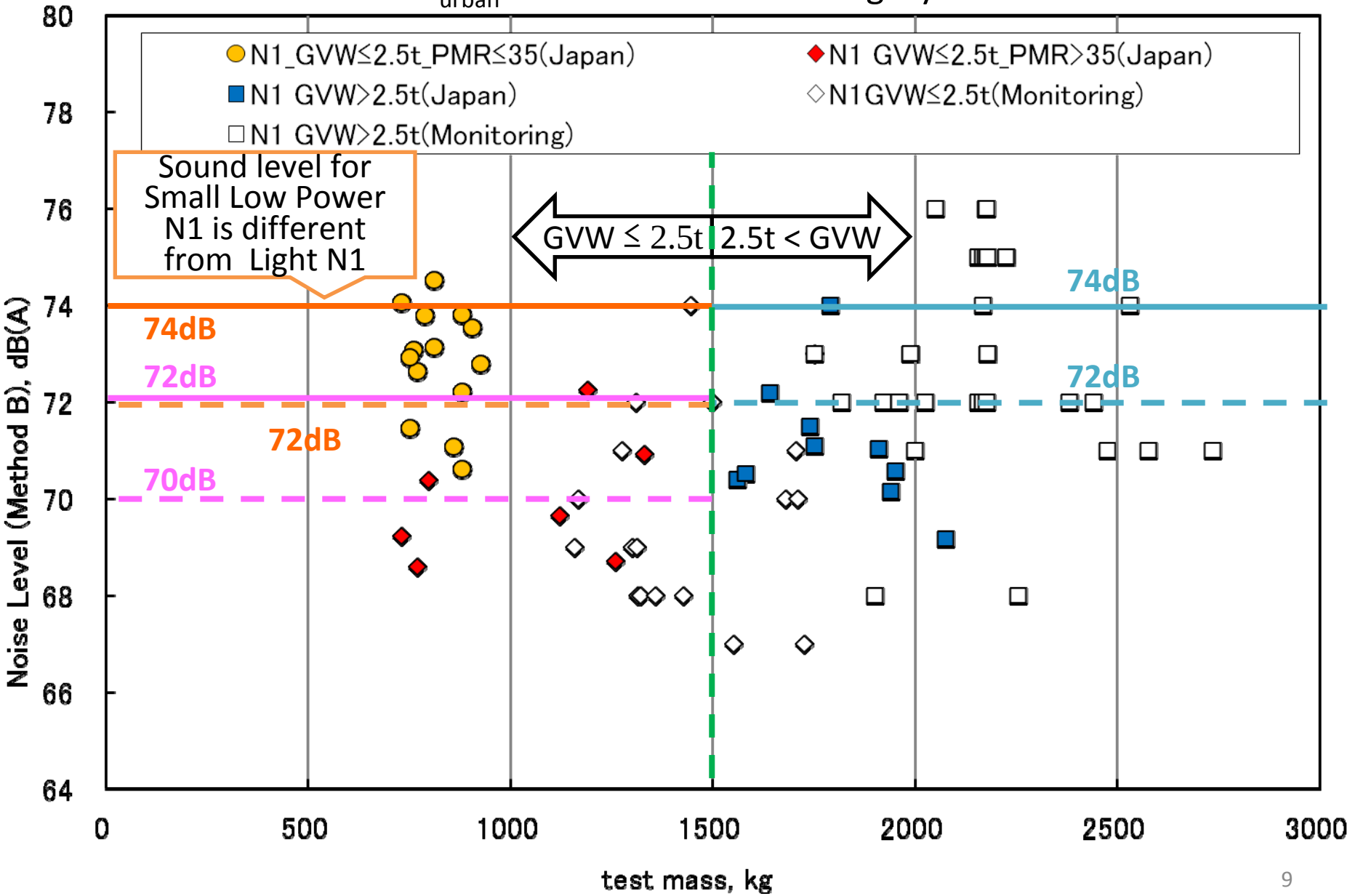
- Although the development cycle of high power M1 tends to be longer than normal M1, the reinforcement gap for Stage 2 of high PMR vehicles should be same as the normal M1, from the political aspect.

M2

- In Japan, all M2(GVW<3.5t) models come from N1 and the GVW of them is over 2.5 ton. Therefore, the subcategory for M2(GVW<2.5t) is not necessary.

Discussion on N1

L_{urban} Distribution of N1 category



● Noise measures of Small Low Power trucks

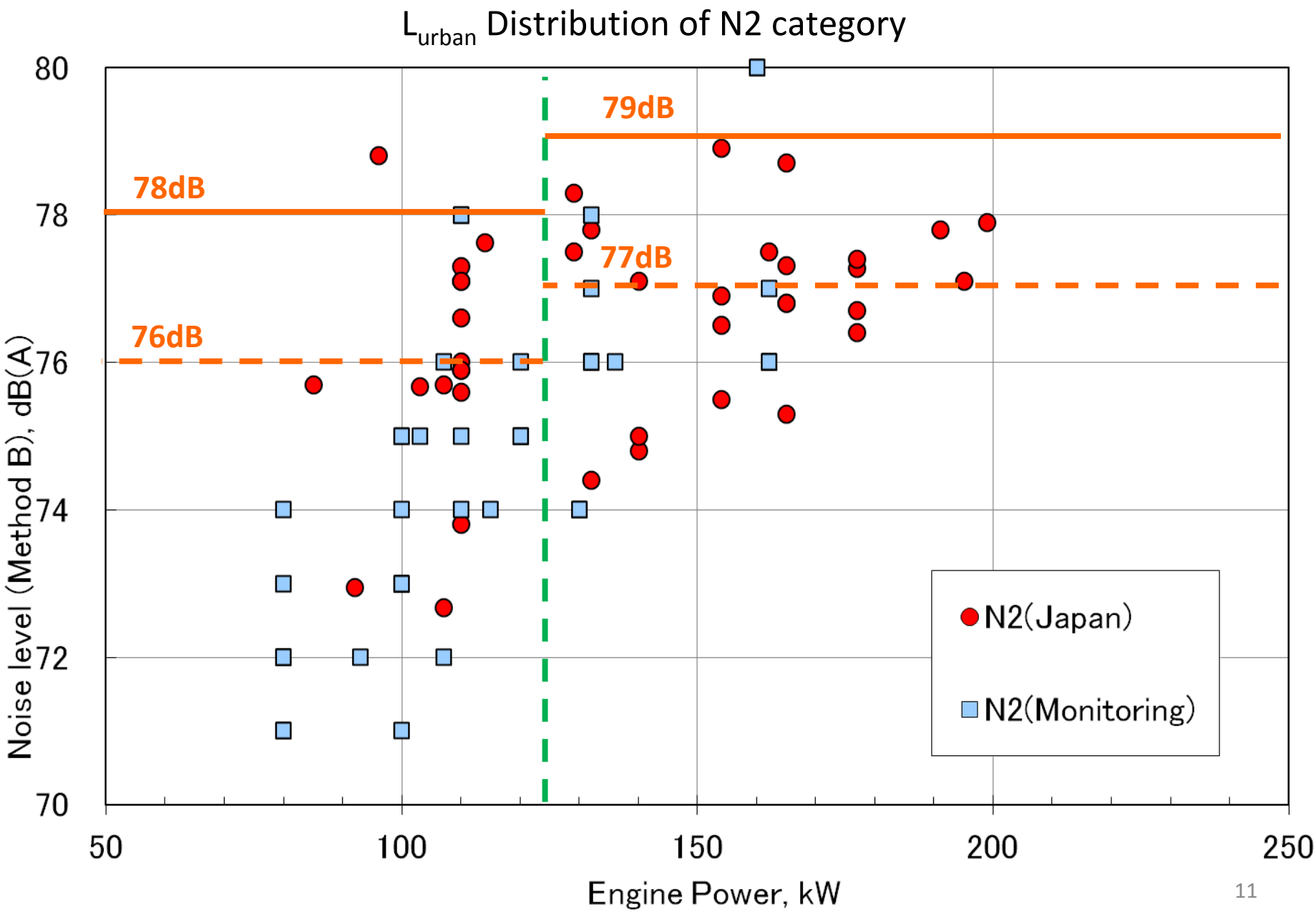
In order to reduce noise level of Small Low Power trucks by 2-3 dB, an engine and a transmission have to be covered.

For keeping a space between an engine and covers, the gap between the ground and the under cover will be smaller than the present gap.

▼It is difficult to reduce the gap because of the usage condition especially for agricultural fields.

⇒No space for noise cover

Discussion on N2



● Speed limit device regulation for N2

- The equipment of the speed limit device (90km/h) is mandated in EU.
- In Japan, there is no regulation of the speed limit device for N2. (A speed limit device for N3 is mandated.) The maximum engine/driving speed of N2 in Japan is much higher and higher performance cooling devices/measures are required. Consequently, it is difficult to equip noise covers, such as transmission covers, etc.

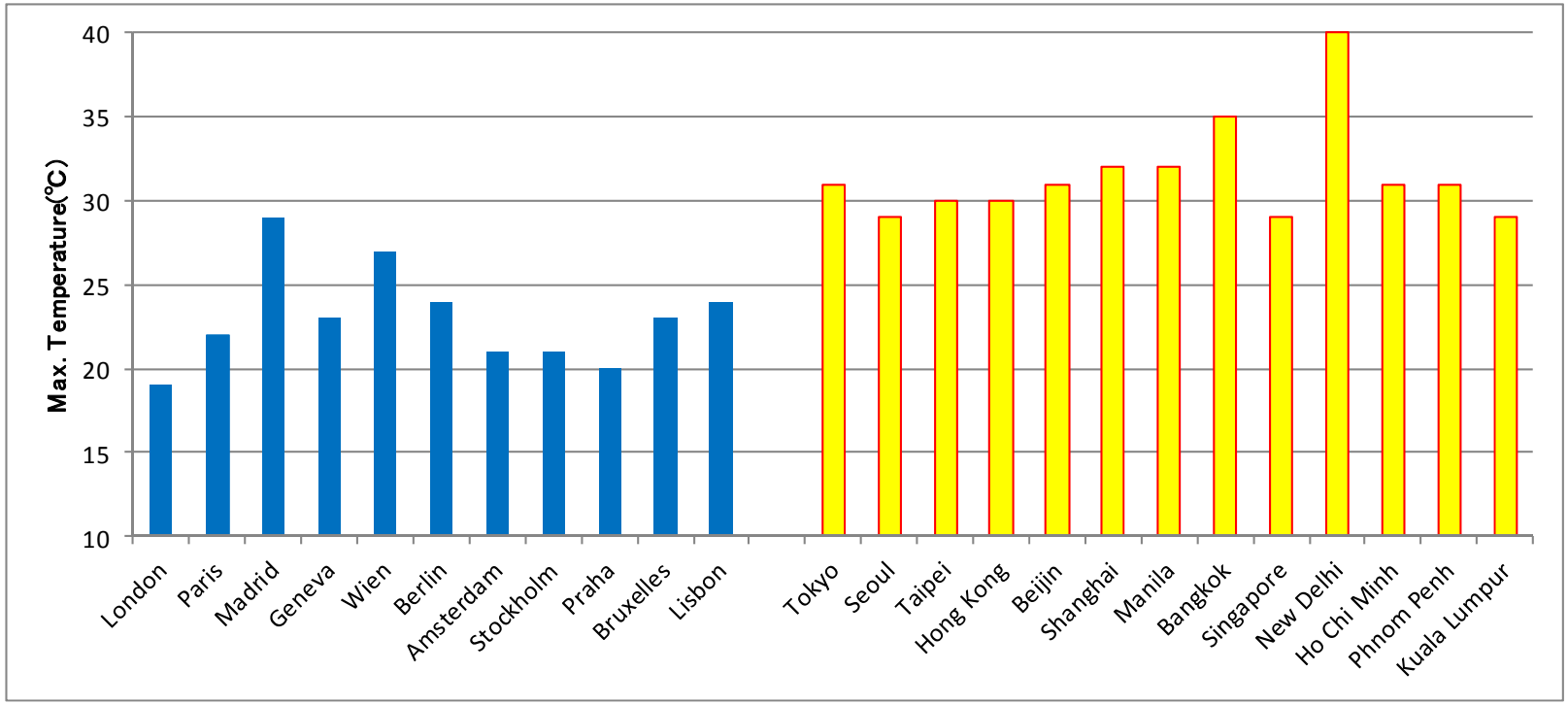
Coverage of driving speed

	EU	Japan	Example of trucks in Japan
3.5t＜GVW≦8t	～90km/h	~150km/h	
8t<GVW	～90km/h	～90km/h	

- Influence from the climate difference between Europe and Asia

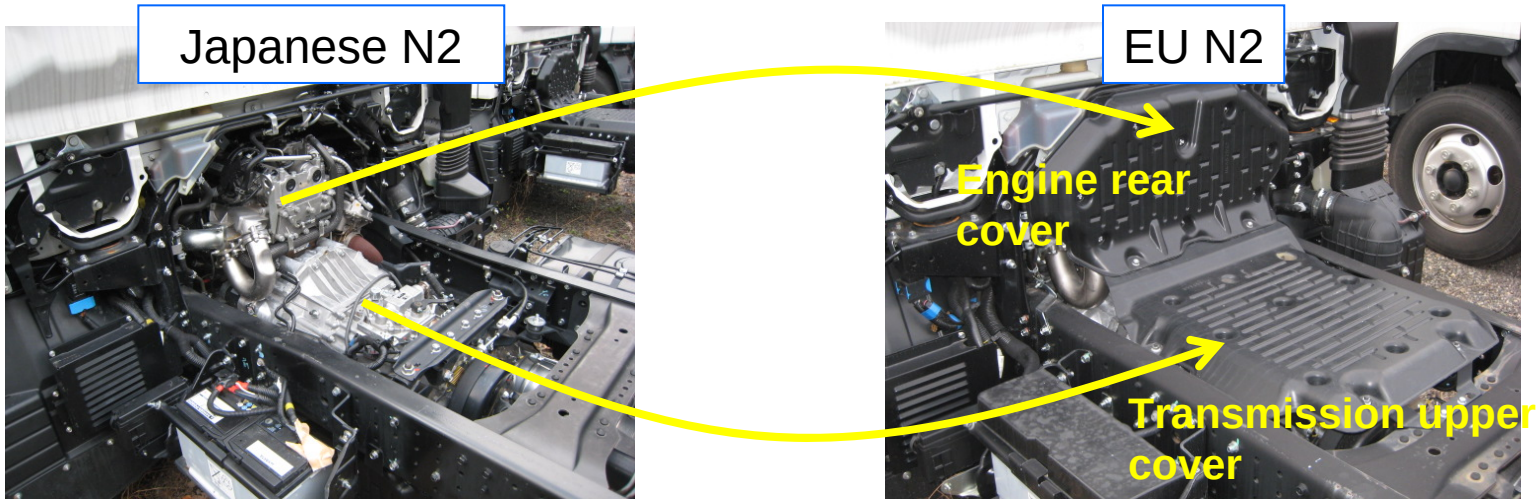
  - The temperature of Asia area is higher than EU region. Therefore, high performance cooling devices/measures are required.

    →Trading off for noise cover equipment

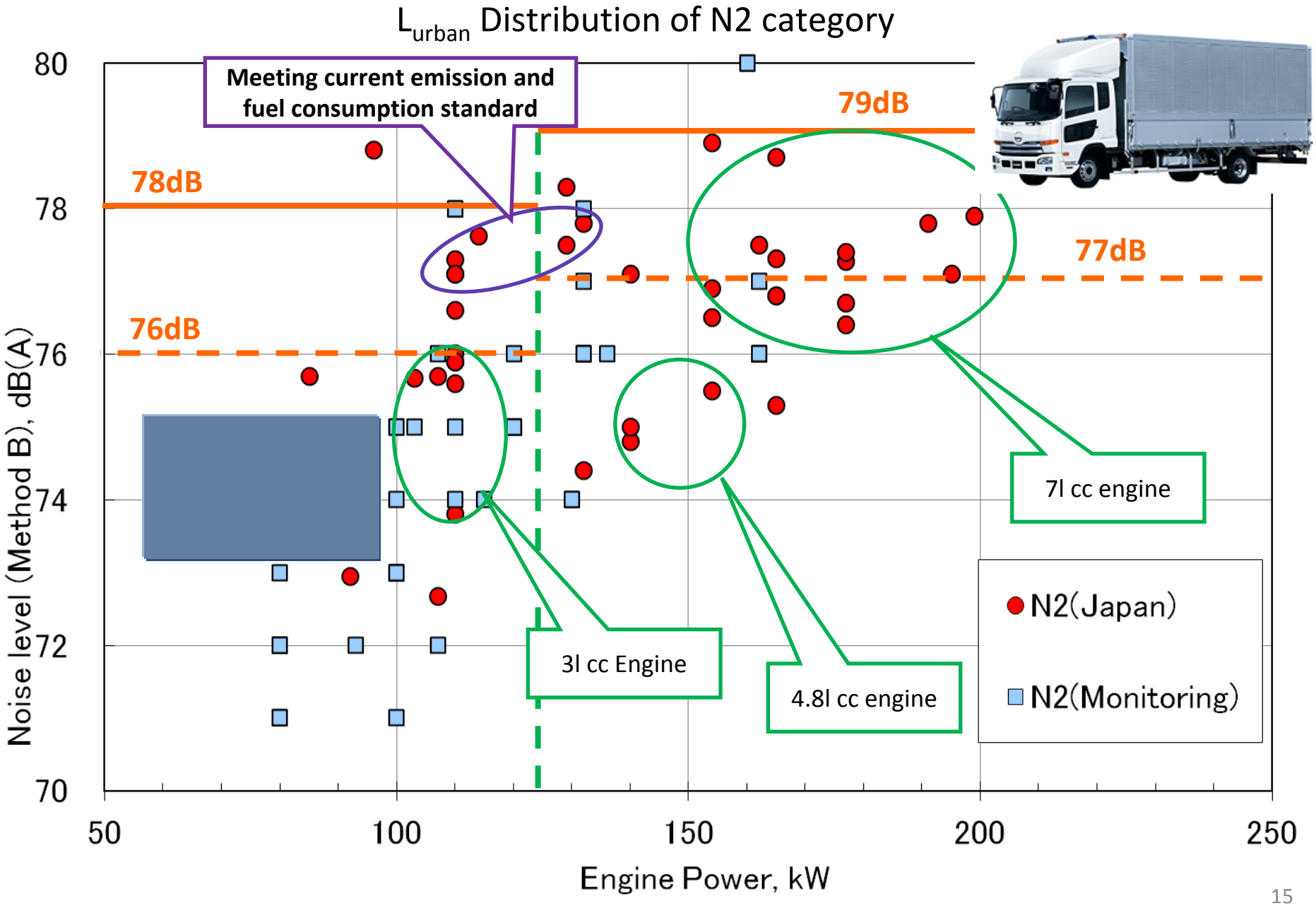


- Influence from fuel consumption standard in Japan
  - The fuel consumption standard is applied not only to passenger vehicles but also heavy duty vehicles since 2015. There is a trading-off between noise reduction and emission or fuel consumption, which requires delicately balanced engine design.

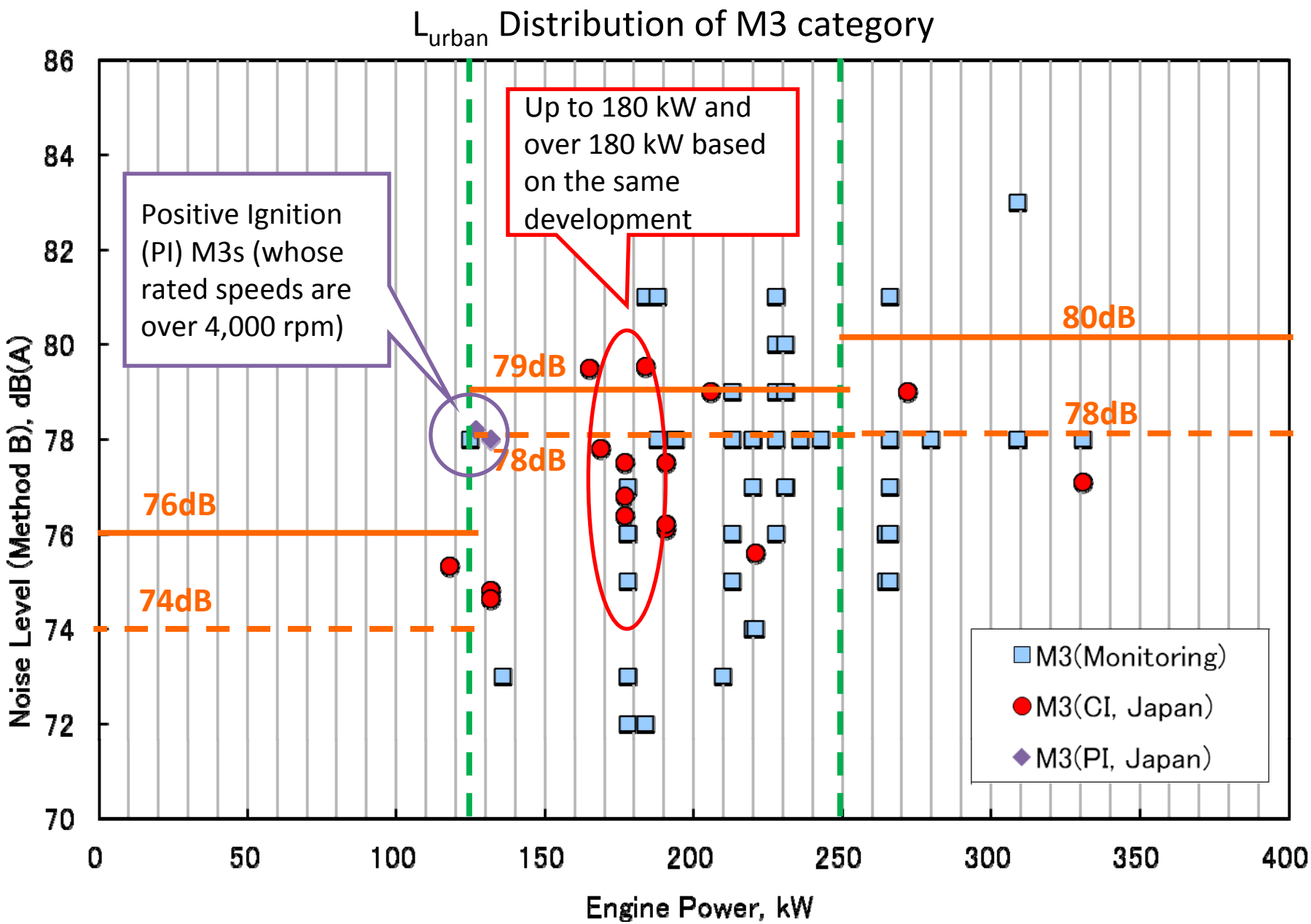
- Different measures between Europe and Japan
  - A noise cover on an engine and a transmission for EU N2 trucks is compatible with cooling performance. While, it is difficult for Japanese N2 trucks to equip such covers because of the influence on cooling performance.



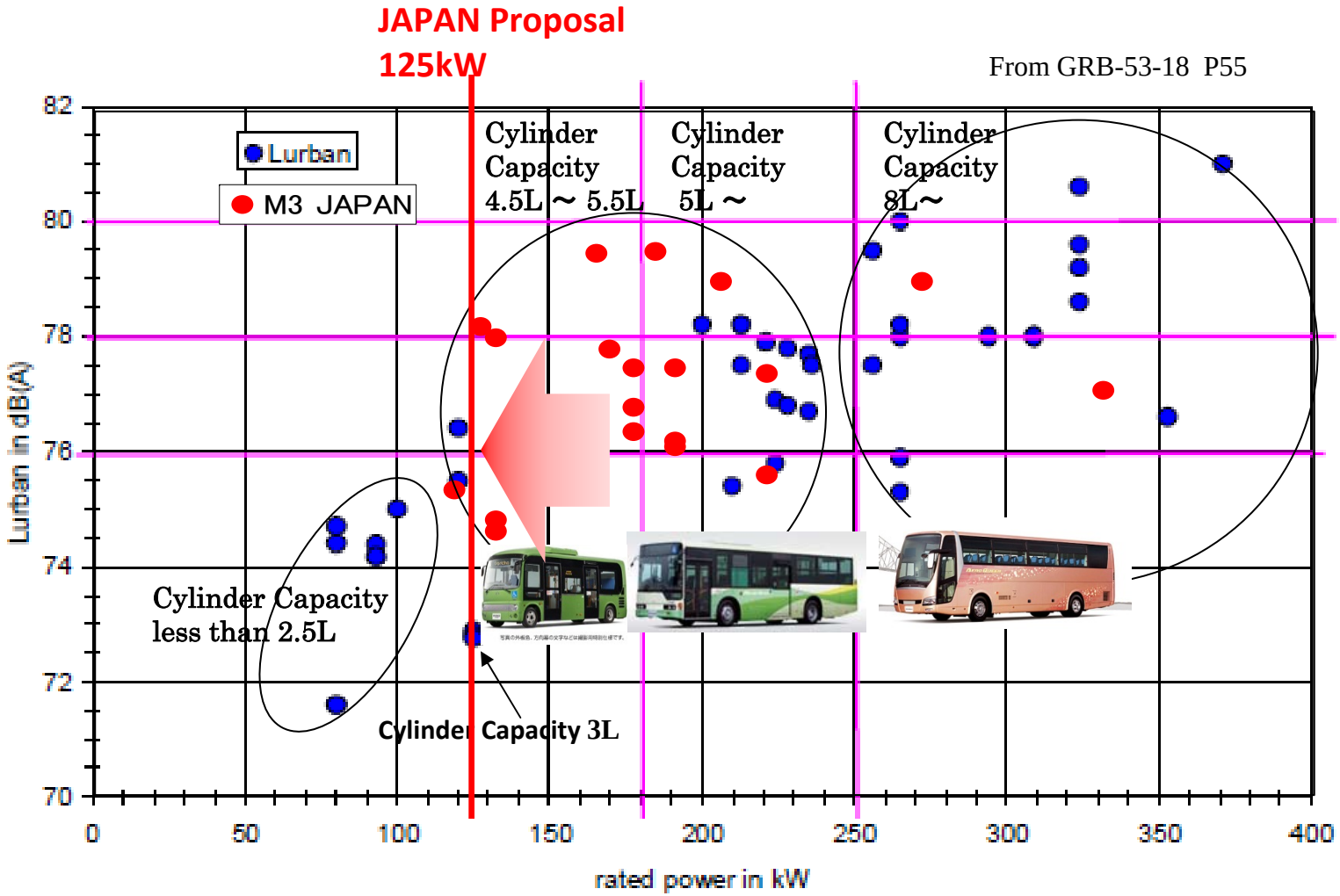
- N2 category Monitoring & Japanese data



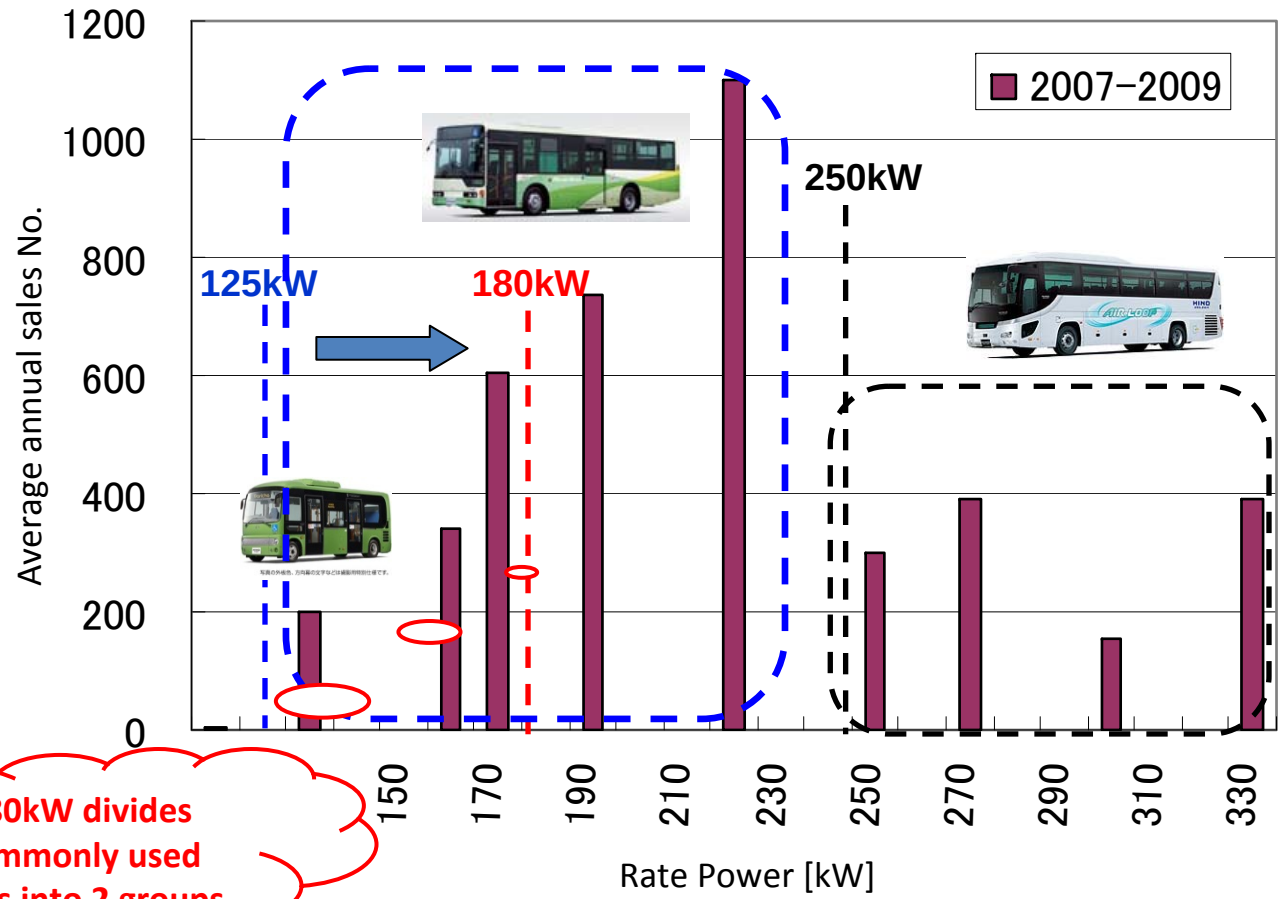
Discussion on M3



L_{urban} Distribution of M3 category (based on ACEA data)



- Influence from M3 Threshold of 180kW



180kW divides commonly used buses into 2 groups.

Average annual sales of M3 (2007-2009)

Influence from M3 Threshold of 180kW

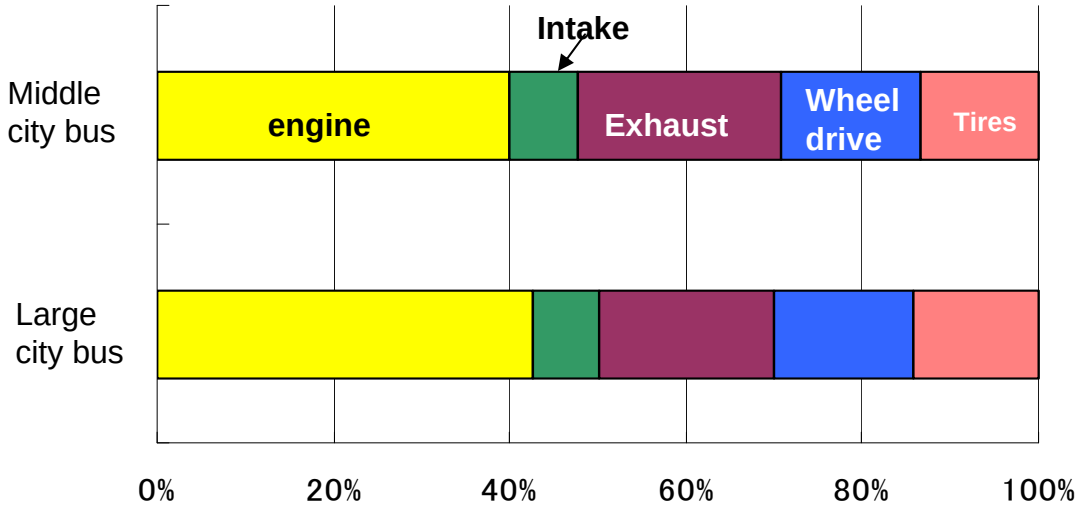
Middle city bus
177kW, 50 passengers

Large city bus
221kW, 80 passengers

City bus Lineups in Japan

Bus types	Rated power (Engine type)	Category in the current regulation
Middle	162kW(6M60T3) 162kW(6HF1TCN CNG) 177kW(4HK1TCH)	Over 150kW
Large	180kW(6HF1TCS CNG) 191kW(6HK1TCC) 199kW(6M60T2) 221kW(6HK1TCS)	

Difference of noise source between Middle and Large city bus

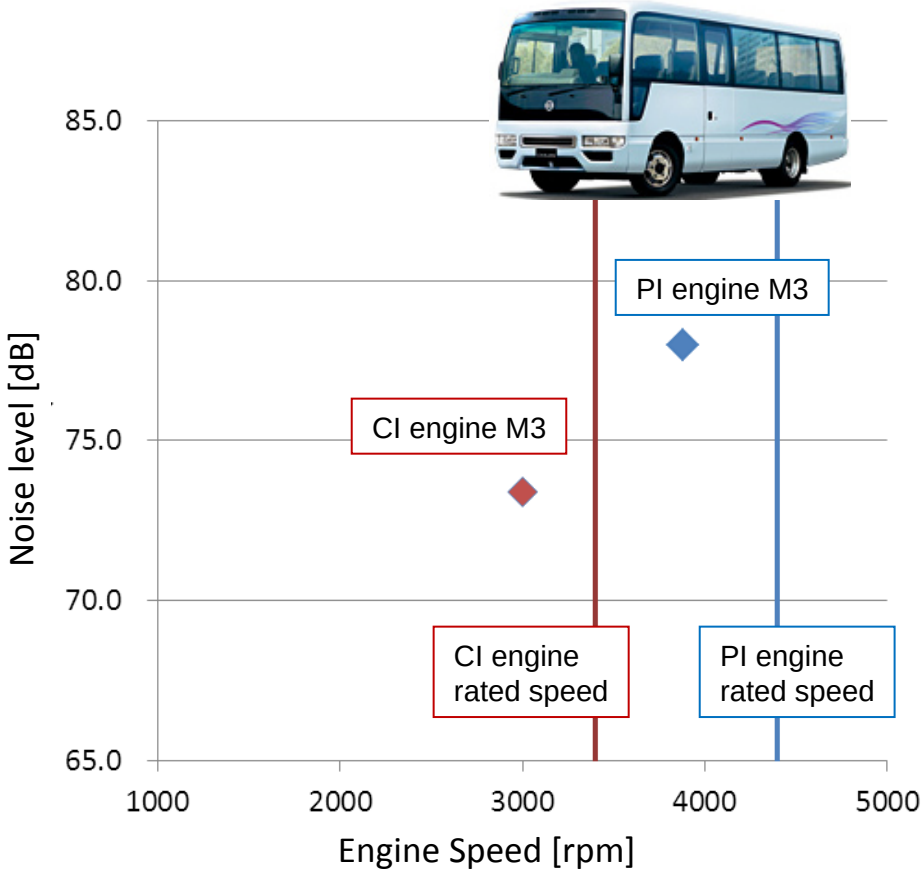


The Common development of Middle and Large city buses leads the cost reduction and the development process reduction. The measures can also be common between Middle and Large city buses, which leads the vehicle/device prices, as well as the convenience of the maintenance.

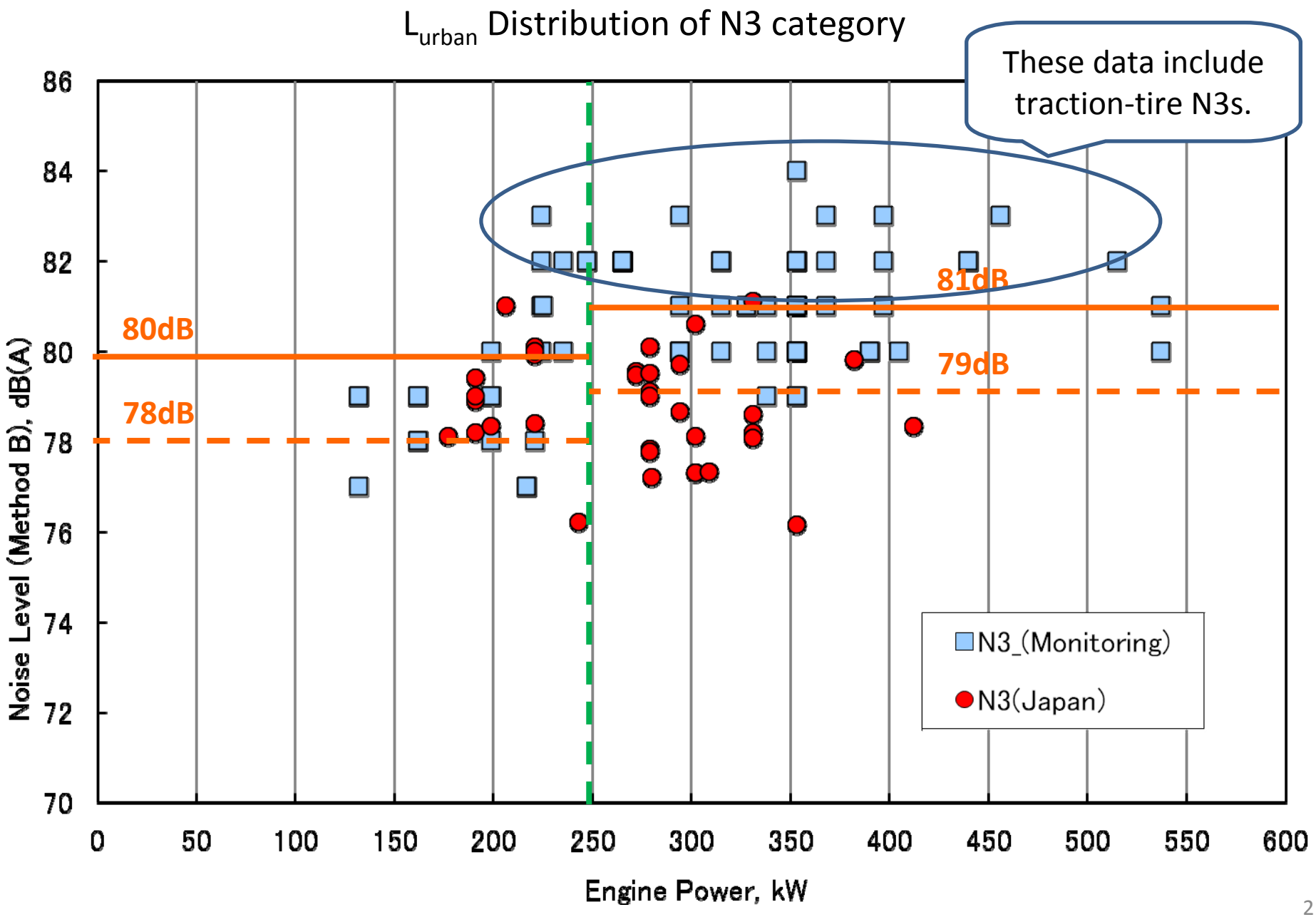
- Difference between PI and CI engines in M3

  Difference between PI and CI engines are due to the difference of engine rotating speeds.

	PI	CI
Engine Type	TB45E	ZD30DDTi
Cylinder layout	Linear 6	Linear 4
Cylinder Capacity	4.478 L	2.953 L
Rated Power kW(PS)/rpm	127(173) /4400	110(150) /3400
Transmission	5MT	5MT
Driving type	2WD	2WD
GVW	5315 kg	5405k g
Passenger	29名	29名
Max engine speed in R51 test	3880rpm	3000rpm
Noise level(dBA)	78.0	73.4



Discussion on N3



- As N3 trucks often drive in urban area in Japan likely to N2 trucks, the current limit value for N3 is same as N2.

(Reference) Database

		Japanese + Monitoring		
			Japanese	Monitoring
M1	PMR≤120kW/t	575	52	523
	120<PMR≤160kW/t	60	5	55
	160kW/t<PMR	23	0	23
	M1G	28	4	24
M2	GVW≤3.5t	-	-	-
	3.5t<GVW	-	-	-
M3	P≤125kW	2	1	1
	125<P≤250kW	53	15	38
	250kW<P	18	2	16
N1	GVW≤2.5t & PMR≤35kW/t	14	14	-
	GVW≤2.5t & 35kW/t<PMR	25	7	18
	2.5t<GVW	51	10	41
N2	P≤125kW	41	14	27
	125kW<P	38	24	14
N3	P≤250kW	35	12	23
	250kW<P	77	24	53
Total		1040	184	856