Informal document No. 6
(54th GRRF, 6-8 October 2003,
agenda item 3.)

PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 90
(Replacement brake linings)

Transmitted by the expert of the Federation of
European Manufacturers of Friction Materials (FEMFM)

Note: The text reproduced below was prepared by the expert from FEMFM in order to strengthen some prescriptions of the Regulation. It completes the proposals appearing in document TRANS/WP.29/GRRF/2001/18.

A. PROPOSAL

Annex 3,

Paragraph 2.1.2.1., amend to read:

"2.1.2.1....make three brake applications with the initial speed (v_I) and final speed (v_F) as given in the table below:

Axle	Braking Interval		Evaluation Window		Remark
	v_I	v_F	v_1	v_2	
Front	70	25	60	30	
	110	45	100	50	
	145	55	135	65	if $v_{max} > 150$
Rear	50	20	40	25	
	70	25	60	30	
	100	40	90	45	if $v_{max} > 150$

All speeds in km/h

Calculate the mean fully development deceleration for the corresponding evaluation window between the speeds v_1 and v_2 in the table above."

Paragraph 2.2.4.1., amend to read:

"2.2.4.1.,... make three brake applications with the initial rotational speed (v_I) and final rotation speed (v_F) corresponding to the vehicle linear speed as given in the table below:

Vehicle Category	Axle	Braking Interval		Evaluation Window		Remark
		v_I	v_F	v_1	v_2	
M1	front	80 125 165	30 50 60	70 115 150	35 60 65	 if $v_{max} > 150$
M1	rear	85 125 165	30 50 40	75 115 150	35 60 65	 if $v_{max} > 150$
M2	front	85 130 165	35 50 35	75 120 150	40 60 45	 if $v_{max} > 150$
M2	rear	75 110 150	30 50 60	70 100 135	40 55 65	 if $v_{max} > 150$
N1	front	85 130 165	30 45 25	75 120 150	35 55 35	 if $v_{max} > 150$
N1	rear	80 115 160	35 45 65	70 105 145	40 50 75	 if $v_{max} > 150$

All speeds in km/h

Calculate the mean fully development deceleration for the corresponding evaluation window between the speeds v_1 and v_2 in the table above."

Annex 4,

Paragraph 1.2.2.2.1., amend to read:

"1.2.2.2.1....make three brake applications with the initial speed (v_I) and final speed (v_F) as given in the table below:

Braking Interval		Evaluation Window		Remark
v_I	v_F	v_1	v_2	
40 60 80	20 35 55	35 55 75	25 40 60	 if $v_{max} > 90$

All speeds in km/h

Calculate the mean fully development deceleration for the corresponding evaluation window between the speeds v_1 and v_2 in the table above."

Paragraph 2.2.3.1., amend to read

"2.2.3.1....make three brake applications with the initial rotational speed and final rotational speed corresponding to the vehicle linear speeds v_I and v_F as given in the table below:

Braking Interval		Evaluation Window		Remark
v_I	v_F	v_1	v_2	
55	30	50	35	
80	45	75	50	
110	75	105	80	if $v_{max} > 90$

All speeds in km/h

Calculate the mean fully development deceleration for the corresponding evaluation window between the given speeds v_1 and v_2 in the table above."

* * *

B. JUSTIFICATION

Document GFFR/2001/18 has explained in detail the reasons for the proposal to introduce "snub braking" instead of stop braking for the evaluation of the speed sensitivity. It has also pointed out that vehicle test and dynamometer test does not always correspond well regarding the absorbed energy. This means speed sensitivity test on the vehicle and dyno test are at present not fully comparable.

The proposals in GRRF/2001/18 tried to overcome these problems. However, during the discussion in the 50. GRRF some delegates felt that the proposal seemed to weaken existing requirements whereas the principle of snub braking was not argued.

A small adhoc working group came together in February 2002 and discussed the issues raised in GRRF. The proposal above is the result out of this discussion.

The main amendments to GRRF 2001/18 are the definition of the braking interval and the evaluation window. The braking interval is calculated such that the energy absorbed is equal to the existing requirements in Regulation 90, which is proven in the table below where the factor C shows the relation of the braking energies (C>1 means the braking energy in the stop braking is greater than in the snub braking). The evaluation window guarantees a repeatable and precise.

Axle	v_I	v_F	v_{Stop}	C
front	70	25	65	0,99
front	110	45	100	0,99
front	145	55	135	1,01
rear	50	22	45	0,96
rear	70	25	65	0,99
rear	100	40	90	0,96

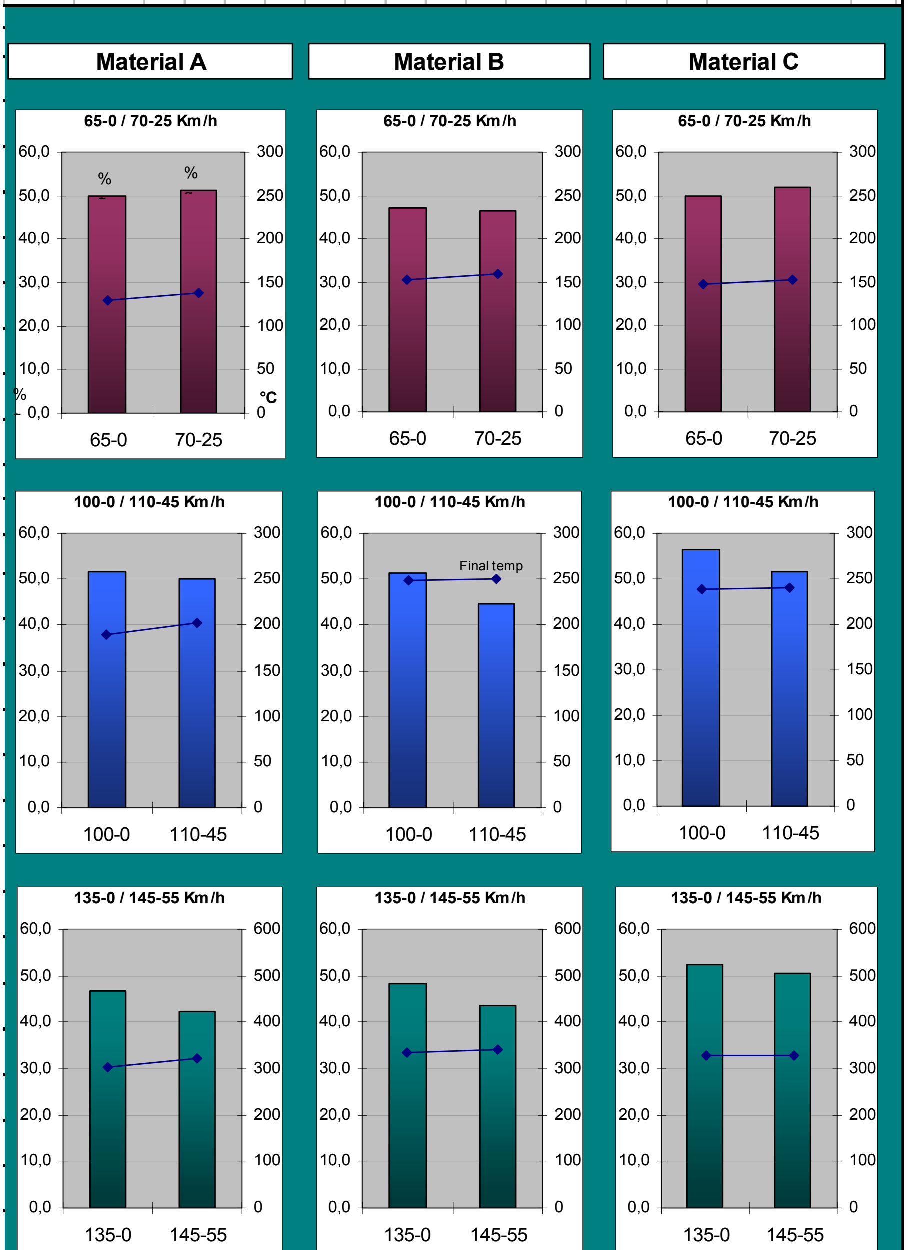
In the table below the factor F as defined in GRRF 2001/18 is calculated for all test conditions for speed sensitivity in annex 3 and 4. The values are all close to 1 proving that vehicle test and dyno test are comparable for the new requirements.

Vehicle Category	Axle	Vehicle Test		Dyno Test		ma/M	F
		Brake Application		Brake Application			
		v_I	V_F	V_I	V_F		
M1	front	70	25	80	30	0,77	1,009
M1	front	110	45	125	50	0,77	0,997
M1	front	145	55	165	60	0,77	0,989
M1	rear	50	20	85	30	0,32	1,038
M1	rear	70	25	125	50	0,32	1,018
M1	rear	100	40	165	40	0,32	1,024
M2	front	70	25	85	35	0,69	1,033
M2	front	110	45	130	50	0,69	1,014
M2	front	145	55	165	35	0,69	1,003
M2	rear	50	20	75	30	0,44	1,010
M2	rear	70	25	110	50	0,44	1,012
M2	rear	100	40	150	60	0,44	1,010
N1	front	70	25	85	30	0,66	1,024
N1	front	110	45	130	45	0,66	1,026
N1	front	145	55	165	25	0,66	1,025
N1	rear	50	20	80	35	0,39	1,041
N1	rear	70	25	115	45	0,39	0,979
N1	rear	100	40	160	65	0,39	1,008
M3,N2,N3	f+r	40	20	55	30	0,55	1,027
M3,N2,N3	f+r	60	35	80	45	0,55	0,987
M3,N2,N3	f+r	80	55	110	75	0,55	0,948

A vehicle test has been carried out in order to compare the existing with the new requirement using three different materials (Material A is the OE material). In the graphs below the bars show the performance achieved comparing stop and snub braking. The dots linked with a straight line show the maximum disk temperature achieved in the tests. Regarding the speed sensitivity of the three materials both stop and snub braking come to a similar result. The temperatures show that in this case the snub braking is a little more severe, however, the difference is very small.

- Fronts Only Speed Sensitivity Comparison Curves -

GVW:1980 Kgs



Vehicle: Vw Passat	Brake: Teves	Piston dia: 57mm	Effective rad: 127mm	Disc dia : 287mm
	Vented Disc	Alloy Wheels	195/65 R15 (RR 306mm)	Disc Width : 25mm