

# Injury Threshold for the Flex-PLI Tibia Bending Moment (JAMA proposal)

The Japan Automobile Manufacturers Association Inc.  
Vehicle Safety subcommittee and Pedestrian Safety WG

# Current Proposal

## Flex-GT Tentative Threshold Values

TEG-035

### Human value

Body regions	50% Injury risk level of AMS0 (tentative)		References
	Human value		
Leg (Tibia)	BM (312 - 350 Nm)		BM (312 Nm): Kerrigan et al., 2004 BM (350 Nm): INF GR/PS/82
Knee (MCL)	BA (18 - 20 deg)		BA (18 deg): Ivarsson et al., 2004 BA (20 deg): INF GR/PS/82

AMS0: 50 percentile of american male

BM: Bending moment, BA: Bending angle, EL: Elongation, SD: Shearing displacement.

### Convert: Human value >>> Flex-GT value

Human	Human Model	Flex-GT Model	Flex-GT
Tibia bending moment	Tibia bending moment	Tibia bending moment	Tibia bending moment
$H_{TBM}$	$HM_{TBM}$	$FGTM_{TBM}$	$FGT_{TBM}$
(Nm)	(Nm)	(Nm)	(Nm)
312	312	299	299
350	350	337	337

Tentative threshold values

$$FGT_{TBM} = 0.9977 * HM_{TBM} - 12.325 \text{ (from regression curve)}$$

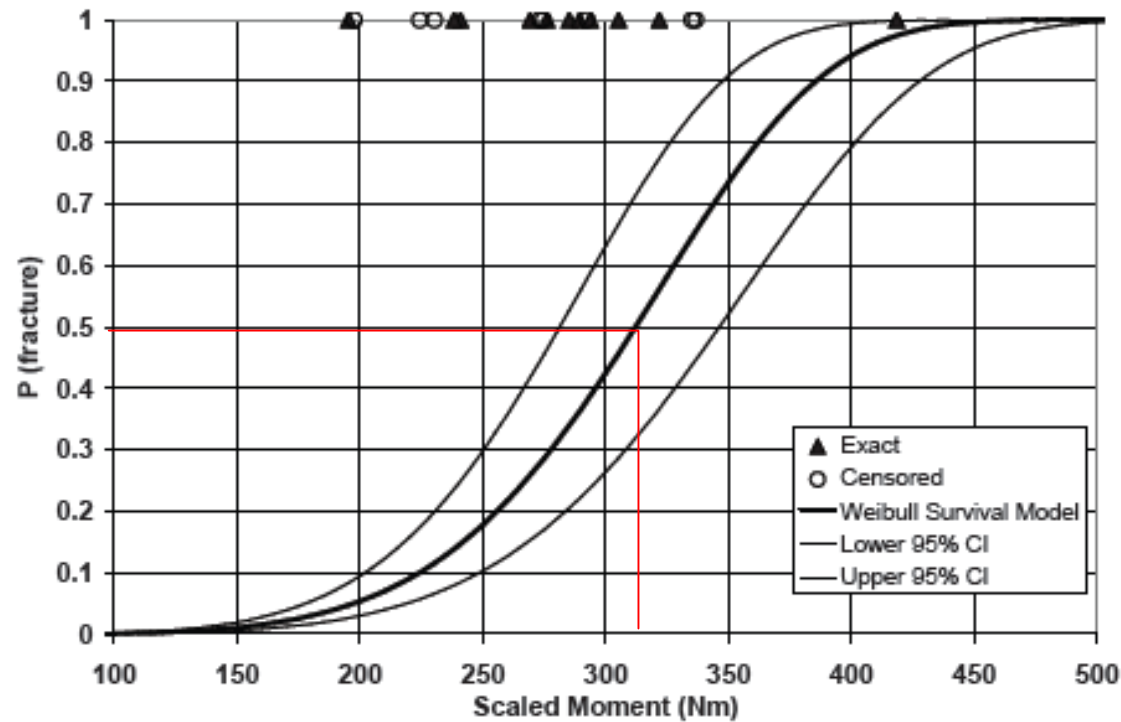
Based on the SAE paper by Nyquist et al. and the ICRASH paper by Kerrigan et al., the threshold values were set at 299 and 337Nm.

# Current Proposal

## References (referred contents)

Human value

### Injury Risk Curve for Mid-Leg



- Kerrigan, J.R., Drinkwater, D.C., Kam, C.Y., Murphy, D.B., Ivarsson, B.J., Crandall, J.R., Patrie, J. (2004) Tolerance of the Human Leg and Thigh in Dynamic Latero-Medial Bending, ICRASH 2004.

Injury risk curves for leg fracture from the ICRASH paper by Kerrigan et al. (2004)

# Current Proposal

## References (referred contents)

Human value

### Injury Risk Curve for Mid-Leg

Tibia Bending Strength and Response  
 Nyquist G. W. et al, 1985 (SAE, Paper No. 851728)

Tibia Bending: Strength and Response  
 Nyquist G. W. et al, 1985 (SAE 851728)

TestNo.	CadaverNo.	Sex	Age (years)	Stature (m)	Body Mass (kg)	Impact Speed (m/s)	Direction of Loading	Peak Bending Moment at Midspan (Nm) *		
118	458	M	54	1.82	88	3.5	LM	395		
124	406	M	64	1.77	82	4.2	LM	287		
126	375	M	58	1.74	73	4.2	LM	224		
127	404	M	56	1.76	79	3.7	LM	237		
129	395	M	57	1.78	99	3.7	LM	349		
132	525	M	57	1.87	45	3.8	LM	264		
147	400	M	57	1.78	84	2.9	LM	431	Ave.	10%up
									312.4	343.7

\* The peak values were attenuated by 10 % by filtering (CFC 60) procedure.

**Proposed injury threshold for tibia bending: 350 Nm**

- ECE/TRANS/WP.29/GRSP/INF GR PS (2004) Discussion on Injury Threshold for Pedestrian Legform Test, INF/GR/PS/82, P. 2.

Injury risk curves for leg fracture from the SAE paper by Nyquist et al. (1985)

# New Proposal

Injury threshold for Flex-PLI Tibia bending moment (JAMA proposal): **318Nm**

Average value of the two threshold values shown in this presentation