

## PROPOSED MOTORCYCLE BRAKES GTR - SUMMARY TABLE

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LAYOUT		PROPOSED CONTENT IN SUMMARISED FORM	NOTES + OUTSTANDING ACTIONS																					
1. SCOPE		<p>This GTR specifies the requirements for service brake and, where applicable, parking brake systems. It applies to vehicles in category 3 (two and three-wheeled vehicles) as summarised in the following table:</p> <table><tr><th colspan="2">CATEGORY</th><th>DESCRIPTION</th></tr><tr><td><i>Proposed: (from TRANS/ WP29/ 2004/25)</i></td><td><i>ECE R78 Reference:</i></td><td></td></tr><tr><td>3-1</td><td>L<sub>1</sub></td><td>2 wheels, engine &lt; 50cc and max speed &lt; 50 km/h</td></tr><tr><td>3-2</td><td>L<sub>2</sub></td><td>3 wheels, engine &lt; 50cc and max speed &lt; 50 km/h</td></tr><tr><td>3-3</td><td>L<sub>3</sub></td><td>2 wheels, engine &gt; 50 cc or max speed &gt; 50 km/h</td></tr><tr><td>3-4</td><td>L<sub>4</sub></td><td>3 wheels – asymmetric, engine &gt; 50 cc or max speed &gt; 50 km/h (motorcycle + sidecar)</td></tr><tr><td>3-5</td><td>L<sub>5</sub></td><td>3 wheels – symmetrical, engine &gt; 50 cc or max speed &gt;50 km/h .</td></tr></table> <p>Notes:</p> <ul style="list-style-type: none"><li>- Includes vehicles with electric power.</li><li>- Does not include vehicles with a V max. of &lt; [25 km/h], those equipped for invalid drivers, and those with a mass ≥ 1000 kg.</li></ul>	CATEGORY		DESCRIPTION	<i>Proposed: (from TRANS/ WP29/ 2004/25)</i>	<i>ECE R78 Reference:</i>		3-1	L <sub>1</sub>	2 wheels, engine < 50cc and max speed < 50 km/h	3-2	L <sub>2</sub>	3 wheels, engine < 50cc and max speed < 50 km/h	3-3	L <sub>3</sub>	2 wheels, engine > 50 cc or max speed > 50 km/h	3-4	L <sub>4</sub>	3 wheels – asymmetric, engine > 50 cc or max speed > 50 km/h (motorcycle + sidecar)	3-5	L <sub>5</sub>	3 wheels – symmetrical, engine > 50 cc or max speed >50 km/h .	<p>Vehicle classification <u>still under discussion in AC3</u>.</p> <p>Confirm low speed vehicle situation.</p>
		CATEGORY		DESCRIPTION																				
		<i>Proposed: (from TRANS/ WP29/ 2004/25)</i>	<i>ECE R78 Reference:</i>																					
		3-1	L <sub>1</sub>	2 wheels, engine < 50cc and max speed < 50 km/h																				
		3-2	L <sub>2</sub>	3 wheels, engine < 50cc and max speed < 50 km/h																				
		3-3	L <sub>3</sub>	2 wheels, engine > 50 cc or max speed > 50 km/h																				
		3-4	L <sub>4</sub>	3 wheels – asymmetric, engine > 50 cc or max speed > 50 km/h (motorcycle + sidecar)																				
		3-5	L <sub>5</sub>	3 wheels – symmetrical, engine > 50 cc or max speed >50 km/h .																				
2. DEFINITIONS		See draft GTR – Attachment 1	Being added to during GTR development																					
3. GENERAL REQUIREMENTS																								
3.1 Brake system requirements																								
	3.1.1	2 wheelers (3-1 + 3-3) shall have 2 separate service brake systems or a split service brake system – 1 brake operates on front wheel, 1 on rear.																						
	3.1.2	Category 3-4 (motorcycle + sidecar) shall be as 3.1.1. A sidecar brake is not required if the performance requirements can be met.																						
	3.1.3	3 wheelers (3-2) shall have: - a parking brake - 2 service brake systems (or split service braking) which brakes all wheels OR - a service brake system that operates on all wheels ( <u>other than a split service brake system</u> ) and a secondary brake system that may be the parking brake.																						

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	3.1.4	3 wheelers (3-5) shall have: - a parking brake - or split service braking) which brakes all wheels OR - a service brake system that operates on all wheels ( <u>other than a split service brake system</u> ) and a secondary brake system that may be the parking brake.	Informal group to consider N American tricycles
	3.1.5	Where 2 separate service brake systems are installed, there may be a common brake provided failure in 1 system does not affect the performance of the other.	
	3.1.6	Master cylinders shall have separate reservoir for each system, separate covers, and fluid level shall be easily checked.	
	3.1.7	Vehicles equipped with split braking systems shall be fitted with a red warning lamp to signify hydraulic failure <u>or</u> low fluid level.	
	3.1.8	Vehicles with ABS shall be fitted with an amber warning lamp to signify electrical failures	
	3.1.9	Brake linings shall contain no asbestos.	
<b>3.2 Function</b>			
	3.2.1 Service brake	Shall progressively reduce speed of the vehicle, bring it to a halt, and keep it halted. Rider seated with both hands on steering.	
	3.2.2 Secondary brake	Where fitted, shall progressively reduce the vehicle speed and halt it <u>in the event of a service brake system failure</u> – driver seated with 1 hand on the steering.	
	3.2.3 Parking brake	Where fitted, must hold vehicle on prescribed slope with a separate control.	
<b>3.3 Durability</b>			
	3.3.1	Lining wear shall be taken account of automatically or manually.	
	3.3.2	Lining thickness shall be visible or camshaft rotation noted.	
	3.3.3	During tests, no lining detachment or fluid leakage.	
<b>3.4 Dynamic performance results</b>		These may be presented in 3 ways ( <u>as specified in respective test</u> ):	
	3.4.1 MFDD	Mean Fully Developed Deceleration OR	
	3.4.2 Stopping distance	Stopping distance - $S = 0.1V + (X) v^2$ OR	
	3.4.3 Continuous readout	Continuous readout of deceleration for Wet brake test and ABS surface transition.	

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4. TEST CONDITIONS, PROCEDURES, AND PERFORMANCE REQUIREMENTS			For all relevant variables, e.g. speeds, forces etc. add a tolerance and correction factors within that range. USA & Canada to provide proposal.																				
4.1 General																							
	4.1.1: [Test surface]	Test area to be clean, dry and level road surface ≤ 1%. Test surface shall have a nominal peak friction coefficient of adhesion of 0.9. using ASTM E1136 standard reference tyre in accordance with ASTM Method E1337-90 OR coefficient of adhesion of ≥ 0.8 using vehicle test procedure based on ECE R78 Annex 4 ABS K test.  For testing vehicles equipped with ABS, 2 surfaces (measured using ECE K test): - High friction ≥ 0.8 - Low friction ≤ 0.45  For parking brake test, a clean, dry, solid surface of the specified slope.  Maximum lane width of 2.5 m for 2 wheeled motorcycles; vehicle width plus 2.5 m for 2 wheeled motorcycles with sidecar or 3 wheeled motorcycles.	The informal group is still discussing how to specify the surface friction. The alternatives are: 1. specify a coefficient but no method 2. specify both the coefficient and method  Need to review the issue of having two methods of determining surface friction. How will this affect compliance auditing / enforcement.																				
	4.1.2: Ambient temperature	4° - 38° C	To avoid frozen surface.																				
	4.1.3: Wind speed	Agreed - JAPAN SS 12 – 61 :- Not more than 5 m/s																					
	4.1.4: Test speed	Vehicles to be tested at the specified speed or [ 0.8 ] Vmax, whichever is the lower.	Informal group to finalise																				
	4.1.5: Auto gearboxes	These vehicles shall complete engine connected and disconnected tests and the gearbox shall be in “drive”.																					
	4.1.6: Vehicle position and wheel lock	All stops to be made without wheels deviating from the test lane and without wheel lockup (not applicable to ABS equipped vehicles < 10 km/h). Vehicles shall start in the middle of the lane																					
	4.1.7: Test sequence	<table><thead><tr><th>TEST ORDER</th><th>SECTION</th></tr></thead><tbody><tr><td>1. Dry Stop - with single brake control activated</td><td>4.3</td></tr><tr><td>2. Dry Stop – with both brake controls activated</td><td>4.4</td></tr><tr><td>3. High Speed</td><td>4.5</td></tr><tr><td>4. Wet Brake</td><td>4.6</td></tr><tr><td>5. Heat Fade</td><td>4.7</td></tr><tr><td colspan="2">6. If fitted:</td></tr><tr><td>6.1 Parking Brake</td><td>4.8</td></tr><tr><td>6.2 ABS</td><td>4.9</td></tr><tr><td>6.3 Partial failure test, for a split-brake system</td><td>4.10</td></tr></tbody></table>	TEST ORDER	SECTION	1. Dry Stop - with single brake control activated	4.3	2. Dry Stop – with both brake controls activated	4.4	3. High Speed	4.5	4. Wet Brake	4.6	5. Heat Fade	4.7	6. If fitted:		6.1 Parking Brake	4.8	6.2 ABS	4.9	6.3 Partial failure test, for a split-brake system	4.10	Add text to say that the heat fade always comes at the end
	TEST ORDER	SECTION																					
1. Dry Stop - with single brake control activated	4.3																						
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<b>4.2 Preparation</b>			
	4.2.1: Engine idle speed	Engine idle speed to be at manufacturers specification	
	4.2.2: Tyre pressures	Manufacturer <u>specification</u>	
	4.2.3: Control lever application point	Input force applied [50] mm from the outer end of the [lever].	Informal group to discuss
	4.2.4: Brake Temperatures	Also specified for each test in GTR text.  At the beginning of each stop, the temperature measured inside the brake linings or on the braking path of the disc or drum , will be ?[55-65°C for single brake systems and below 100 °C for CBS], Brake temperatures are measured <u>with thermocouples</u> , on the disc or <u>drum, or on the drum shoe or disc pad</u> .	Informal group to discuss: - IMMA data to show that a cold brake temperature of 0-100°C does not affect repeatability - USA data to show that there could be repeatability problems unless 55-100°C is used - IMMA to provide details on rubbing thermocouples , so that they can be considered as the only measurement method
	4.2.5: Brake burnishing	Include a requirement that the manufacturer will carry out the burnishing and show records to the test house on request. Procedure to be adopted by a government when doing conformity testing: - Vehicle unladen - Initial speed 50 km/h or 0.8 Vmax, whichever is the lower - Reacceleration speed 5-10 km/h - Decel CBS 3.5-4.0 m/s <sup>2</sup> - Decel front separately 3.0-3.5 m/s <sup>2</sup> - Decel rear separately 1.5-2.0 m/s <sup>2</sup> - 100 stops per brake system - Engine disconnected - Initial brake temperature before each stop <100°C	
	Vehicle mass	Specified for each test in GTR text Note: Fully laden = max mass and loading according to manufacturer's specification. Unladen = rider and test equipment	Clarify definitions of laden and unladen. <u>"See SR1"</u>

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<b>4.3 Dry Stop Test– single brake control activated</b>	<p>Agreed the ECE tests:</p> <ul style="list-style-type: none"> <li>- Laden vehicle only but where CBS fitted, also tested unladen.</li> <li>- Engine disconnected</li> <li>- Initial speed = 40 km/h for 3-1, 3-2 and 60 km/h for 3-3, 3-4, 3-5 vehicles</li> <li>- Brake actuation force – Hand <math>\leq 200\text{N}</math>. Foot <math>\leq 350\text{N}</math> for 3-1, 3-2, 3-3, 3-4. <u>(500N for 3-5 vehicles)</u></li> <li>- 6 stops maximum</li> <li>- Separate tests for each control and CBS</li> </ul> <p>Requirements : <u>Deceleration or equivalent distance based on <math>S = 0.1V + (X)V^2</math></u> Minimum deceleration :</p> <p>Front : 3-1 = <math>3.4 \text{ m/s}^2</math> 3-2 = <math>2.7 \text{ m/s}^2</math> 3-3 = <math>4.4 \text{ m/s}^2</math> 3-4 = <math>3.6 \text{ m/s}^2</math> Rear : 3-1 = <math>2.7 \text{ m/s}^2</math> 3-2 = <math>2.7 \text{ m/s}^2</math> 3-3 = <math>2.9 \text{ m/s}^2</math> 3-4 = <math>3.6 \text{ m/s}^2</math> CBS : 3-1,3-2 = <math>4.4 \text{ m/s}^2</math> 3-3 = <math>5.1 \text{ m/s}^2</math> 3-4 = <math>5.4 \text{ m/s}^2</math> 3-5 = <math>5 \text{ m/s}^2</math> CBS secondary brake = <math>2.5 \text{ m/s}^2</math> for all vehicle types.</p>	<p><u>Add performance requirement for split service (split service failure performance addressed in 4.10)</u></p>
<b>4.4 Dry Stop Test <u>all service brake controls activated</u></b>	<p>Based on FMVSS 122 test. Summary:</p> <ul style="list-style-type: none"> <li>- Unladen vehicle test</li> <li>- Stops with engine disconnected</li> <li>- Test speed = 100 km/h or 0.8 V max whichever is lower. (Min = <u>45</u> km/h)</li> <li>- Brake actuation force – Hand <math>\leq 245\text{N}</math>. Foot <math>\leq 400\text{N}</math></li> <li>- 6 stops maximum</li> <li>- Stops performed with both brake systems activated at the same moment. <u>or of the single brake control in the case of a service brake system that operates on all wheels.</u></li> </ul> <p>Requirements: Minimum deceleration = <u><math>7.6 \text{ m/s}^2</math> or <math>S \leq 0.1V + 0.005 V^2</math></u> for all vehicle types.</p>	<p>IMMA/Italy to consider exempting low speed vehicles below a specified power/mass ratio.</p> <p><u>Informal group to revise the minimum test speed.</u></p> <p>In the interests of uniformity, IMMA to see if the brake actuation force values can be aligned with the forces used in test 4.3 above.</p> <p>Converting the FMVSS stopping distance requirement results in an unexpectedly high MFDD requirement of <math>7.6 \text{ m/s}^2</math> To be discussed further <u>in the informal group</u></p>
<b>4.5 High Speed Test</b>	<p>Agreed to use JAPAN SS 12 – 61 but with higher speed test :-</p> <ul style="list-style-type: none"> <li>- 3-3, 3-4, &amp; 3-5 vehicles with a <math>V_{\text{max}}</math> of <math>\geq 125 \text{ km/h}</math></li> <li>- Unladen vehicle only</li> <li>- Stops with engine connected</li> <li>- Test with both brake controls together - includes CBS+2ndary brake</li> <li>- Initial speed = 160 km/h or 0.8 v max whichever is less (Min = 100 km/h)</li> <li>- Brake actuation force – Hand <math>\leq 200\text{N}</math>. Foot <math>\leq 350\text{N}</math> for 3-3, 3-4. <math>\leq 500\text{N}</math> for 3-5</li> </ul> <p>Requirement:</p> <ul style="list-style-type: none"> <li>- Deceleration <math>&gt; 5.8 \text{ m/s}^2</math> or the stopping distance <math>S \leq 0.1V + V^2/149</math></li> <li>- Maximum of 4 stops to achieve requirements</li> </ul>	

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<b>4.6 Wet Brake Test</b>	<p>Agreed ECE REG 78 test:- Summary</p> <ul style="list-style-type: none"> <li>- For vehicle categories 3-1,3-2,3-3,3-4 <u>[and 3-5]</u> and all brake types <u>,with the exception of "panel brakes" (need to define).</u></li> <li>- Laden vehicle only (CBS, where fitted, also tested unladen)</li> <li>- Initial speed = 40 km/h for 3-1, 3-2 and 60 km/h for 3-3, 3-4, <u>3-5</u> vehicles</li> <li>- Stops with engine disconnected</li> <li>- Separate tests for front brake, rear brake, and CBS (where fitted)</li> </ul>	<p>IMMA/Italy to consider exempting "panel brakes" or exempting vehicles below a specified Power/mass ratio. <u>Informal group to revise the vehicle categories to which this requirement applies.</u></p>
<ul style="list-style-type: none"> <li>- <b>Base line</b></li> <li>- <b>Wet brake</b></li> </ul>	<ul style="list-style-type: none"> <li>- Perform a Dry Stop test – single brake control activated (as 4.3) but measure the control force to achieve <u>an average deceleration of</u> 2.5 m/s<sup>2</sup></li> <li>- Repeat Baseline test after the brake has been continuously wetted at a flow rate of 15 l/h for &gt; 500 m.</li> </ul> <p>Requirement: - Deceleration recorded between 0.5 and 1 sec after brake application <math>\geq 60\%</math>, <u>and</u> <math>\leq 120\%</math> of Base line test using same control force, <u>until stopped.</u></p>	<p>Informal group to review number of tests</p> <p>Informal group to review number of tests</p>
<b>4.7 Heat Fade Test</b>	<p>Agreed ECE REG 78 :-</p> <ul style="list-style-type: none"> <li>- 3-3,3-4, and 3-5 vehicles only</li> <li>- All with laden vehicle</li> <li>- Separate test for each brake system</li> <li>- If CBS fitted, test only CBS</li> <li>- Perform a single Dry stop test as in 4.3 above <u>and record control force.</u></li> </ul>	<p><u>Informal group to revise the vehicle categories to which this requirement applies.</u></p>
<ul style="list-style-type: none"> <li>- <b>Base line</b></li> <li>- <b>Heating Procedure</b></li> <li>- <b>Recovery</b></li> </ul>	<ul style="list-style-type: none"> <li>- Perform 10 repeated stops as quickly as possible</li> <li>- Speeds – Front + CBS = 100 km/h or 70% v max whichever is lower - Rear = 80 km/h or 70 % v max whichever is lower</li> <li>- Braking interval = 1000 m</li> <li>- Engine connected with <u>the highest gear engaged</u> for 50% stop, disconnected for remainder.</li> <li>- For the first stop, deceleration = 3 m/s<sup>2</sup> with constant control force and the same force for remainder</li> <li>- Repeat Baseline test ASAP or at least within 1 minute after completion of Fade test.</li> </ul> <p>Requirement : <u>Single</u> Recovery test <u>with control force &lt; baseline force.</u> performance <math>\geq 60\%</math> of Baseline test performance (engine disconnected)</p>	<p><u>Informal group to discuss how to define the control forces</u></p>

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<b>OPTIONAL / IF FITTED</b>		
<b>4.8 Parking Brake</b>	<p>Agreed: ECE REG 78. Summary :-</p> <ul style="list-style-type: none"> <li>- Static test</li> <li>- Laden vehicle</li> <li>- 18% slope, up and down</li> <li>- control forces: hand &lt; 400N; foot &lt; 500 N</li> </ul> <p>Requirement :</p> <ul style="list-style-type: none"> <li>- Vehicle remains stationary on slope during a period of 5 minutes.</li> </ul>	
<b>4.9 ABS</b>	<p>Based on ECE REG 78. Summary :-</p> <ul style="list-style-type: none"> <li>- 3-1 + 3-3 vehicles only</li> <li>- Tests on 2 road surfaces : <math>\geq 0.8</math>, and <math>\leq 0.45</math></li> <li>- Unladen vehicle only</li> <li>- Initial speed = typically 60 or 80 km/h (depends on test)</li> <li>- Separate tests for each brake control and both controls together.</li> <li>- Stops on high and low friction surfaces.</li> <li>- Wheel lock checks for low to high and high to low surface transitions.</li> </ul> <p>Requirements:</p> <ul style="list-style-type: none"> <li>- If ABS failure, Dry Stop test performance (4.3) shall be maintained</li> <li>- Wheel must not lock on test surface (but acceptable if low speed and vehicle stable)</li> <li>- For low to high surface transition, vehicle deceleration “must rise to the appropriate high value within a reasonable time”</li> </ul>	<p>Informal group to finalise Adhesion utilisation test not included:</p> <ul style="list-style-type: none"> <li>- Difficult to perform</li> <li>- Reliant on rider skill</li> <li>- Not in Japan regs</li> <li>- Stability most important issue for motorcycles</li> <li>- Problems with disabling ABS</li> </ul> <p>How to specify deceleration build up ?</p>
<b>4.10 Partial Failure</b>	<p>Only applicable to a “Split service brake system” – see FMVSS 122 S4. The remaining sub- system must meet the relevant <u>performance</u> requirement</p>	<p>Informal group to discuss <u>performance measure based on stopping distance in FMVSS, S5.5.2.</u> <u>Requirements:</u> Minimum deceleration [MFDD= 3.3 m/s<sup>2</sup> or <math>S \leq 0.1V + V^2/85</math>]</p>