Informal document No. 9
(48th GRRF, 11-13 September 2000,
Agenda Item 6.1)

Japanese position on the Proposal for a new draft regulation: Uniform provision concerning the approval of wheels for passenger cars and their trailers

Submitted by Japan

Comments from Japan based upon the contents of the latest proposal TRANS/WP.29/GRRF/1998/19.Rev.1 dated 3 August 2000 will be submitted as an informal document.

A. Proposal

Paragraph 2.8.(e) 5/ Amend to read

5/ JATMA, NO.33 MORI BLDG. , 8TH FLOOR 3-8-21 TORANOMON, MINATO-KU, TOKYO, JAPAN, 105-0001".

Paragraph 3.1.2.3, 3.1.2.5, and 3.1.2.7 should be deleted and renumbering as follows

3.1.2.1. rim contour designation - wheel inset - wheel attachments;
3.1.2.2. mounting torquing of studs and nuts;
3.1.2.3. International Standard of reference;
3.1.2.4. suitable valves types;
3.1.2.5. max load capacity;
3.1.2.6. max inflation pressure.

Paragraph 5.1.2.1.1. Amend to read

5.1.2.1.1. Rim size designation formed of:
rim contour designation
nominal rim diameter
the symbol "x" ~~if one piece rim~~ (as a separator between rim contour and rim diameter)
~~the symbol " " if multipiece rim~~
~~letter "A" if well located asymmetrically~~
~~the letter "S" if well located symmetrically~~
hump contour designation (s) optionally

Paragraph 5.1.3. Amend to read

5.1.3. the wheel inset; (only for Aluminium and Magnesium wheel)

Paragraph 6.3 should be deleted and renumbering as follows

~~6.3 Wheel type construction materials shall be analysed according to annex 4.~~

6.~~3~~4. The wheels shall pass without any faults the following tests:

6.~~3~~4.1. Steel wheels

6.**3~~4~~**.1.1. Disc wheels

For this kind of wheels the following tests are requested:

(a) Rotating bending test as per annex **5~~6~~**;
(b) Rolling test as per annex **6~~7~~**.

6.**3~~4~~**.2. Aluminium alloy wheels

6.**3~~4~~**.2.1. One piece wheels

For this kind of wheels the following tests are requested:

(a) Corrosion test as per annex 5. If the process within a production line is always the same, only one representative test is to be carried out.
(b) Rotating bending test as per annex **5~~6~~**;
(c) Rolling test as per annex **6~~7~~**. This test is not required for cast wheel without any other forming additional operation;
(d) Impact test as per annex **7~~8~~**.
(e) Alternate torquing test as per annex **8~~9~~**. If the wheel design (small cross section area between spoke and rim and small number of spokes) makes necessary that test.

6.**3~~4~~**.2.2. Demountable rim wheels

For this kind of wheels the following tests are requested:

(a) Rotating bending test as per annex **5~~6~~**;
(b) Rolling test as per annex **6~~7~~**;
(c) Impact test as per annex **7~~8~~**;
(d) Alternate torquing test as per annex **8~~9~~**.

6.**3~~4~~**.3. Magnesium alloy wheels

6.**3~~4~~**.3.1. One piece wheels

For this kind of wheels the following tests are requested:

(a) Corrosion test as per annex **4~~5~~**;
(b) Rotating bending test as per annex **5~~6~~**;
(c) Rolling test as per annex **6~~7~~**;
(d) Impact test as per annex **7~~8~~**.

6.**3~~4~~**.3.2. Demountable rim wheels

For this kind of wheels the followings tests are requested:

(a) Corrosion test as per annex **4~~5~~**;
(b) Rotating bending test as per annex **5~~6~~**;
(c) Rolling test as per annex **6~~7~~**;
(d) Impact test as per annex **7~~8~~**.
(e) Alternate torquing test as per annex **8~~9~~**.

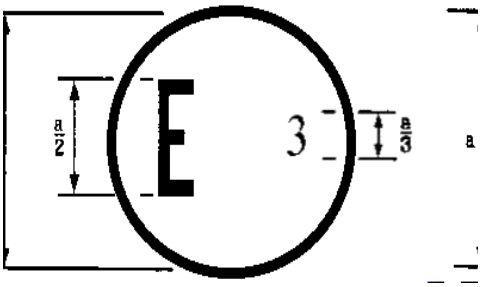
6.**4~~5~~**. Alternative test procedures to those describes in annexes 5 to **8~~10~~** are allowed if the reliability is demonstrated.

6.**5~~6~~**. Where a wheel manufacturer submits application for type approval for a range of wheels, it is not considered necessary to carry out all tests on every type of wheels in the range. Worst case selection may be made at the discretion of the approval authority.

Annex 2. Amend to read

Annex 2

ARRANGEMENT OF THE APROVAL MARK



XY R - 0001148 }a/3 XY R - 0001148 }a/3

a = 9 mm min.

The wheel bearing the above approval mark has been approved in Italy (E3) under approval number 0001148. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. XY in its original form.

The marking of approval mark, approval number and Regulation No. may be at a distance from each other.

Annex 3. Amend to read

Annex 3

ARRANGEMENT OF THE WHEEL MARKINGS

Example of markings which shall be apposed on a wheel conforming to this Regulation:

ABCDE 5 ½ J x 14 FH 36 01 99 ab123

This example of marking defines a wheel:

manufactured by ABCDE
having a rim contour designation (5½ J)
~~**having a one-piece structure**~~ **a separator between rim contour and rim diameter** (x)
having a nominal rim diameter (14)
~~**having a non-symmetrical location of the well (no mark)**~~
having a flat hump configuration of the bead-seat area on one side only (FH) – optional marking
having a wheel inset of 36 mm **(only for Aluminium and Magnesium wheel)**
manufactured in January 1999 (0199)
the manufacturer's part number code (ab123)

the rim designation shall include in the order the rim contour designation, ~~**the structure,**~~ the nominal rim diameter~~**, the location of the well**~~ and the bead-seat configuration, as in the example 5½ J x 14 FH. It is allowed also to follow the inverse order for the first three elements as in the example 14 x 5½ J FH.

The marking of the wheel inset and of the date of production may be at a distance from the rim designation.

The marking of the date of production can be indicated by a code system as shown in the following example.
Example;
The number of 1 to 12 and zero are indicated by alphabets as shown in the table below.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**0**
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**

According this code system, the date of January 1999 can be indicated by "AII". (The first letter "A" represents January and the second and third letters "II" mean "99".)

Annex 4 should be deleted

~~Annex 4~~

~~MATERIAL TEST~~

~~The following metallurgic analysis shall be documented:~~

~~Material~~	~~Tests~~
~~Aluminium alloy~~	~~a, c, e~~
~~Magnesium alloy~~	~~a, c, e~~
~~Steel~~	~~a, b, d~~

~~(a) Chemical analysis of the raw material.~~

~~(b) Check of the following mechanical characteristics ($R_{p0,2}$, R_m, and A) relevant to raw materials:~~

~~- percentage elongation after fracture (A) : Permanent elongation of the gauge length after fracture ($L_u - L_o$), expressed as a percentage of the original length (L_o).~~

~~Where~~

~~original gauge length (L_o) : Gauge length before application of force.~~

~~final gauge length (L_u) : Gauge length after rupture of the test piece.~~

~~- proof strength, non proportional extension (R_p) : Stress at which a non proportional extension is equal to a specified percentage of the extensometer gauge length (L_e). The symbol used is followed by a suffix giving the prescribed percentage of the extensometer gauge length, for example: $R_{p0,2}$.~~

~~tensile strength (R_m) : Stress corresponding to the maximum force (F_m).~~

~~(c) Check of the mechanical characteristics ($R_{p0,2}$, R_m, and A) of test pieces taken in hub coupling area and in the disc rim transition area or in the failure zone if any.~~

~~(d) Analysis of the metallurgic defects and of the raw material structure.~~

~~(e) Analysis of the metallurgic defects and of the test pieces structure taken out in the hub coupling area and in the disc rim transition area or in the failure zone if any.~~

Annex 5 Amend to read:

Annex ~~4~~5

CORROSION TEST

1. Carry out a salt-spray test as per ISO 9227 for 384 hours.

1.1. Sample preparation

A painted sample, taken out by mass-production, shall be damaged by a cross engraving and artificial stones falling (ISO 565) in damaging situations during the normal usage of vehicle (rim flange and drop inside the wheel).

1.2. Test development

The sample pre-treated but not modified shall pass a salt-spray test, this means that the sample and its components which could cause a contact corrosion are put in erect position into the salt-spray test box. Wheel is turned of 90° every 48 hours.

1.3. Evaluation

The single manufacture measurements which can slow down the corrosion are evaluated (covers, screws / zinc or cadmium bushes alloy, insulating covers. etc.).

To the test documentation shall be enclosed photos showing the main corrosion points which have been mechanically washed in order to define the material defects.

After a test length of 192 hours, remarkable corrosion problems shall not occur at all. After a salt-spray test length of 384 hours the wheel functionality, the mounting components and the tyre seat shall not be compromised. This shall be documented by a rotating bending test as per annex 6 or by a rolling test as per annex 7, depending of where the corrosion problems take place.

_____

Annex 6 Amend to read:

Annex ~~5~~**6**

ROTATING BENDING TEST

1. Rotating bending test execution

During the rotating bending test, lateral forces acting on wheel in driving curve are simulated. In order to prove that the resistance is sufficient, it is necessary test two wheels for ~~each value percentage (50 per cent and 75 per cent)~~ **100 per cent** of the max moment. The rim wheel is fixed rigidly on the test bench, and the wheel is stressed with a bending torque M_b applied to the hub coupling area (i.e. through a loading arm with flange having the same pitch circle diameter of the foreseen vehicle). ~~The light alloy wheels are fixed to the internal rim side through two semicircular flanges.~~

Should other fixing devices be used, it is necessary to prove that they have the same efficacy .

Screws or fixing nuts are tightened to the torque stated by the vehicle manufacturing company and retightened after 10,000 cycles approximately.

1.1. Formula for the bending moment calculation

Cars and off-the-road ones : $M_{bmaX} = S * F_V (\mu * r_{sta} + d)$

M_{bmaX} = reference moment of load [Nm]
F_V = wheel maximum load capacity [N]
r_{sta} = **static radius** ~~dynamic radius~~ of biggest tyre foreseen [m]
d = inset [m]
μ = coefficient of friction
S = coefficient of safety

1.2. The test is carried out with ~~two percentage values (50 per cent and 75 per cent)~~ 100 per cent of the max moment and on the basis of the following standards

Coefficient of friction	**0.7** ~~0,9~~
Coefficient of safety	**1.5** ~~2,0~~
Nominal cycles per minute	The number of cycles per minute shall be the highest ~~than~~ possible but out of the testing rig resonance frequency.

	Aluminium / Magnesium		Steel	
	M1 and M1G	O1 and O2	M1 and M1G	O1 and O2
Min cycles with ~~75~~ **100** per cent M_{bmaX}	**$1,0*10^5$**	$0,66*10^5$	**$2,0 * 10^4$**	$2,0*10^4$
~~Min cycles with 50 per cent M_{bmaX}~~	~~$1,8*10^6$~~	~~$0,60*10^6$~~	~~$6,0*10^5$~~	~~$2,3*10^5$~~
Specifications of evaluations	**Technical cracks are not accepted.**		**Shaft displacement of 10 per cent when compared to the displacement measured after approximately 10,000 cycles.** ~~Technical cracks are not accepted.~~	
Allowable torquing moment loss	Maximum 30 per cent			

1.3. Test schedule for same wheels' types

Wheels of the same type (paragraph 2.2.) with different inset values can be grouped having as testing moment the highest one, and taking as reference the following test schedule.

Wheel versions having a bigger pilot hole shall be included in the test. Should one of the tests have a negative result, amended samples shall be required.

Necessary tests:

wheels to be tested	Rotating bending test	
	Short test	~~Long test~~
Minimum PCD	1	~~1~~
Maximum PCD	1	~~1~~
Inset variations up to 2 mm	--	--
From 2 mm to 5 mm	1	--
> 5 mm	1	~~1~~

Tests to be carried out should the load increase subsequently

Test moment increase up to 10 per cent max.	1	~~1~~

Short test = rotating bending test with ~~75~~ 100 per cent of l M_{bmax} (calculated for the max wheel load)

~~Long test = rotating bending test with 50 per cent of M_{bmax}~~

Should the testing moment be increased of more ~~of~~ than 10 per cent, when compared to the first approval, the whole programme shall be repeated.

Annex 7 Amend to read:

Annex **6~~7~~**

ROLLING TEST

1. In the rolling test the stress on the wheel straight driving is simulated and takes place testing two wheels on the test rig with drum which shall have a minimum outside diameter of 1.7 m, in case of outside rolling, or a minimum internal diameter same of the dynamic radius of the tyre divided 0.4.

1.1. Formula for the calculation

All types of vehicles	$F_P = S * F_V$

F_P = testing load [N]
F_V = wheel maximum load capacity
S = coefficient of security

1.2. Tests are carried out on the basis of the following specifications:

	M1 and M1G		O1 and O2
Rolling direction	Straight		
Coefficient of security f	**Aluminium/ Magnesium**	**2.25 ~~1~~/**	2.0
	Steel	**2.25**	
Tyres	Mass-production ones and if choosable, those with major nominal width		
Testing speed in km/h	The max allowed by the tyre (usually 60-100)		
Min cycles or Rolling distance	**Aluminium/ Magnesium**	**$5.0*10^5$ cycle**	2,000 km
	Steel	**$4.0*10^5$ cycle**	
Tyre pressure at test beginning (not limited during the test)	**Tyre pressure at Normal usage (kPa)**	**Tyre pressure at rolling test (kPa)**	
	Up to 160	**280**	
	161 to 280	**450**	
	281 to 450	**550**	
Evaluation parameters	Variance of the cylinder stroke or vibration level of 10 per cent. Compared to the value remarked after approximately 10,000 cycles. Technical cracks are not allowed.**2/** Air leakage is not accepted.		
Allowable loss of the torquing moment ~~2/~~1/	≤ 30 per cent		

~~1/ for passenger cars steel disc wheels~~

~~2~~1/ check through screw and mounting wheels nuts retightening (not through reloosening)

2/ For Aluminum and Magnesium wheels only.

Annex 8 Amend to read:

Annex 7~~8~~

IMPACT TEST

1. Impact test

Wheel strength to the breaks on edges and on critical points when it goes on an obstacle shall be checked. In order to show the sufficient strength to breaks it is necessary to carry out an impact test as per appendix 1.

1.1. Formula for the calculation

m = 0.6 W + 180

m = Striker mass (kg)

W = Maximum static wheel loading (kgf)

1.2. Tests are carried out on the basis of the following specifications

	M1 and M1G
Experimental structure	As per appendix 1
Tyre pressure	The tyre pressure foreseen by tyre manufacturing company is determined on the basis of the allowed load index per wheel and of the max vehicle speed, but at least 2 bar.
Tyres	Mass-production ones if the tyres are choosable those with minor nominal width or, if the nominal width is the same, those with minor rolling circumference
Parameters of evaluations	The test shall be considered positive in case there is no visible fracture penetrate throught the wheel surface and if there is not a total drop of pressure in a minute time. Breaks and strains caused by the direct contact with the falling weight are allowed.
Number of samples	No. 1 for each impact position
Impact positions	1. in the area connecting spokes to rim 2. in the are between two spokes, very closed to the valve hole If possible, the impact direction shall be between the radial direction of two fixing holes to the hub.

1.3. Tests schedule for wheels types

Tests necessary:

wheels to be tested	Impact test
Minimum PCD Maximum PCD	No. 1 for each impact position No. 1 for each impact position
Inset differences up to 15 mm > 15 mm	-- No. 1 for each impact position

Annex 9 Amend to read:

Annex 8~~9~~

ALTERNATE TORQUE TEST

In a constant oscillations test the torque moment acting on wheel during brake and acceleration are simulated. For each percentage value (50 per cent and 75 per cent) of the max. moment shall be tested two wheels. Each wheel flange is rigidly fixed on the test table and stressed through a M_T, torquing dynamic moment, introduced through the attachment face i.e. through the brake disc foreseen or through other components.

1. Formula for the calculation

$$M_T = S * F_V * r_{dyn}$$

Where:

M_T torquing dynamic moment [Nm]
S coefficient of security
F_V wheel maximum load capacity
r_{dyn} dynamic radius

Tests are carried out on the basis of the following parameters:

coefficient of safety f	1,0
Min number of cycle with M_T of 90 per cent	$2* 10^5$
Min number of cycle with M_T of 45 per cent	$2* 10^6$
Parameters of evaluation	Without technical cracks of radius loosening
Allowable loss of the torquing moment 1/	30 per cent

1/ test takes place through retightening (not through loosening) of the screws or wheel mounting nuts.

_____

Annex 8 Appendix 1 paragraph 3 Amend to read

3. CALIBRATION

Ensure, by means of a test calibration adapter, that the 1,000 kg mass (paragraph 2.3.) applied vertically to the centre of the wheel fixing as shown in figure 2 causes a deflection of 7,5 mm ± 0,75 mm when measured at the centre of the beam.

4. TEST PROCEDURE

4.1. Mount the test wheel (paragraph 2.1.) and tyre in the test machine (paragraph 2.2.) such that the impact loading is applied to the rim flange of the wheel. The wheel shall be mounted with its axis at an angle of 13° ± 1° to the vertical with its highest point presented to the striker.

Dimensions in millimetres

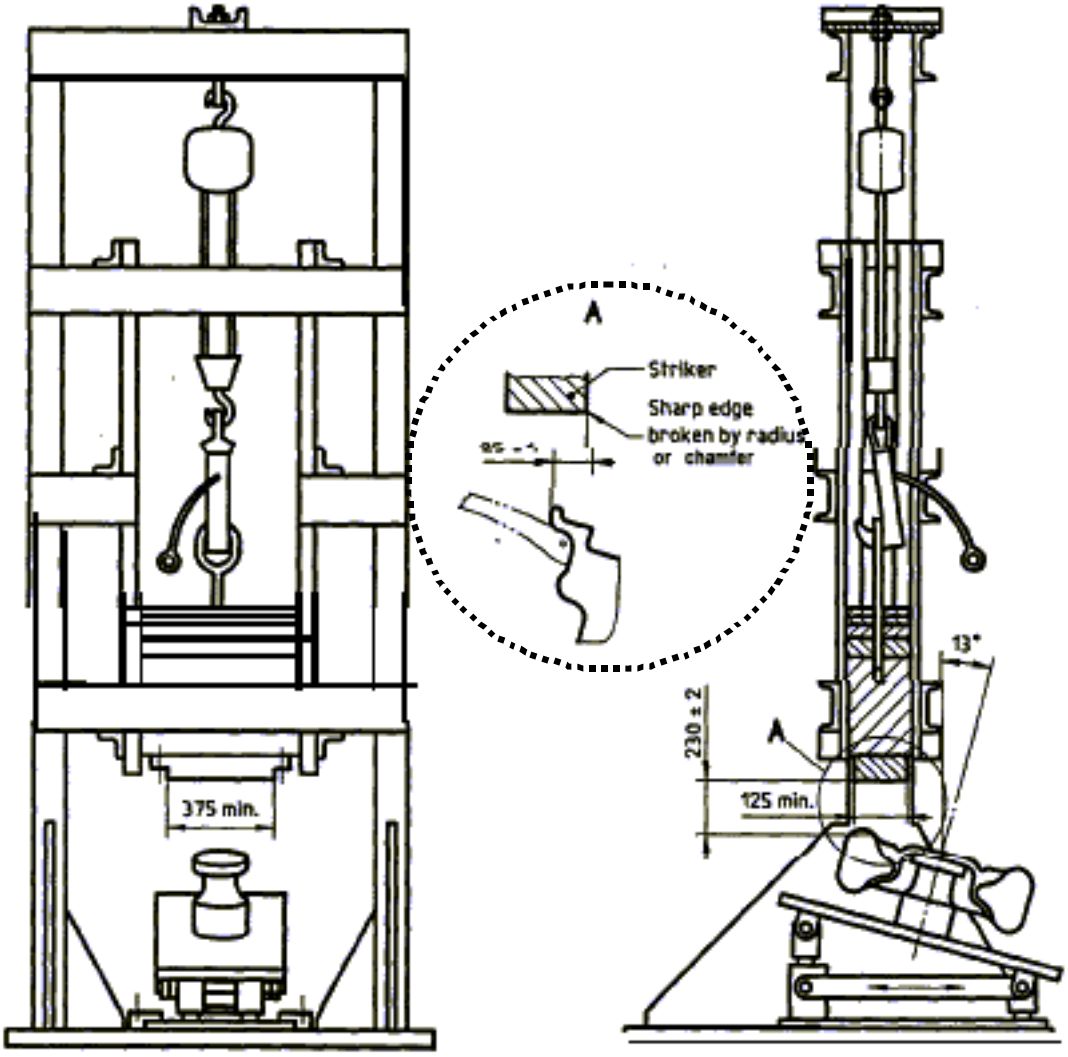
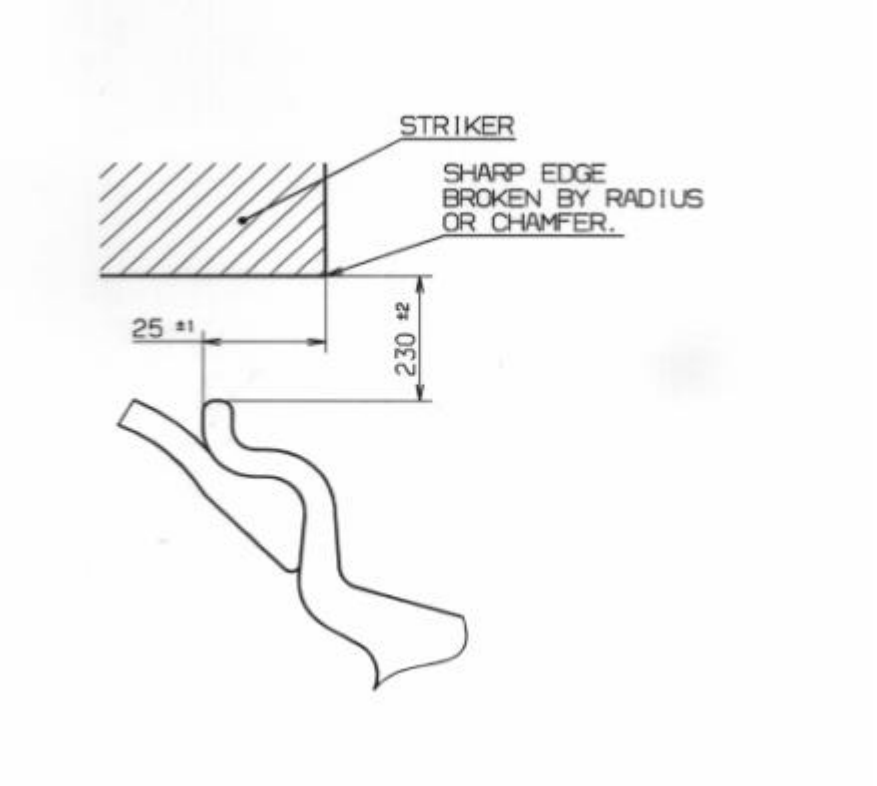


Figure 1 – Impact loading test machine

Detail A shown in Annex 8 Appendix 1 figure 1, correct as shown below:



B. Justification

Paragraph 3.1.2.3, 3.1.2.5, and 3.1.2.7:
Since wheel manufacturers cannot gain the information of the above three items, we would like them to be deleted from " Application for approval".

Paragraph 5, WHEEL MARKING:
In case of steel wheels varying inset can be gained with the same disc and rim. Therefore, we would like the inset designation of steel wheels to be omitted in order to enhance the common usage of discs and rims.

Paragraph 6.3 and Annex 4:
The material test is not necessary because the requirements as a wheel are evaluated by rotating bending test, rolling test and impact test.

Annex 2 ARRANGEMENT OF THE APPROVAL MARK:
Some wheel design might not give enough space to arrange the approval mark in one place.

Annex 6 ROTATING BENDING TEST,
Test method:
The proposed correction of (1) to (3) is referring to ISO3006 (Passenger car road wheels-Test method).

Requirements (Min. Cycles):
The requirement of light alloy wheels has been applied for about 20 years without any safety problems. The requirement of steel wheels is determined from the test data of those reliable steel wheels that have been used without any safety problems in Japan.

Annex 7 ROLLING TEST
1.2. "Evaluation parameters"
It was agreed at the third informal meeting.

1.2 Requirements (Min. Cycles):
The requirement of light alloy wheels has been applied for about 20 years without any safety problems. The requirement of steel wheels is determined from the test data of those reliable steel wheels that have been used without any safety problems in Japan.

1.2. Tyre pressure at test:
The proposed test value is referring to ISO3006 (Passenger car road wheels-Test method).

Annex 8 IMPACT TEST
1.1. Formula for the calculation,
These amendments are in accordance with Appendix 1.

*****