

# Current Framework of Vehicle Noise Regulation in Japan



Ministry of the Environment, JAPAN

# Topics

## 1. Background of Vehicle Noise Regulations

- ◆ Environmental Quality Standards for Noise
- ◆ Environmental Monitoring Related to Road Traffic Noise
- ◆ Area Evaluation of Road Traffic Noise
- ◆ Situations on Road Traffic Noise
- ◆ Framework of the Vehicle Noise Regulations
- ◆ Viewpoints for Reviewing the Noise Regulation Framework

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- ◆ Adoption of Advance Certification System for Replacement Mufflers
- ◆ Additional Requirement for Muffler Structure and Performance

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- ◆ Future Policy for Vehicle Noise Reduction
- ◆ Future Policy Measures for Road Traffic Noise Reduction
- ◆ Measures Implemented for Road Traffic Noise Reduction (Reference)

# 1. Background of Vehicle Noise Regulations

## ◆ Environmental Quality Standards for Noise

Environmental Quality Standards (EQSs) for Noise are designated as the standards to be maintained for the purpose of protection of human health by environmental pollution, in accordance with the Basic Environment Law, Article 16.

### □ General Areas

Categories of area	Standard Value	
	Daytime (6:00~22:00)	Nighttime (22:00~6:00)
Area AA (where silence is especially required, e.g. hospitals)	50dB or less	40dB or less
Area A or B (for residence, exclusively or mainly)	55dB or less	45dB or less
Area C (for commerce)	60dB or less	50dB or less

### □ Areas Facing Roads

Categories of area	Standard Value	
	Daytime (6:00~22:00)	Nighttime (22:00~6:00)
Area A facing road with two or more lanes	60dB or less	55dB or less
Area B facing road with two or more lanes and Area C facing road with one or more lanes	65dB or less	60dB or less

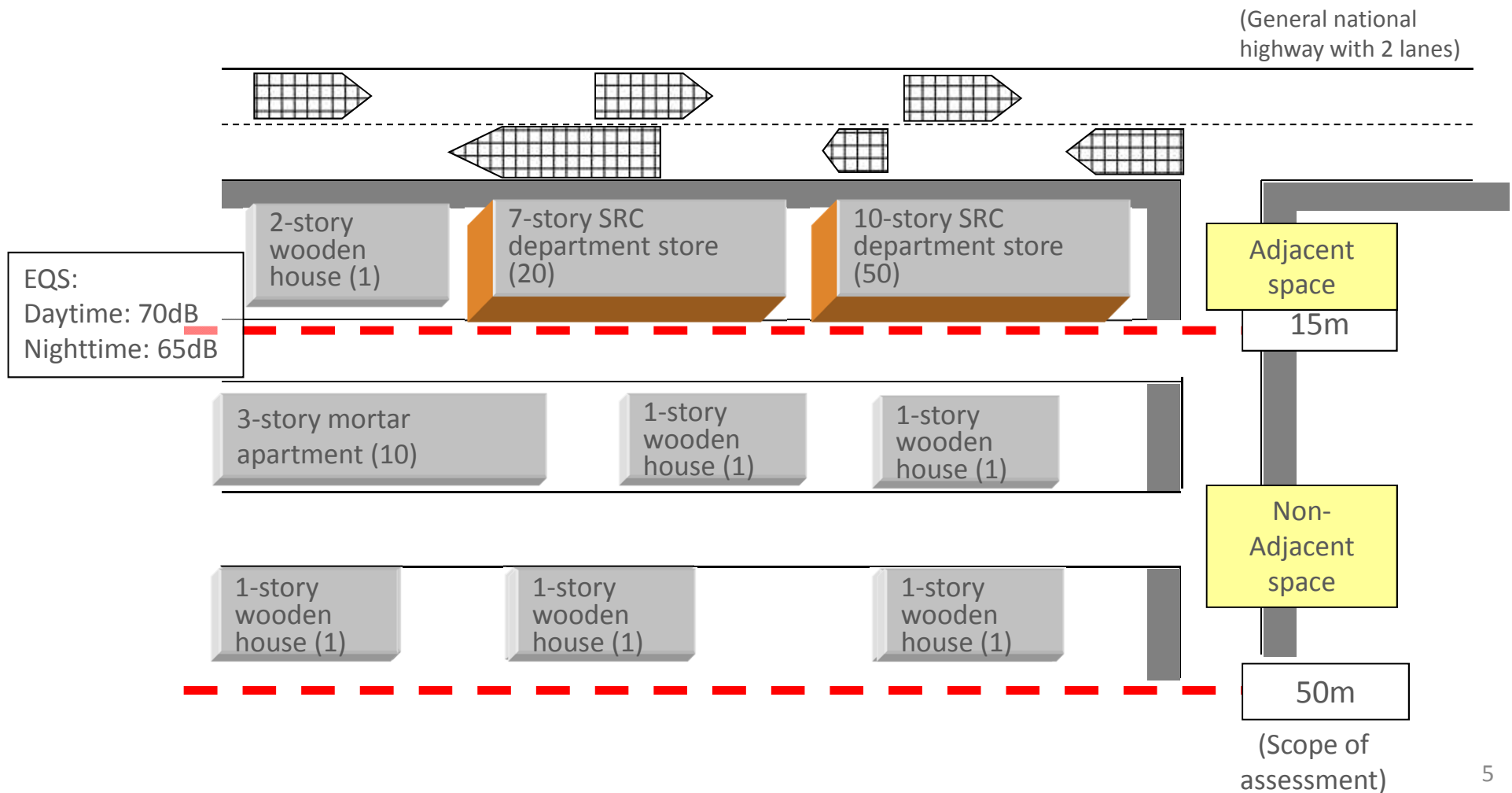
### □ Space Adjacent to Road Carrying Arterial Traffic

Standard Value	
Daytime (6:00~22:00)	Nighttime (22:00~6:00)
70dB or less	65dB or less



## ◆ Area Evaluation of Road Traffic Noise

For areas along roads, achievement in principle is evaluated by choosing points considered to represent the noise of the respective concerned areas.



# Disclosure of Area Evaluation Results via the Internet

環境展望台

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ニュース・イベント | 研究・技術 | 政策・法令 | 環境学習 | **環境GIS** | 検索・ナビ

環境の状況 | 環境指標・統計 | 環境規制・指定

全国自動車交通騒音調査/昼間/全体/2008年度/(2007,2006,2005,2004,2003年度)

環境基準達成状況(%)

- 95 - 100
- 80 - 95
- 60

Achievement of environmental standard (%)

表示 | 検索 | 検索結果

表示項目

測定年度

2008年度

1年前を表示

2年前を表示

3年前を表示

4年前を表示

5年前を表示

騒音

環境基準達成状況

地図表示内容(分類)

昼間

地図表示内容(項目)

全体

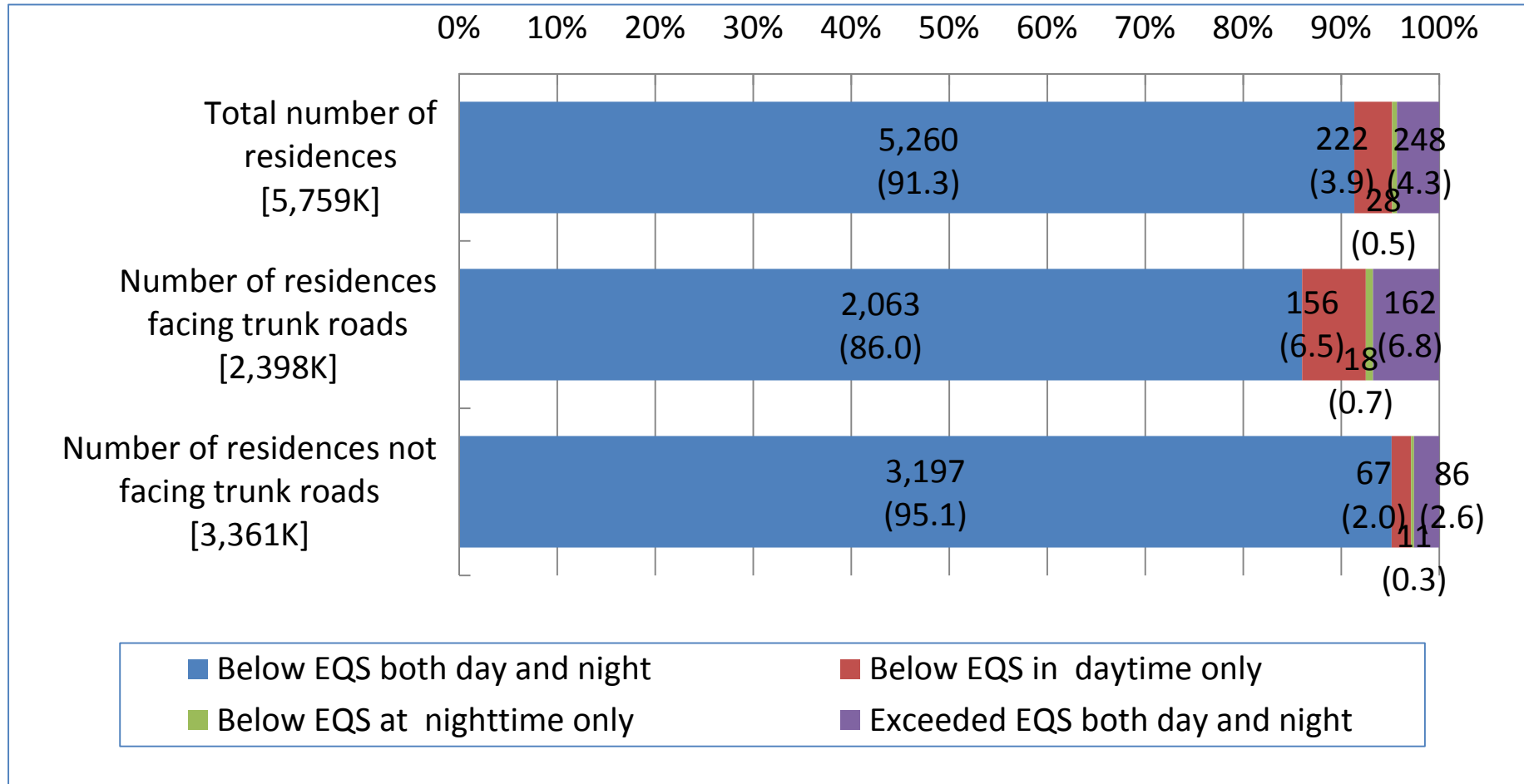
地図印刷 | 操作ガイド

独立行政法人 国立環境研究所 〒305-8506 茨城県つくば市小野川116-2 TEL:029-850-2674 e-mail: tenbou@nies.go.jp

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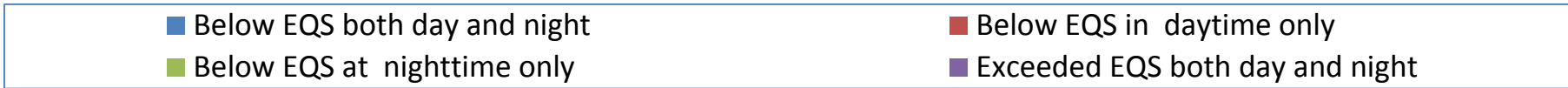
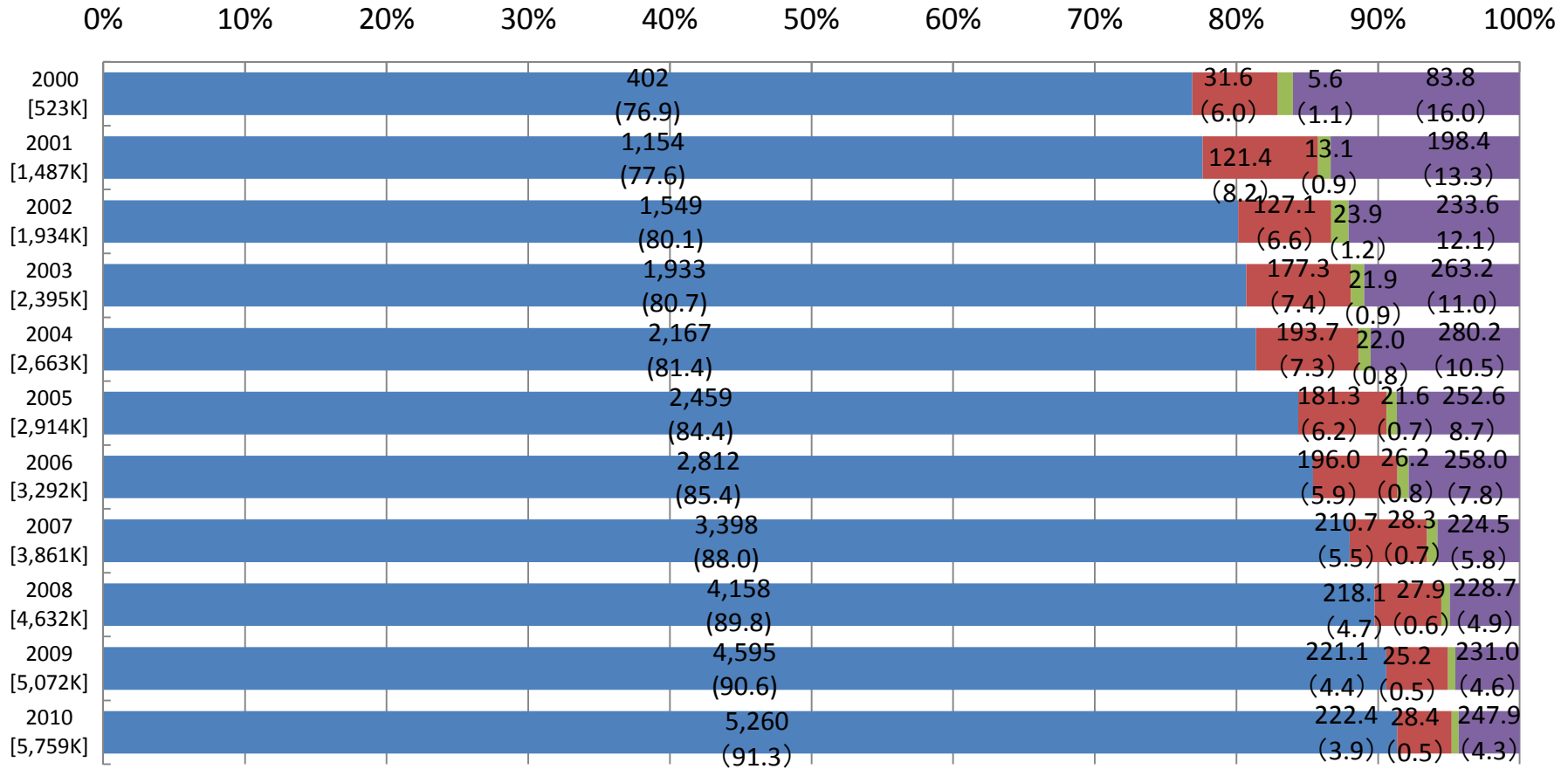
## ◆ Situations on Road Traffic Noise

Results of the Achievement of EQSs for Road Traffic Noise  
(FY2010)



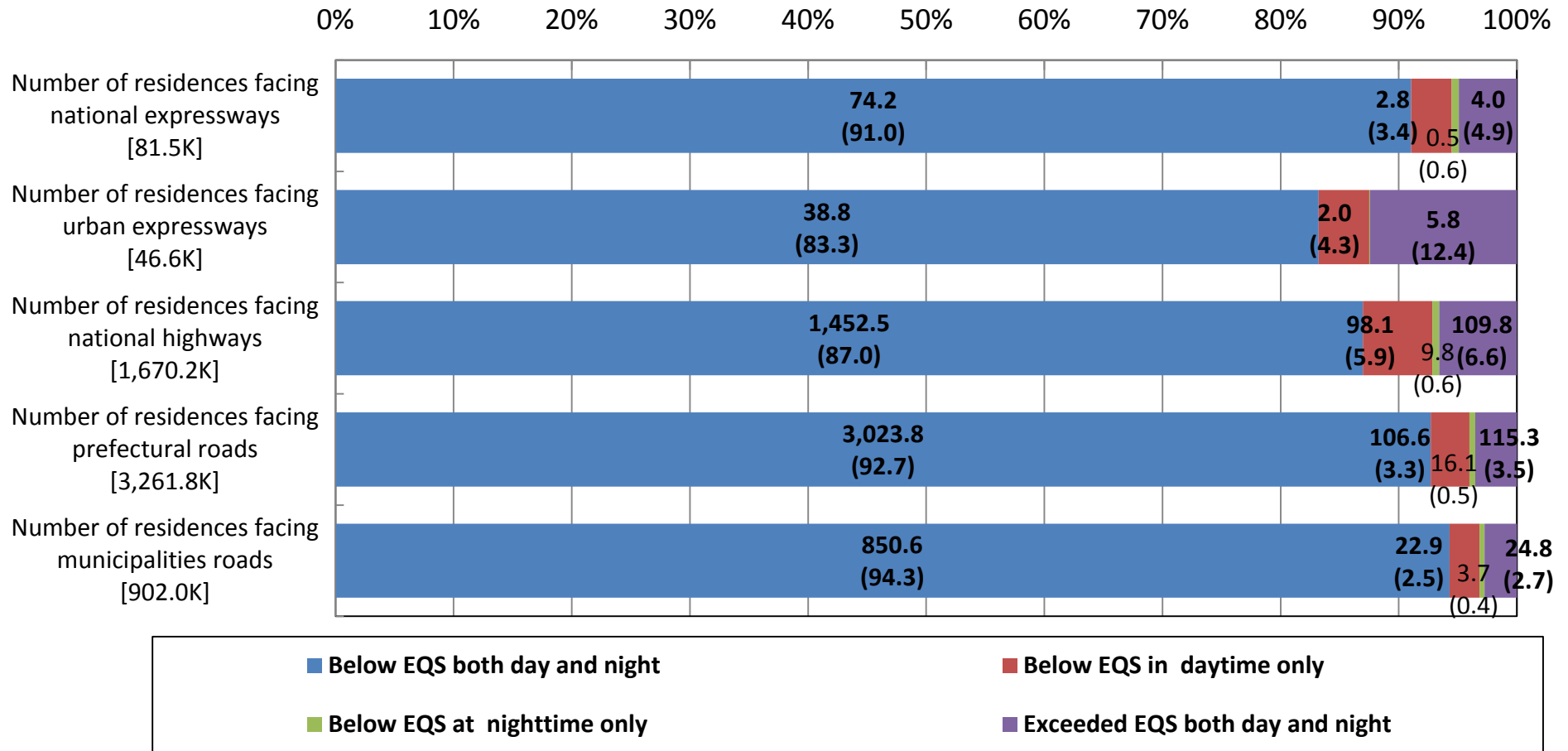
EQS: Environment Quality Standards for noise

## Result of the Achievement of EQSs for Road Traffic Noise (Since FY2000)



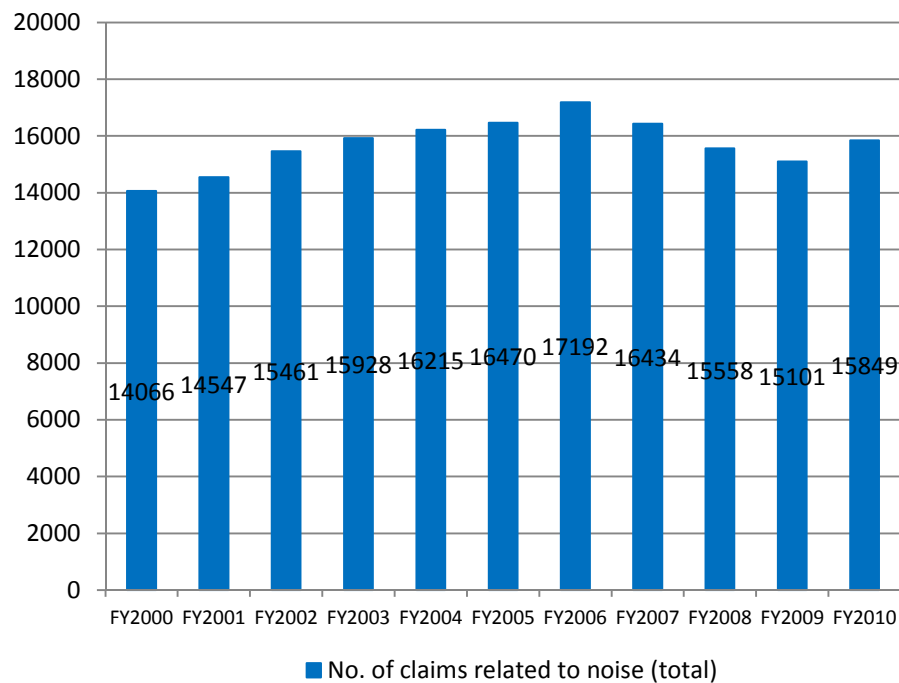


## Results of the Achievement of the Environmental Quality Standards for Road Traffic Noise (Classified by Road Types, FY2010)

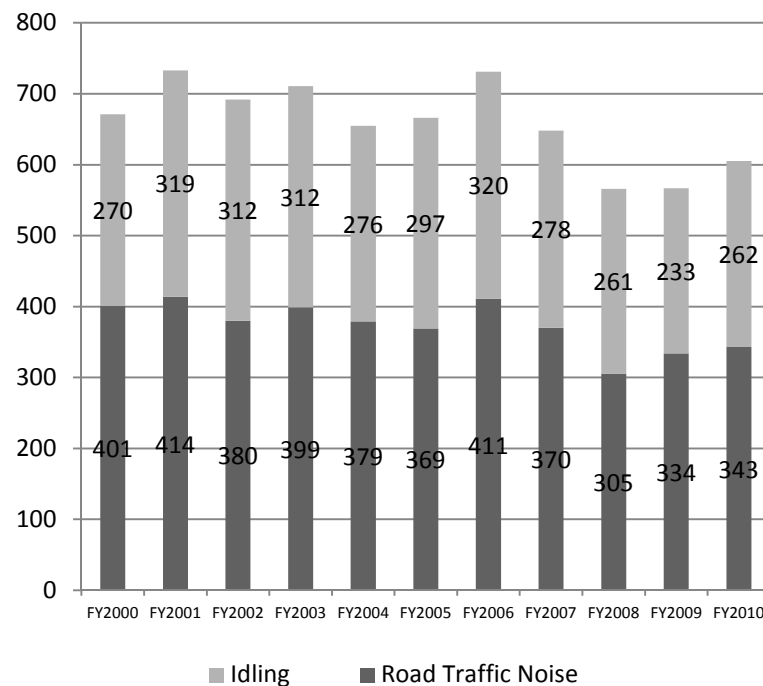


## No. of Claims Related to Vehicle Noise (Since FY2000)

### No. of claims related to Noise (Total, including vehicle noise)



### No. of claims related to Noise (Vehicle noise only)



Source: Research of the Implementation of  
Noise Regulation Act by MOE, Japan

## ◆ Framework of the Vehicle Noise Regulations

### □ Methods for Testing Vehicle Noise

Test types	Contents	Note
Full Throttle Acceleration (since 1971)	Measure the sound level when approaching to the measuring range at a constant speed (e.g. 50km/h or 0.75S for vehicle having at least four wheels) and accelerator fully depressed (throttle control fully opened)	A wide testing area and devices are required for these tests and it is difficult to conduct for in-use vehicles.
Cruising (Since 1951)	Measure the sound level when approaching to the measuring range at a constant speed (e.g. 50km/h for vehicle having at least four wheels) and keeping the speed	
Stationary (Since 1986)	Measure the sound level in the immediate vicinity of the exhaust-system outlet during a period of targeted engine speed and deceleration by the release of accelerator/throttle	A wide testing area is not required and this test is applicable for in-use vehicles.



Full Throttle Acceleration/Cruising Test  
(A test course is required)

Stationary Test  
(A test course is not required)



□ Maximum Permissible Levels for Vehicle Noise

Vehicle Types		Full Throttle Acceleration	Cruising	Stationary
Passenger vehicles (11 passengers or more) and commercial vehicles	GVW > 3.5t and P >150 kW	81 (82 <sup>*1</sup> )	82 (83 <sup>*1</sup> )	99
	GVW > 3.5t and P ≤150 kW	80 (81 <sup>*2</sup> )	79 (80 <sup>*2</sup> )	98
	GVW ≤ 3.5t	76	74	97
Passenger vehicles (10 passengers or less)		76	72	96 (100 <sup>*3</sup> )
Motorcycles	cc ≤ 50	71	65	84
	50 < cc ≤ 125		68	90
	125 < cc ≤ 250	73	71	94
	250 < cc		72	

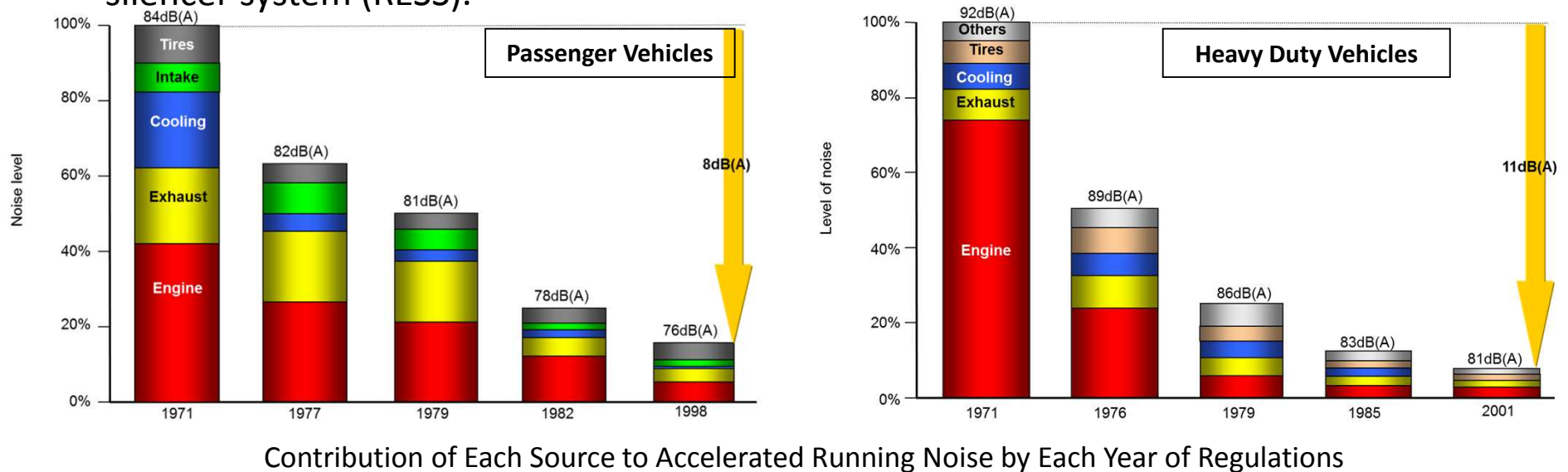
\*1 For all-wheel-powered vehicles, tractors or crane trucks

\*2 For all-wheel-powered vehicles

\*3 For rear engine vehicles

## ◆ Viewpoints for Reviewing the Noise Regulation Framework

- The values for new vehicles are reduced by 84% in maximum on the energy basis from the level in 1971, when the Full Throttle Acceleration Noise Regulation came into effect.
- A relative contribution of tire rolling noise is increasing in comparison to the power unit noise.
- In order to keep noise levels of in-use vehicle at the same level as new ones, it is effective to regulate noise levels of replacement tire and replacement exhaust silencer system (RESS).

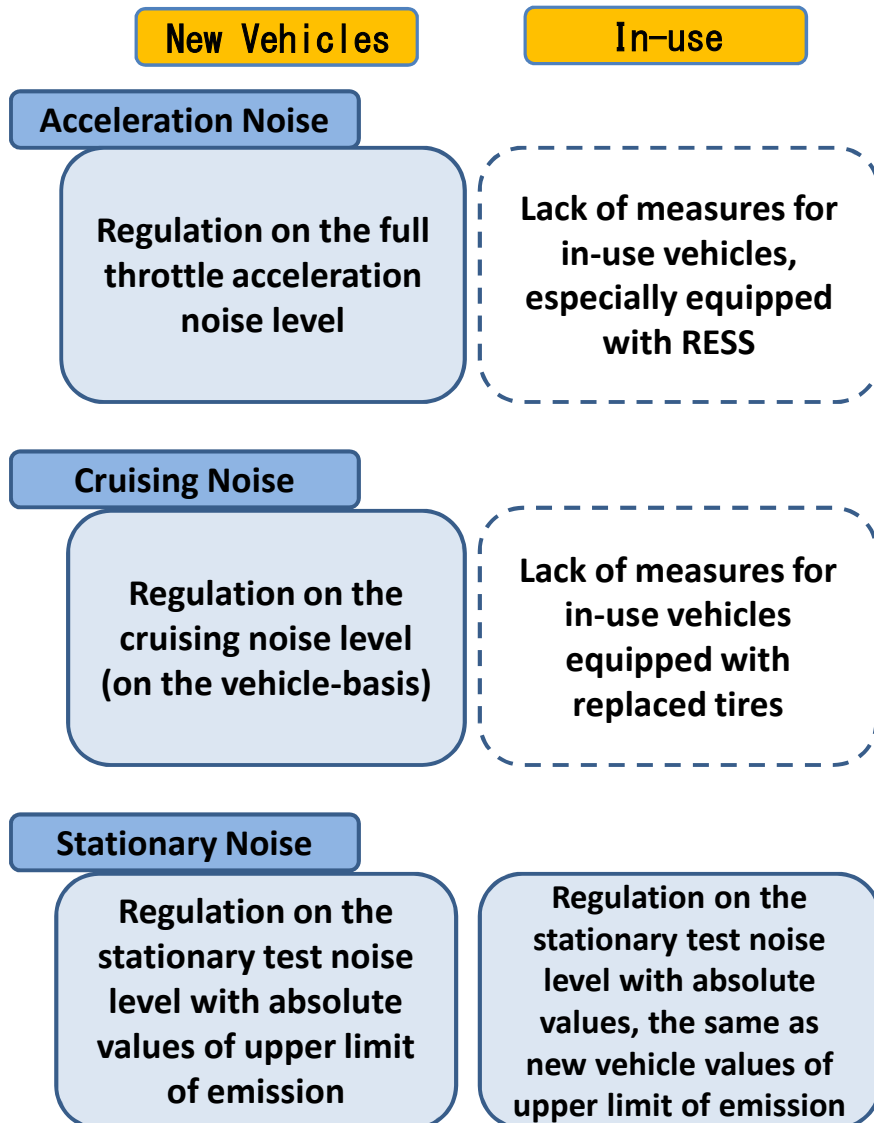


Source: "Vehicle Traffic and Noise", JAMA

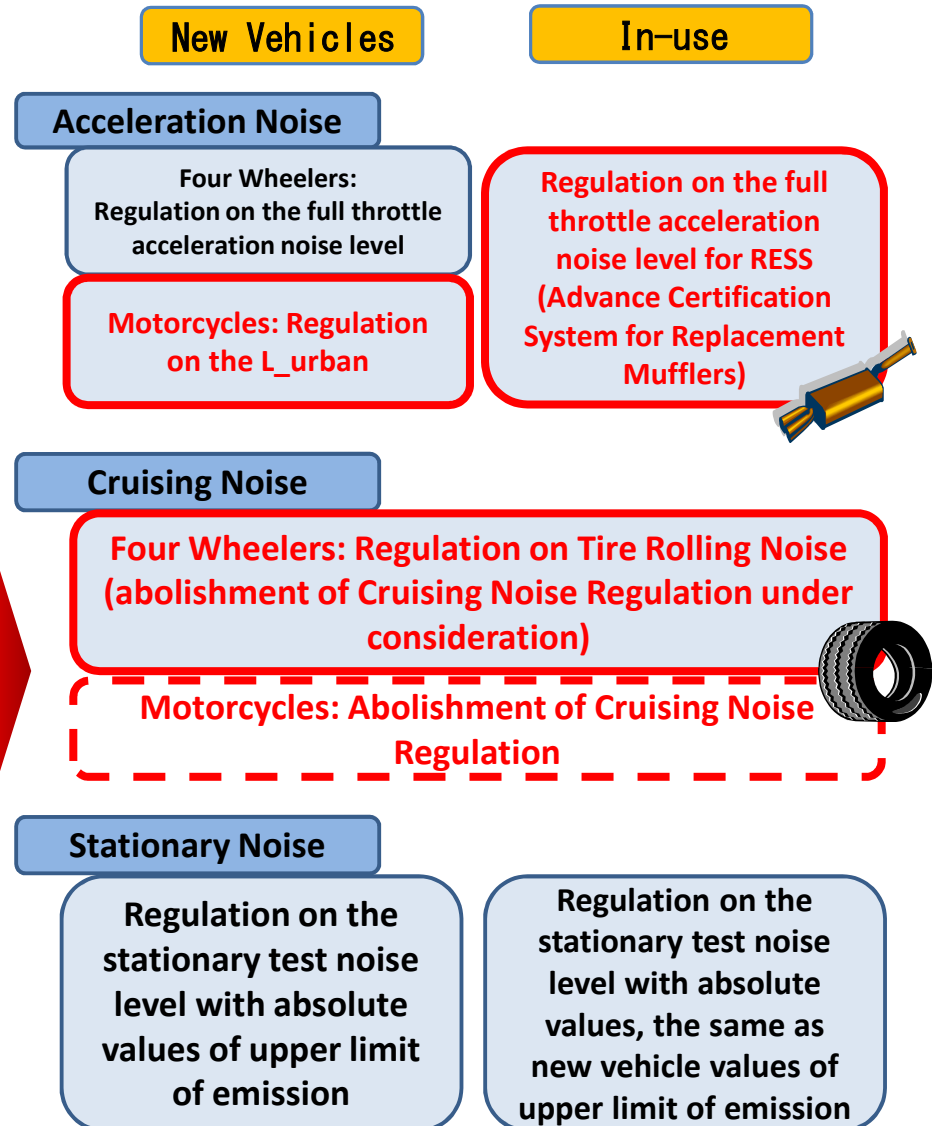
In response to the Inquiry of June 2005, the Expert Committee on Motor Vehicle Noise, established under the Noise and Vibration Committee of the Central Environment Council, has been considering "the Future Policy for Motor Vehicle Noise Reduction", including the measures for reduction of the in-use vehicle noise.

# □ Framework of Vehicle Noise Regulation (Image)

At the Inquiry (2005)

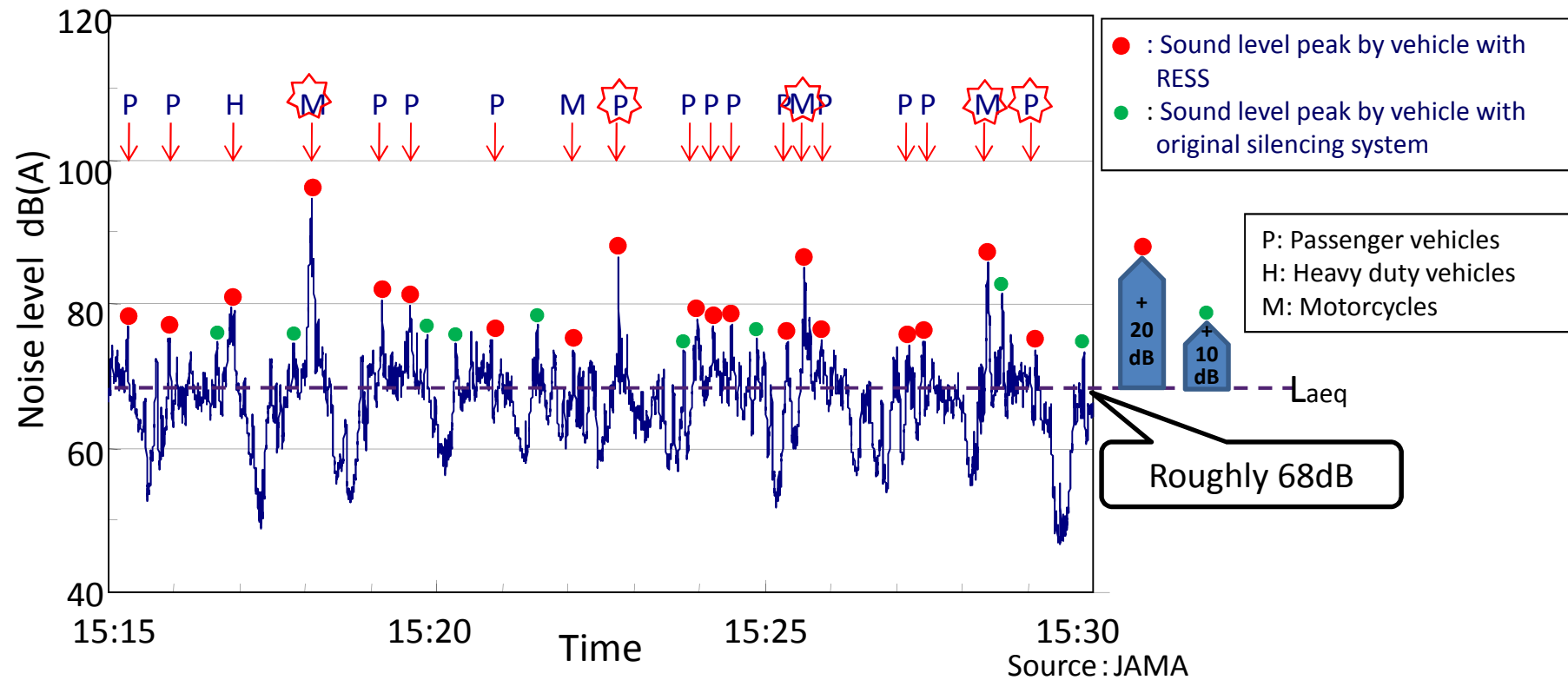


After the Interim Report (2008) and the Second Report (2012)



## 2. Reinforcement of Muffler Noise Reduction

### ◆ Road Noise Level (Impact of the passage of vehicles with RESS)



- Ratio of RESS-Equipped Vehicles (Sampling Research)

Four Wheelers: About 5% (Resource: MOE Japan)

Motorcycles: About 40% (Resource: JAMA)

## ◆ Adoption of Advance Certification System for Replacement Mufflers

- On 18 December 18 2008, the Noise and Vibration Committee of the Central Environment Council discussed and compiled the “Future Policy for Motor Vehicle Noise Reduction (Interim Report)”.
- The Interim Report recommended the adoption of Advance Certification System for Replacement Mufflers as a noise reduction measure that should be promptly implemented on in-use vehicles as well as a check scheme for certified mufflers at mandatory automobile inspections. In the System, full throttle acceleration noise regulation is applied to replacement mufflers and those meeting the requirement are marked as “Certified Mufflers”. The Report also recommended that after the system began, it should be reviewed in consideration of the survey on sales status of RESSs.



- On 26 December 2008, Regulation and relevant Bulletins for the Safety and Environmental Protection of Motor Vehicles were amended.
- The vehicles manufactured on and after 1 April 2010 have to equip original mufflers or Certified Mufflers.



◆ **Additional Requirement for Muffler Structure and Performance**  
Prohibition of removal noise reduction devices.

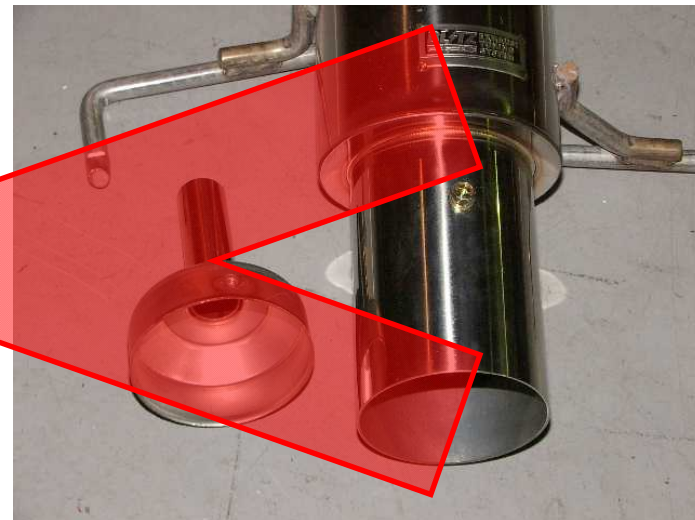


Normal (Original) Muffler

Inner device is easily removed by removing a pin.



Replacement Muffler



Removed Inner Device and Muffler

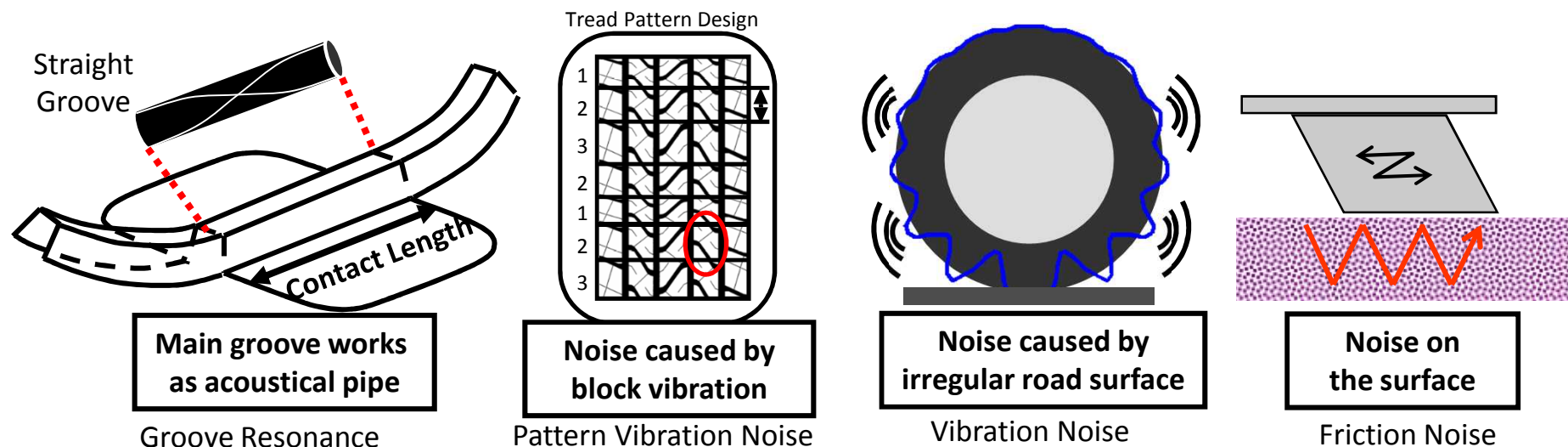
➔ **Banned**

### 3. Adoption of Tire Rolling Noise Regulation

#### ◆ Background of Reinforcement of Tire Rolling Noise Reduction

##### □ Sources of Tire Rolling Noise

Tire rolling noise is mainly divided into the noise owing to tread pattern, such as groove resonance and pattern vibration noise, and the noise owing to other elements, such as vibration noise by irregular road surface, friction (on the surface), and so on.



##### □ Previous Discussions on the Adoption of Tire Rolling Noise Regulation

MOE established a Study Team for Tire Rolling Noise in 1998 with the aim of considering the effectiveness of tire noise regulation. The team concluded that the adoption of ECE R117-01 would not be very effective as a measure for vehicle noise reduction, since the tire rolling noise levels were already below the limits, which were regulated by ECE R117-01 in most of the tires manufactured and sold by Japanese tire manufactures at that time.

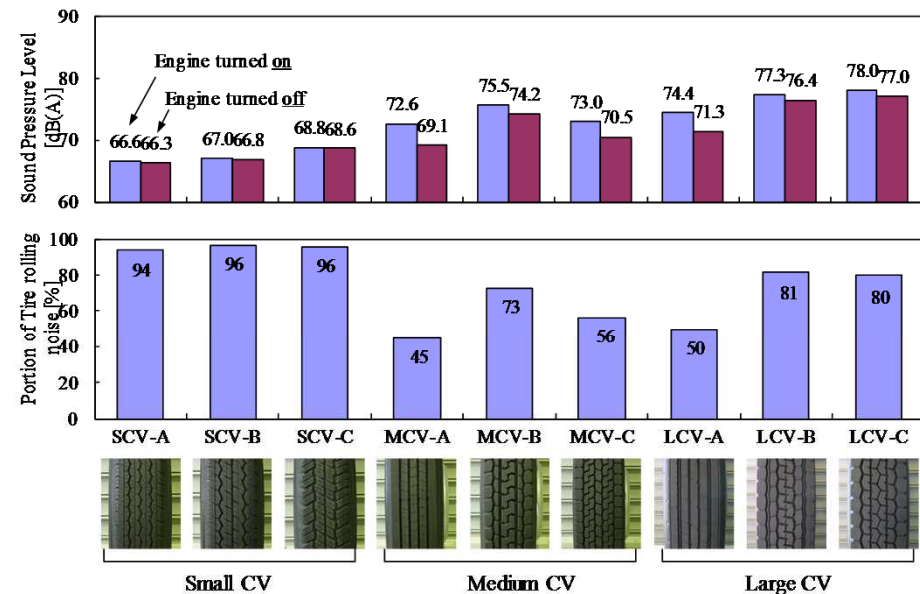
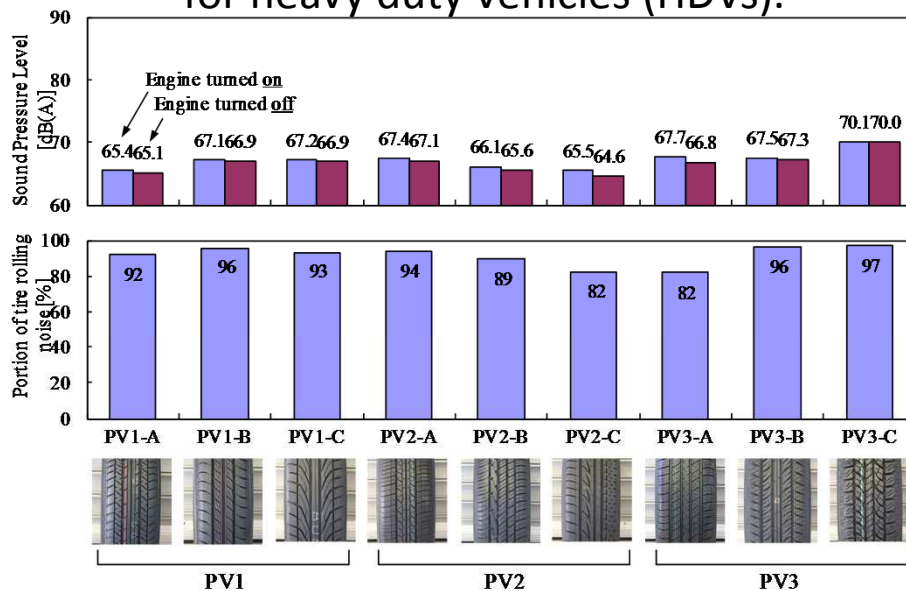
## ◆ Discussion on Tire Rolling Noise Level

### □ The Current Tire Rolling Noise Level

Once again, MOE established a Study Team for Tire Rolling Noise in 2009 with the aim of considering the effectiveness of tire noise regulation.

The team conducted an analysis of the recent tire rolling noise and interviewed Japanese tire manufactures, and came to the following understanding;

- About half of tires sold in Japan exceeded the limit values regulated by ECE R117-02.
- There are Sports Type Tires for passenger vehicles (PVs) and All Terrain and Studless Tires for sports utility vehicles (SUV) that exceed 1 to 3 dB, and Mud Terrain Tires for SUV that exceed 5dB as the maximum noise levels.
- The ratios of tire noise at cruising are over 82% for PVs, and between 45% and 81% for heavy duty vehicles (HDVs).

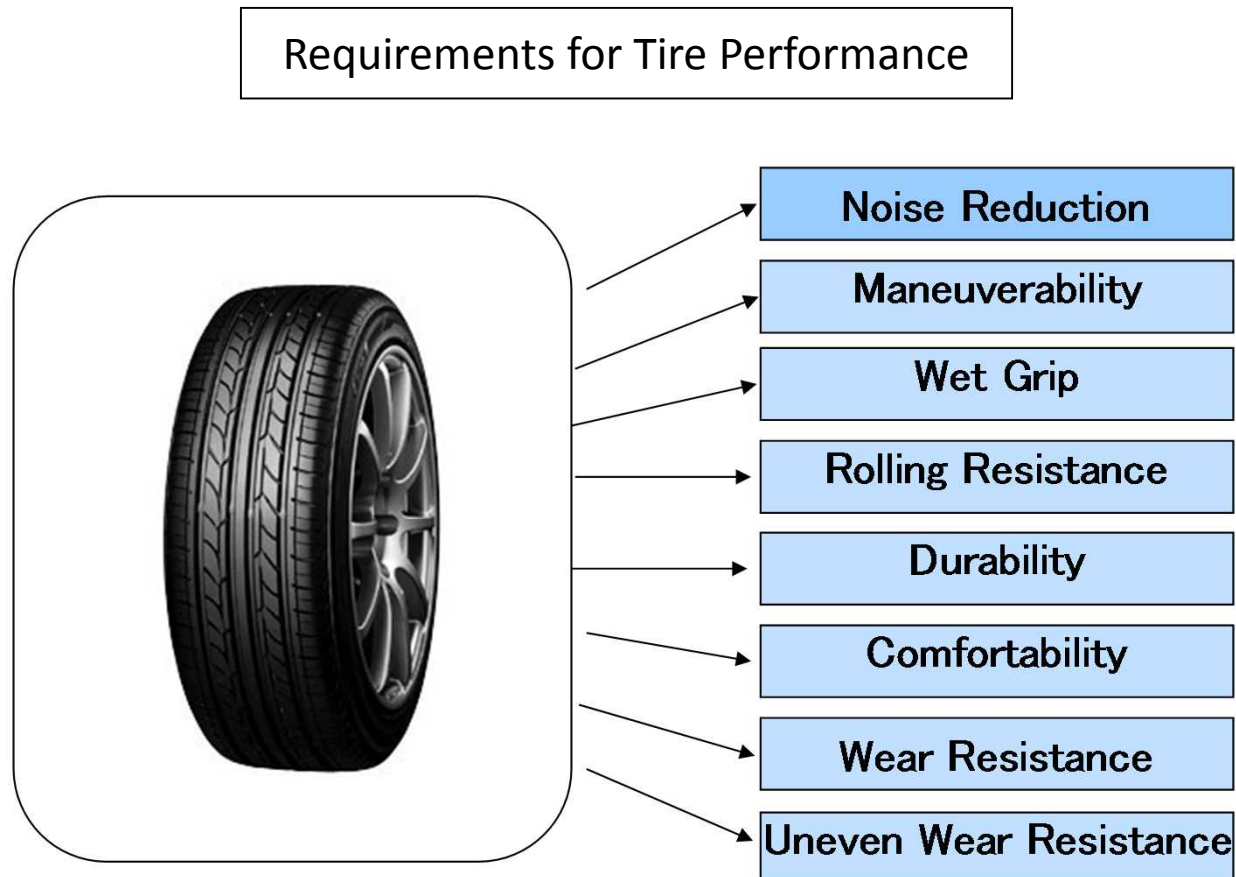


- Tire A is originally equipped while the Tire B and C are retrofit.
- Each test is conducted when cruising at 50km/h.

Cruising Noise and Ratios of Tire Rolling Noise  
(3 passenger vehicles (PVs) and 3 commercial vehicles (CVs) )

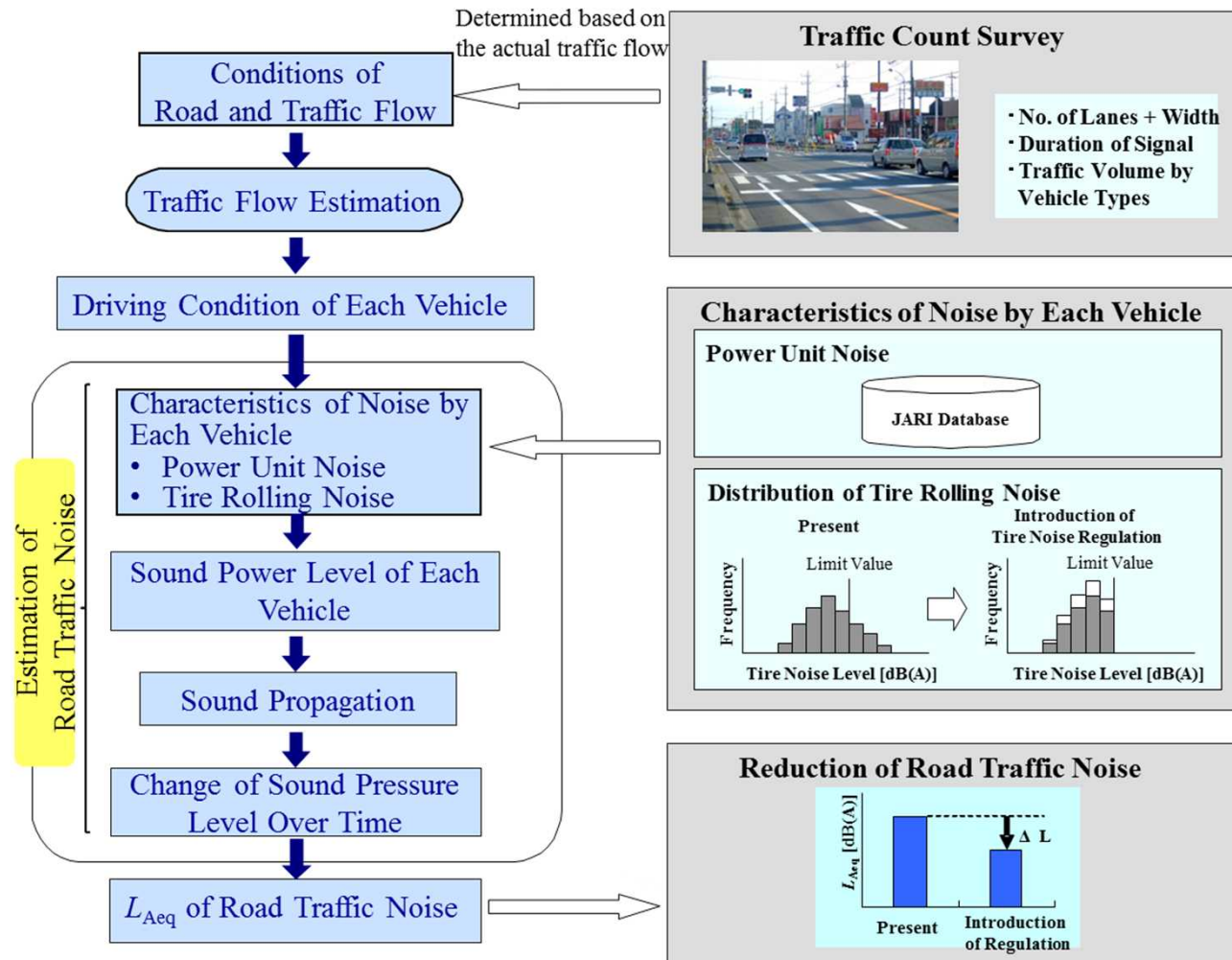
□ Discussion on the Limit Values

- It seems possible to reduce 1 or 2 dB of tire rolling noise by implementing technical measures that are currently in use or under development.
- On the other hand, it is difficult to reduce the level of tire rolling noise below ECE R117-02 limit values, as the current technical measures have trade-offs between noise and wet grip or rolling resistance.



## ◆ Evaluation of Environmental Effectiveness

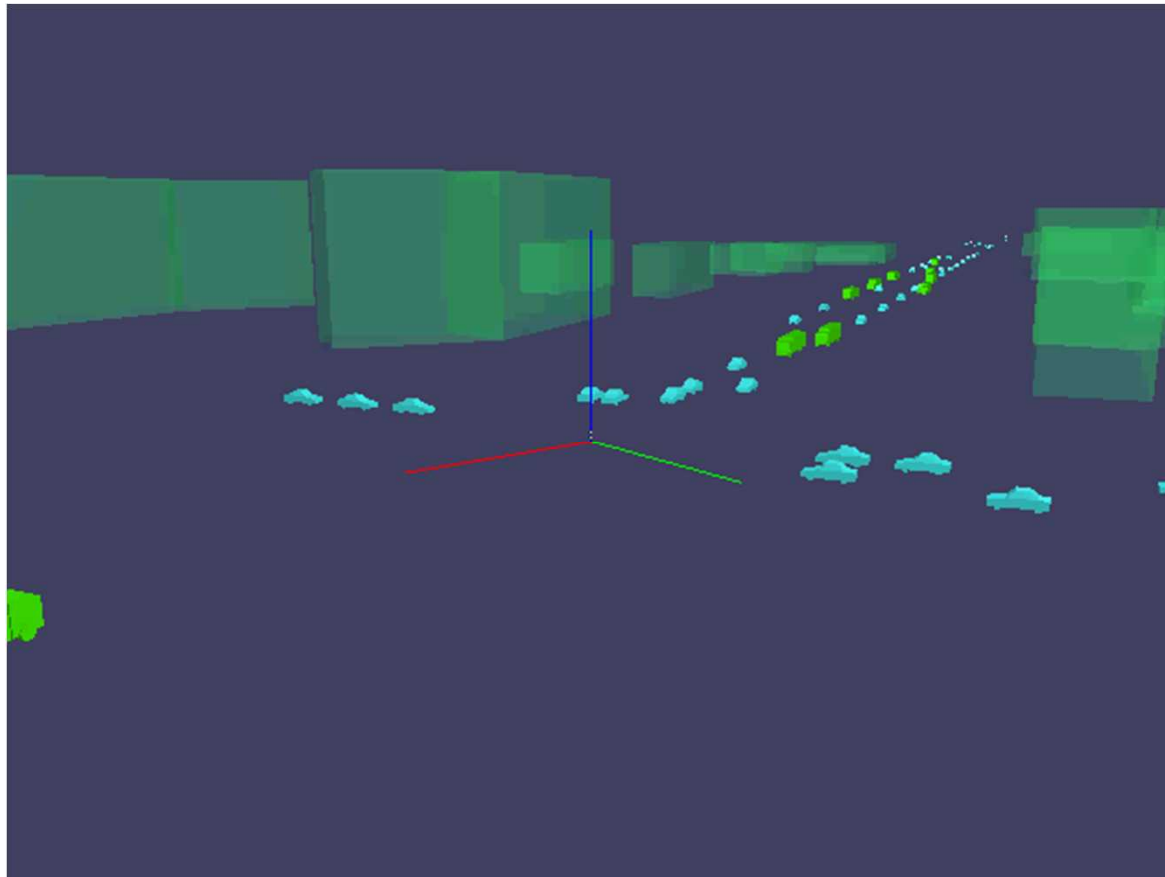
- The simulation using the Road Traffic Noise Prediction Model developed by Japan Automobile Research Institute (JARI) was conducted for the evaluation of effectiveness of the introduction of ECE R117-02. The findings indicated that the adoption of ECE R117-02 noise regulation would reduce **1.3 dB(A)** (equal to **26% reduction in traffic volume**) at maximum.



Flowchart of Simulation using JARI Road Traffic Noise Prediction Model

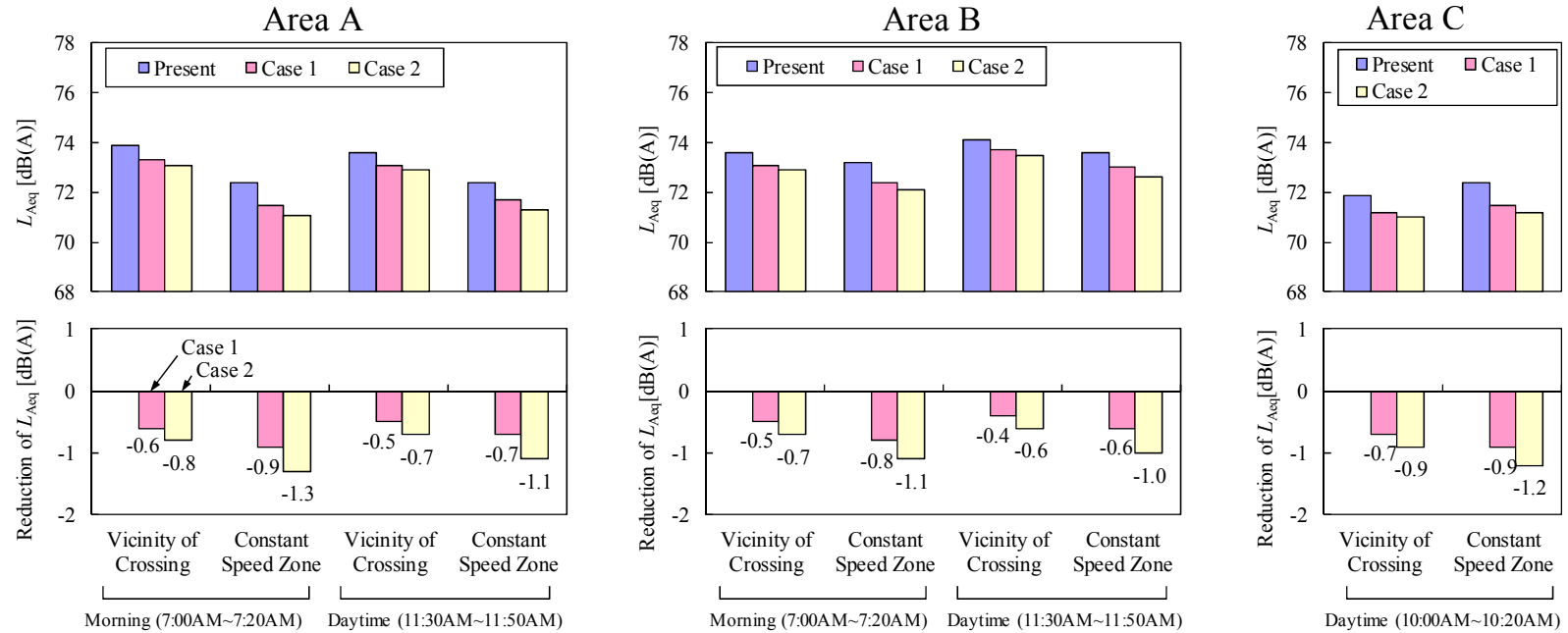
□ Road Traffic Noise Prediction Model (JARI)

- It uses Micro Traffic Flow Model, which simulates each vehicle driving every moment and enables to evaluate the situation of inconsistent traffic flow such as near crossing.
- It requires separate data on vehicle power-unit noise and tire rolling noise in order to estimate the influence of different noise sources on road traffic noise in case of the adoption of vehicle noise regulations.



Micro Traffic Flow Model (JARI )

# □ Estimation Result of Road Traffic Noise Simulation



		Vicinity of Crossing	Constant Speed Zone	Vicinity of Crossing	Constant Speed Zone	Vicinity of Crossing	Constant Speed Zone	Vicinity of Crossing	Constant Speed Zone	Vicinity of Crossing	Constant Speed Zone
Estimated $L_{Aeq}$ [dB(A)]	Present	73.9	72.4	73.6	72.4	73.6	73.2	74.1	73.6	71.9	72.4
	Case 1	73.3	71.5	73.1	71.7	73.1	72.4	73.7	73.0	71.2	71.5
	Case 2	73.1	71.1	72.9	71.3	72.9	72.1	73.5	72.6	71.0	71.2
Reduction of $L_{Aeq}$ [dB(A)]	Case 1	0.6	0.9	0.5	0.7	0.5	0.8	0.4	0.6	0.7	0.9
	Case 2	0.8	1.3	0.7	1.1	0.7	1.1	0.6	1.0	0.9	1.2

## 【Targeted Areas for Simulation】

- Area A: Urban and facing a national highway where the traffic volume is large and the sound pressure level is quite high
- Area B: Urban and facing a by-pass of national highway where vehicles can run at a constant speed despite the high traffic volume
- Area C: Urban and facing a national highway where the traffic volume is less than that of “Area A”

## 【Estimation of Tire Noise Level After Introduction of the Regulation】

- Case 1: Immediately after the entry-into-force of the regulation
- Case 2: Long time after the entry-into-force of the regulation

## ◆ Issues to be Addressed in the Future

### Timing for Implementation of the Regulation

- New tires that are coming into market in the next 3 – 5 years will be able to meet the noise regulation standard.
- However, in contrast to the existing regulations focusing on vehicle unit, the new regulation focuses on tires. Thus, the relevant ministries should examine in detail the regulatory method before determining the appropriate timing for implementation.

### Application of Regulation to Retreaded Tires

Although retreaded tires currently used for heavy duty trucks in Japan are excluded from the regulation for the time being, their widespread use is expected in the future and thus it is appropriate to consider the future application of noise regulation by examining the number of their use, the status of their noise emissions, etc.

### Introduction of Tire Noise Labeling

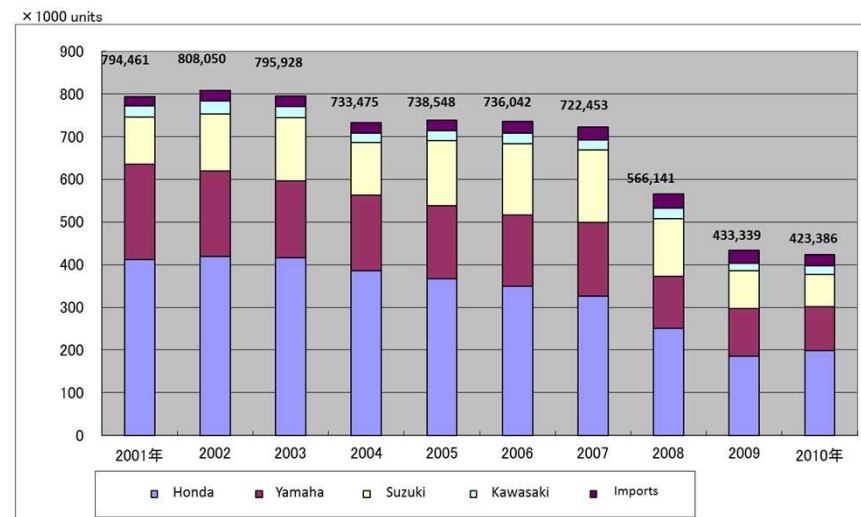
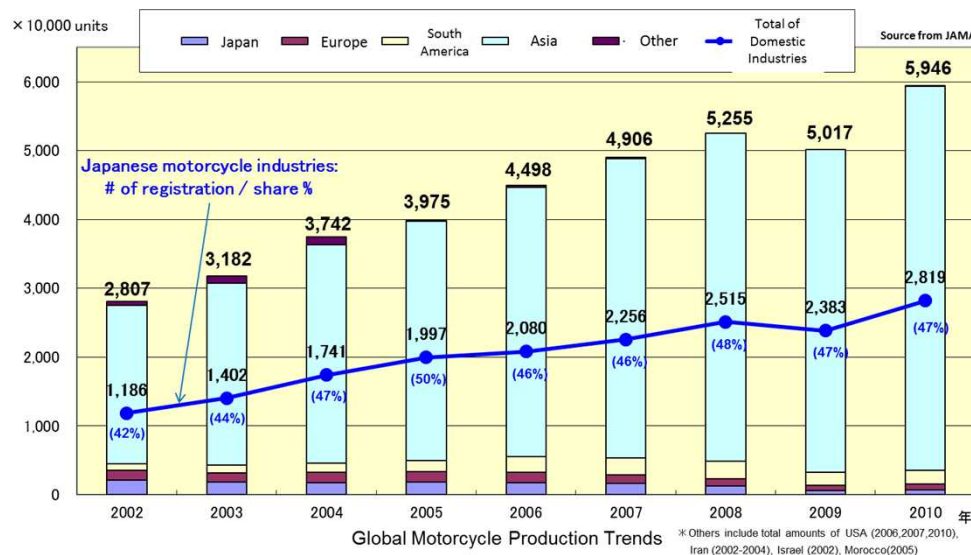
It is expected that the introduction of information regarding tire rolling noise would encourage consumers/vehicle users to choose lower noise emission tires as well as promote awareness of the importance of noise reduction.



# 4. Review of Motorcycle Noise Regulation

## ◆ Standpoints in Discussion of Motorcycle Noise Reduction Measures

- The basic regulatory noise test method has remained unchanged since 1971 for the acceleration noise, while the driving conditions for motor vehicles and the status of their noise emissions have improved over time along with engine power, etc.
- In some vehicles with electronically-controlled engines, it is possible that noise emissions increase rapidly under normal driving conditions although the vehicles passed the noise test.
- Instead of developing products exclusively for the domestic market and meeting more stringent noise regulation while the market itself is decline, harmonization with ECE R41-04 is one of the ways to help mitigate development costs.



Motorcycle sales in Japan

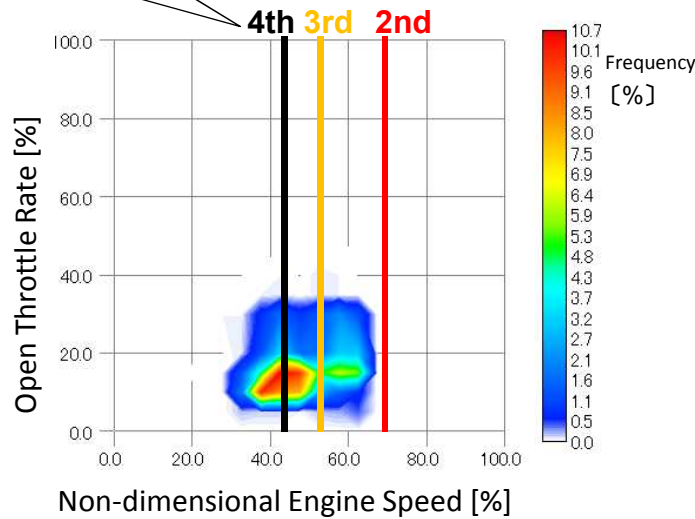
Source from JAMA

# ◆ Comparison between New Acceleration Test Method (ISO 362-2) and Actual Driving Condition

To verify the validity of the current acceleration test method (so called TRIAS) and new method (ISO 362-2) in ECE R41-04, MOE conducted a survey of actual driving conditions of and the acceleration tests on motorcycle in urban area.

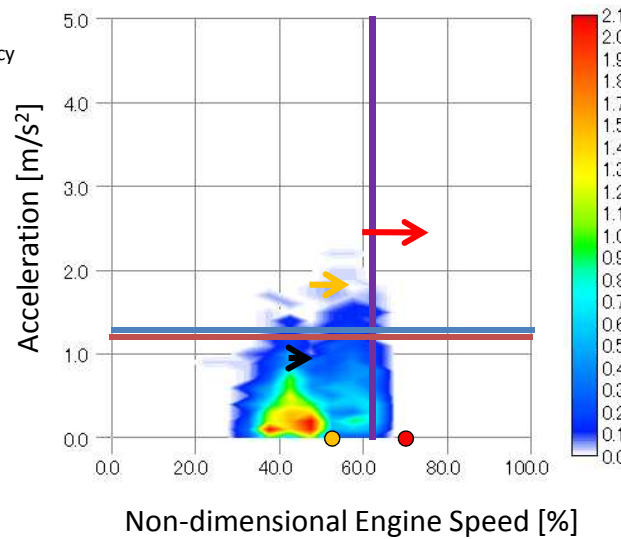
4th gear is selected in TRIAS

Result of the Survey (400 cc with 5MT, PMR=71.6[kW/t])



(Each line shows engine speed at 50 [km/h] with each gear.)

Distribution of Engine Speed and Open Throttle Rate in Urban Driving



Distribution of Engine Speed and Acceleration in Urban Driving

- TRIAS(4th)  
44.0-46.9%,0.92[m/s<sup>2</sup>]
- R41-04 acceleration(2nd)  
60.1-73.5%,2.45[m/s<sup>2</sup>]
- R41-04 acceleration(3rd)  
47.4-57.8%,1.78[m/s<sup>2</sup>]
- R41-04 cruise(2nd)  
69.1%,0[m/s<sup>2</sup>]
- R41-04 cruise(3rd)  
51.9%,0[m/s<sup>2</sup>]
- N<sub>95</sub> 62.6%
- α<sub>urban</sub> 1.18[m/s<sup>2</sup>]
- α<sub>95</sub> 1.23[m/s<sup>2</sup>]

Note : Analysis of Data of 45<V<55[km/h] and α>0[m/s<sup>2</sup>]

As ISO 362-2 is developed with driving data of countries including Japan, the following results were obtained from the comparison with domestic driving conditions:

- Compared to TRIAS, the ISO 362-2 test speed is closer to the one that is frequently used in the actual driving in Japan.
- In the case of Class 2 and 3 motorcycles, WOT acceleration used in TRIAS deviates greatly from acceleration in the actual driving. On the other hand, the ISO 362-2 targeted acceleration is appropriate for the upper limit of acceleration used in the actual driving.
- For manual-transmission motorcycles due to ISO 362-2 reference WOT acceleration, a lower gear among others used in the actual driving is selected.

ISO 362-2 Test Conditions

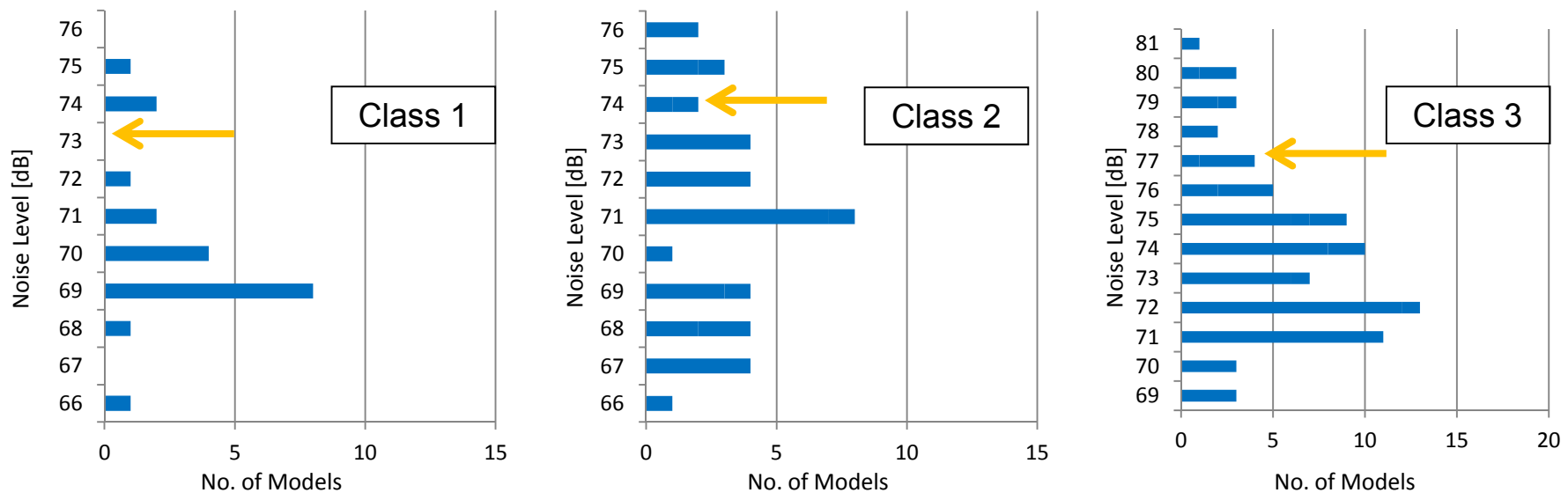
Vehicle Classification			Speed	Test Weight	Acceleration	$\alpha$ urban	$\alpha$ wot ref
Motor cycles	Class 1	$PMR \leq 25$	40 [km/h] (PP')	Vehicle Weight +75kg	WOT	-	-
	Class 2	$25 < PMR \leq 50$			Urban Acceleration	$1.37 \log(PMR) - 1.08$	$2.47 \log(PMR) - 2.52$
	Class 3	$PMR > 50$	$1.28 \log(PMR) - 1.19$			$3.33 \log(PMR) - 4.16$	

TRIAS Test Conditions (Reference)

Vehicle Classification	Speed	Acceleration	Test Weight	Gear Selection
$cc \leq 50$	25 [km/h] or 3/4S (AA')	WOT	GVW	(For MT) Up to 3 gears: 2nd 4 gears: 3rd 5 gears or more: 4th
$50 < cc \leq 250$	40 [km/h] or 3/4S (AA')			
$250 < cc$	50 [km/h] or 3/4S (AA')			

## ◆ Targeted Maximum Permissible Limits in the New Acceleration Noise Regulation

- Among the motorcycles sold in Japan, there are some vehicles whose  $L_{urban}$  exceeds ECE R41-04 limit values (Class 1: 73dB / Class 2: 74dB / Class 3: 77dB), and a majority of such vehicles are domestically not type-approved(imports). It is expected that they have a potential to reduce their noise emissions to around ECE R41-04 limit values but not further, due to technical and/or productivity reasons.
- The regulatory limits for non-type-approved motorcycles have been relaxed under the current regulation, compared to type-approved motorcycles. Hence, the harmonization with ECE R41-04 can strengthen the noise regulation for these non-type-approved motorcycles.

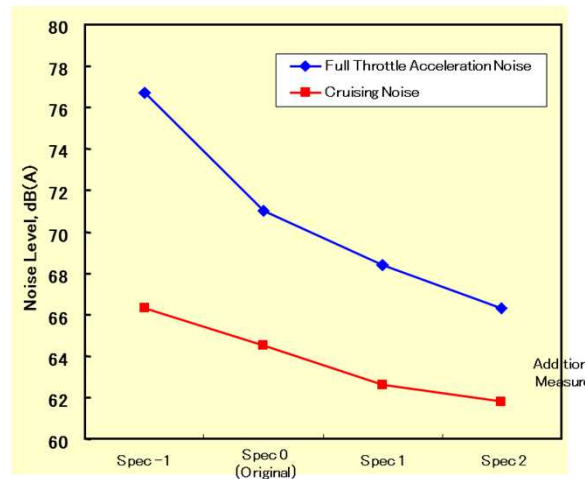
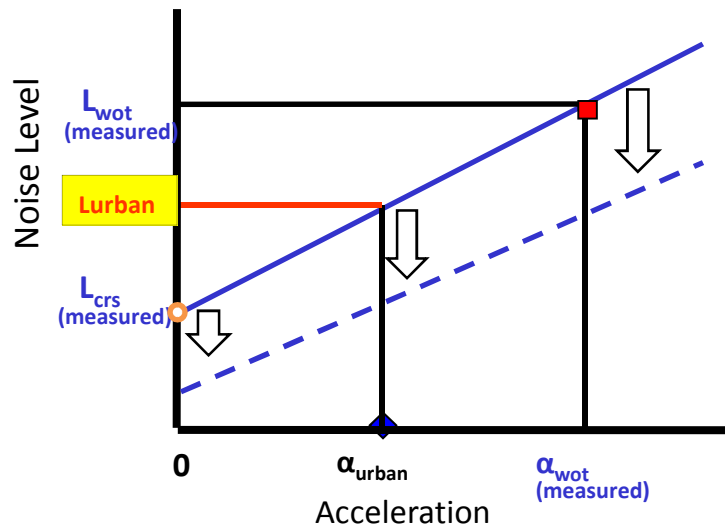


Database of Acceleration Noise Level of Motorcycles Sold in Japan

( ← ECE R41-04 Limits)

## ◆ Abolition of Cruising Noise Regulation for Motorcycles

- Under ISO 362-2,  $L_{wot}$  and  $L_{crs}$  are measured to calculate  $L_{urban}$  by linear interpolation for evaluation of noise emissions. Therefore, it is necessary to reduce both  $L_{wot}$  and  $L_{crs}$  in order to reduce  $L_{urban}$ .
- As a result of a survey, it was found that the effect of reduction in both acceleration noise and cruising noise was almost the same, assuming the measures for reducing noise from power unit and power train were adopted. In addition, tire noise emissions from motorcycles are found negligible.
- For rationalizing the regulatory procedures, it is considered appropriate to abolish the cruising noise regulation for motorcycles.



Noise Reduction Measures for Each Specs

Specs	Engine Noise	Intake / Exhaust Noise	Drive Chain Noise
Spec -1	-	-	Normal Chain
Spec 0 (Original)	-	Reduction of Area of Intake or Exhaust Pipes	Silent Chain
Spec 1	Acoustic shield with sound insulating material for both sides of engine	Large-sized Muffler	Chain Cover
Spec 2	Acoustic Shield with Sound Insulating Material for the Entire Engine	Large-sized Muffler	Chain Cover

Comparison Between Acceleration and Cruising Noise of Motorcycles

Source: JAMA

## 5. Issues to be Addressed in the Future

### ◆ Future Policy for Vehicle Noise Reduction

#### (1) Review of Noise Regulation for Four-Wheeled Vehicles

- Similar to noise emissions from motorcycles, the test conditions of the current acceleration noise testing method for four-wheeled vehicles may differ from the actual driving conditions and the actual noise emissions in Japan.
- Japan has participated in the discussion on ECE R51-03 in the Working Party on Noise (GRB), and is in consideration of adopting a revised ECE R51-03.
- In order to adopt the regulation on tire noise, which contribution to the cruising noise emission is high, Japan should also consider abolishing the current cruising noise regulation upon the adoption of ECE R51-03 for rationalizing the regulatory procedures.

#### (2) Review of Advance Certification System for Replacement Mufflers

The current acceleration noise testing method used needs to be replaced with ISO 362-2, as well as the upper noise limits be reviewed.

#### (3) Review of Stationary Noise Regulation

Certain targeted maximum permissible limits at absolute values are specified for each vehicle class. For prevention of discrepancy of noise levels between the new vehicle test score and the actual use, a regulation using relative values should be considered.

## ◆ The Future Policy Measures for Road Traffic Noise Reduction

- Automobile manufacturers, road administrators, law enforcement agency, transport business operators, and environmental departments and bureaus of national and local governments have promoted comprehensive measures for achievement of the Environmental Quality Standards (EQSs) for Noise, including vehicle units, structural improvements, traffic stream management, and measures for roadside environment.
- Although the achievement rate of EQSs for Noise is in moderate improvement as a whole, the condition remains severe in areas adjacent to urban expressways and national highways and the number of complaints over vehicle noise is hardly reduced.
- Upon 10th anniversary of the implementation of EQSs for Noise, the Ministry of the Environment, together with relevant ministries and agencies, have put together “the Future Policy Measures for Road Traffic Noise Reduction” in June 2009, describing measures to be implemented as well as topics to be discussed in the future including vehicle unit regulation.

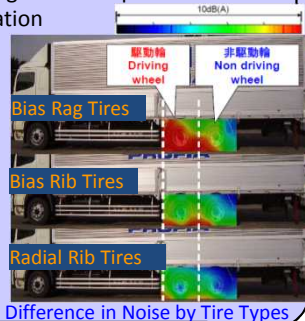
## Measures to be Implemented

### 1. Measures at Sound Source

- ① Review on Regulatory Methods
  - Implementation of Advance Certification System for Replacement Mufflers
  - Consideration of revising the noise regulatory methods, incl. test methods
  - Consideration of Tire Rolling Noise Regulation
- ② Promotion of Low-Emission Vehicles (LEVs)
  - Promotion of technological development on LEVs by national/local governments & public organizations
  - Financial aids
  - Public awareness



Electric Vehicle



### 2. Traffic Stream Management

- ① Installation/Improvement of Road Networks
- ② Reduction in Traffic Volume
  - Promotion of the use of public transportation (urban trains/buses/traffic junctions)
  - Improvement in distribution functions (establishment of urban distribution centers/ use of domestic vessels)
- ③ Traffic Control & Others
  - Promotion of Intelligent Transport Systems (ITS)
  - Dissemination of useful traffic information to drivers
  - Restriction of tracks to inner lanes for noise mitigation
  - Control on speeding, overloading, & poor maintenance



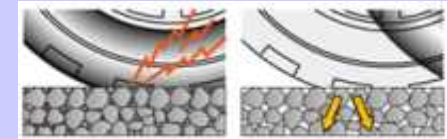
Promotion of the Use of Public Transportation

### 3. Structural Improvement

- Construction of Noise Reduction Pavement
- Implementation of Noise Barriers, Environmental Facility Zones & Planting Giving Consideration to Local Needs
- Comprehensive Measures for Viaducts (implementation of continuous girder or connection of discontinuous girders, installation of sound absorber panels, etc.)



Noise Barriers



Noise Reduction Pavement

### 4. Measures for Roadside Environment

- ① Inducement for Proper Land Use of the Space Adjacent to Road Carrying Arterial Traffic
- ② Use of Land Readjustment Projects & Urban Redevelopment Projects
- ③ Promotion of Implementation of Roadside District Plans & Roadside District Improvement Plans
- ④ Conversion of Urban Structure



Inducement for Proper Land Use

### 5. Others

- ① Public Awareness
  - Promotion of Eco-Driving
  - Promotion of the Use of Public Transportation
- ② Progress Control of the Automobile NOx/PM Reduction Law
- ③ Constant Monitoring of Automobile Traffic Noise



Promotion of Eco-Driving

## Research Agenda Necessary for Promotion of Future Implementation

- Automobile Noise Reduction Technology
- Promotion of Measures for Effective & Efficient Use of Public Transportation
- Promotion of Technological Development & Research on Measures for Road Structure
- Enhancement of Measures for Roadside Environment

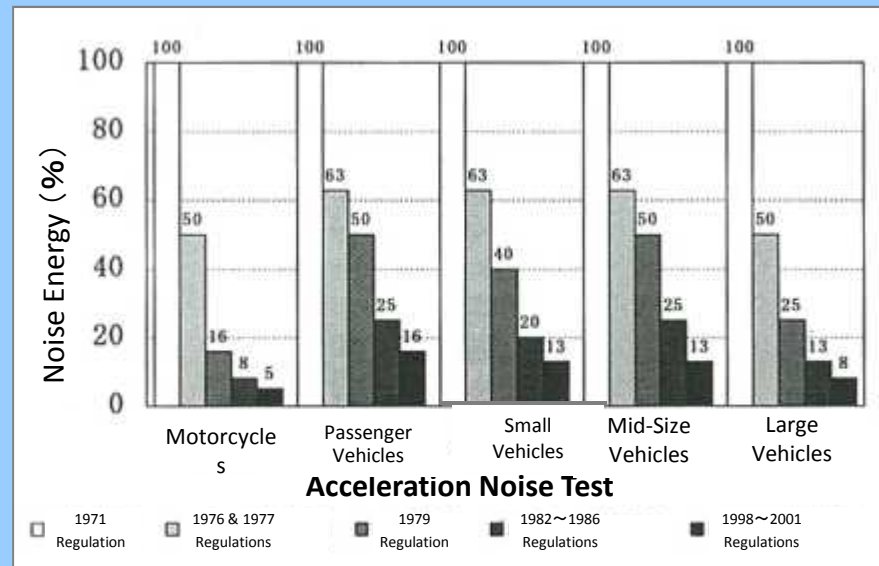
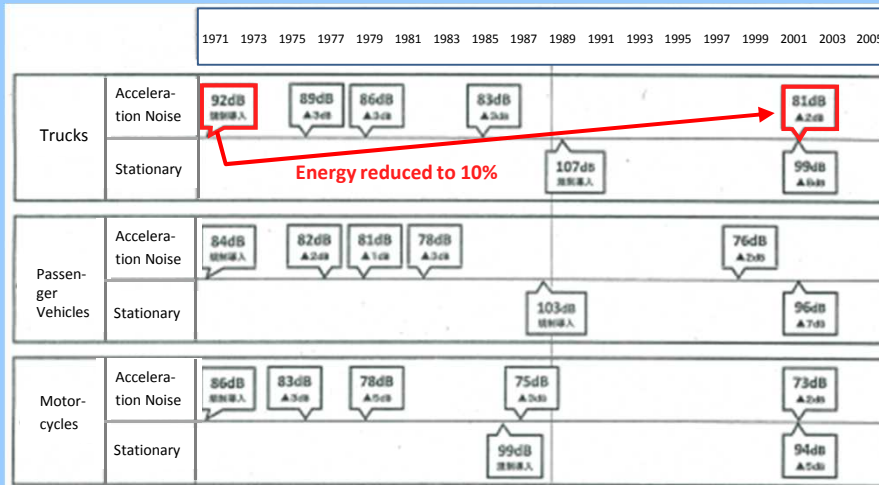
## The Future Policy for Motor Vehicle Noise Reduction



# ◆ Measures Implemented for Road Traffic Noise Reduction (Reference)

## (1) Measures at Sound Source

### ■ Strengthening of Automobile Noise Regulation



## (2) Measures for Traffic Stream

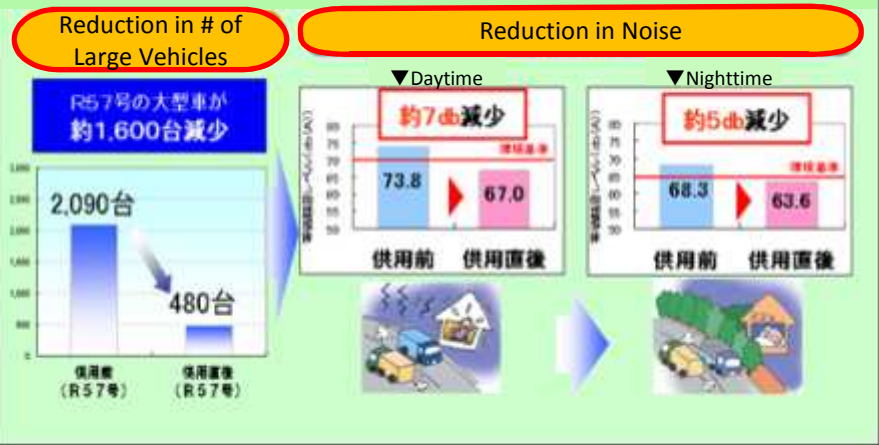
### ■ Installation & Improvement of Road Networks

[Case: Naka-Kyushu Crossing Hwy & Inukai-Chitose Bypass of National Highway Route 57]

Since the Inukai-Chitose Bypass opened for service, 70% of traffic on National Hwy Route 57 was transferred & the number of large trucks was reduced in about 1,600. As a result, the traffic noise dropped about 5-7dB & EQs for Noise was achieved.

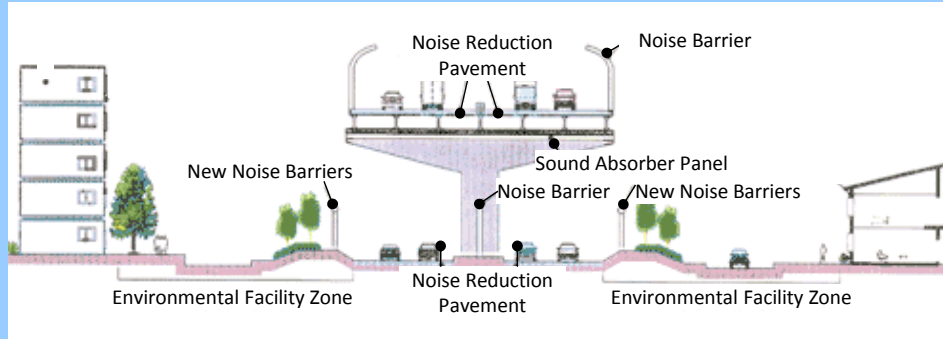


### ● Reduction in Both Entry of Large Vehicles & Corresponding Noise



### (3) Structural Improvement

#### Construction of Noise Reduction Pavement & Noise Barriers



[Case: Fukushima West Bypass of National Highway Route 13]

- Nighttime EQSs for Noise (65 dB) was exceeded in residential areas adjacent to Fukushima West Bypass of National Hwy Route 13.
- Transparent noise barriers were installed for prevention of blocking visibility of the entrance as well as spoiling the scenery.
- After installation, noise was reduced more than 3-5 dB at the road demarcation.
- About 70% of residents were happy about the installation of noise barriers, according to the questionnaire.

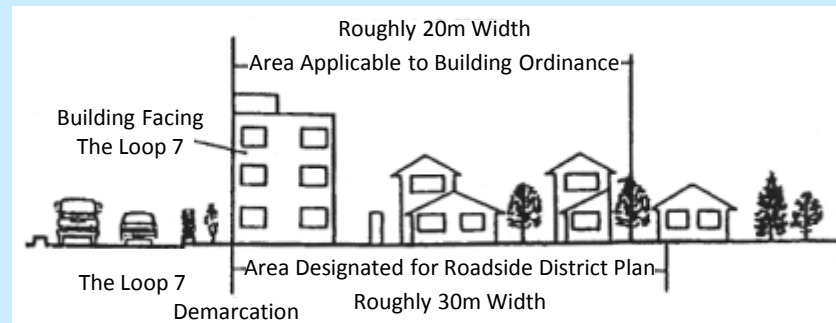


### (4) Measures for Roadside Environment

#### Roadside District Plans

- Prevention of road traffic noise & promotion of installation of the soundproofing system in residences through proper land use management of areas adjacent to the Loop 7.

[Case: Roadside District Plan for the Loop 7 in Kita Ward]



### (5) Others

#### Public Awareness



# □ Influence of Textures of Road Pavement on Noise

**Dense asphalt concrete**



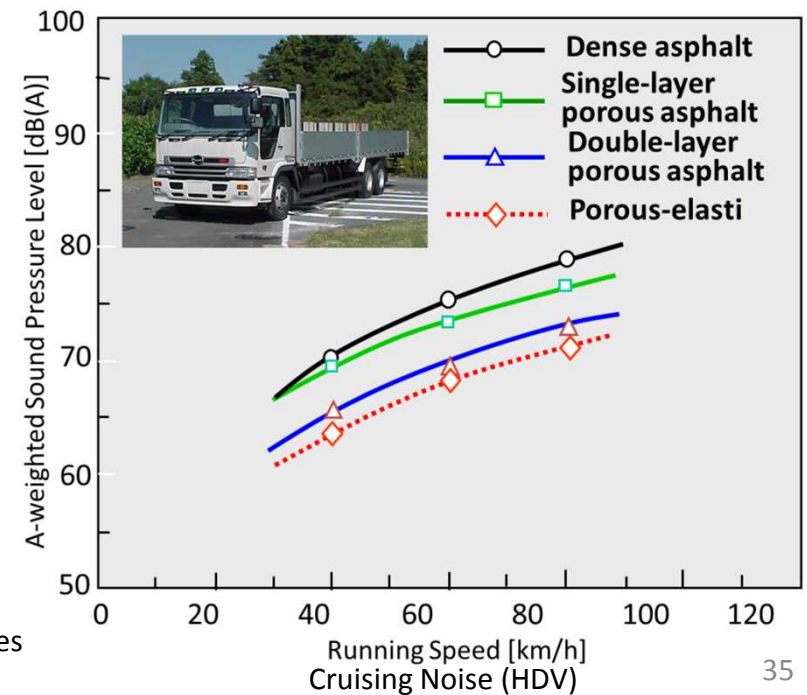
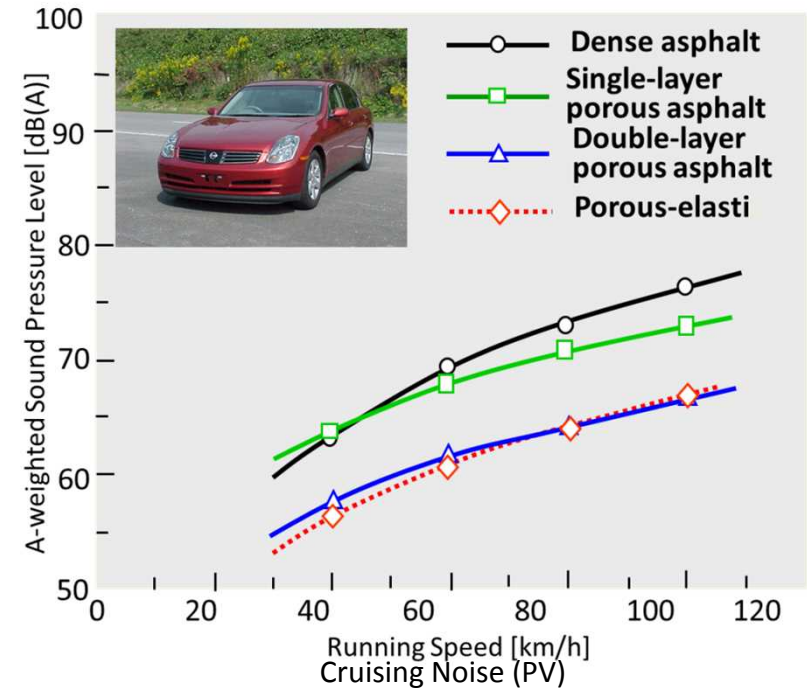
**Porous asphalt concrete**  
Single-layered Double-layered



**Porous elastic road surface**



Textures of the Test Road Pavements



Source: Y. Oshino and H. Tachibana, "Combined effects of noise reduction measures of road vehicles, tires and pavements", Proceedings of Euro Noise 2003 (2003)

# Thank you !



Ministry of the Environment, JAPAN