



INTERNATIONAL ORGANIZATION OF MOTOR VEHICLE MANUFACTURERS

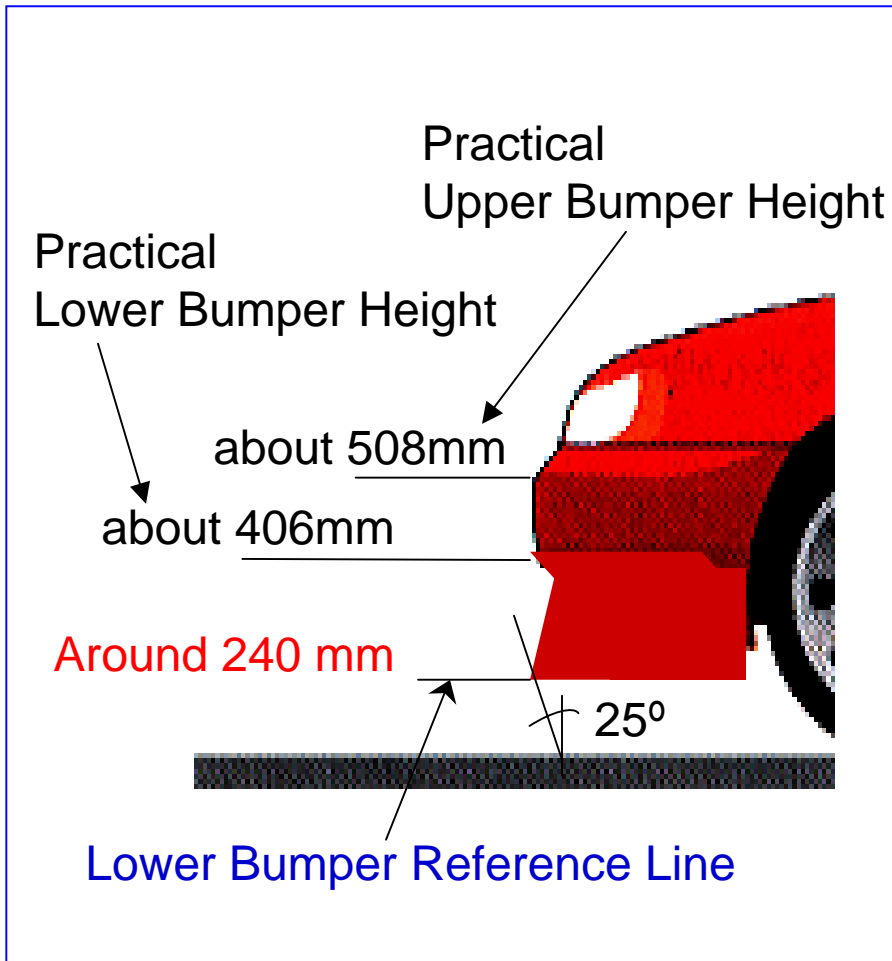
Lower/Upper Bumper Reference Line

Data on existing vehicles

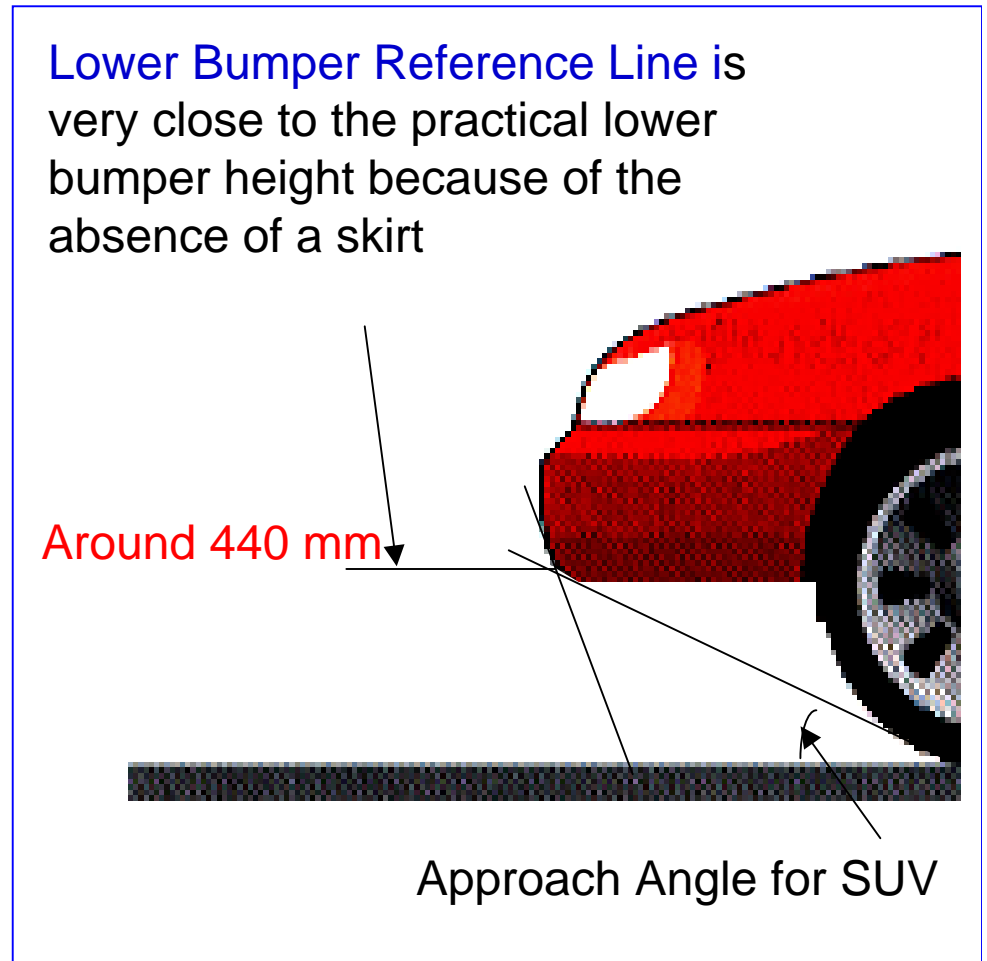


Introduction

Typical Passenger Car



Typical SUV





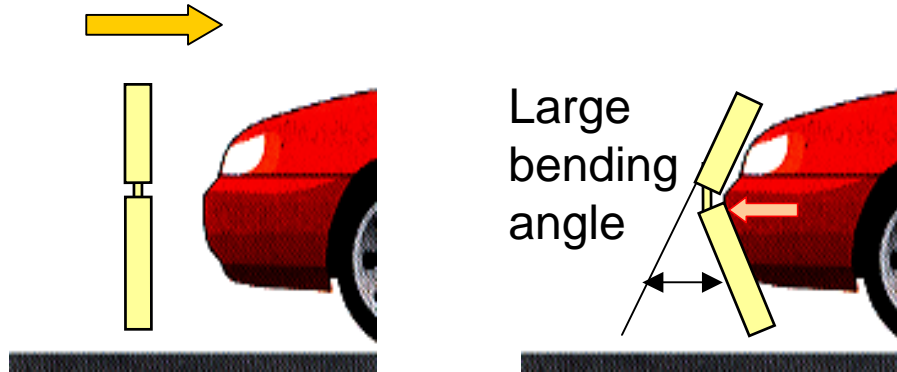
Car	Category	LBRLH i , j	UBRLH i , j	Car	Category	LBRLH i , j	UBRLH i , j
1	SUV	466	NA	26	Sport	210	NA
2	Large SUV	497	730	27	Sport	210	NA
3	Large SUV	492	592	28	Large MPV	378	679
4	Large SUV	485	712	29	Large MPV	356	596
5	Large SUV	466	716	30	Large MPV	274	570
6	Large SUV	414	604	31	Large MPV	263	565
7	Middle SUV	479	751	32	Large MPV	235	575
8	Middle SUV	474	764	33	Large MPV	213	517
9	Middle SUV	472	655	34	Large Family	273	555
10	Middle SUV	458	648	35	Large Family	256	495
11	Middle SUV	456	731	36	Large Family	237	586
12	Middle SUV	445	646	37	Large Family	235	469
13	Middle SUV	441	642	38	Large Family	231	496
14	Middle SUV	441	642	39	Large Family	228	487
15	Middle SUV	440	618	40	SmallFamily	300	565
16	Middle SUV	420	685	41	SmallFamily	240	473
17	Middle SUV	418	696	42	SmallFamily	236	522
18	Middle SUV	345	588	43	SmallFamily	224	493
19	Small SUV	500	608	44	SmallFamily	219	562
20	Small SUV	455	603	45	Super Mini	225	514
21	Small SUV	424	665	46	Super Mini	205	545
22	Small SUV	391	669	47	Super Mini	190	530
23	Small SUV	360	670	48	Super Mini	216	544
24	Small SUV	360	655	49	Super Mini	214	522
25	Small SUV	340	633	50	Super Mini	214	509

SUV average:438mm

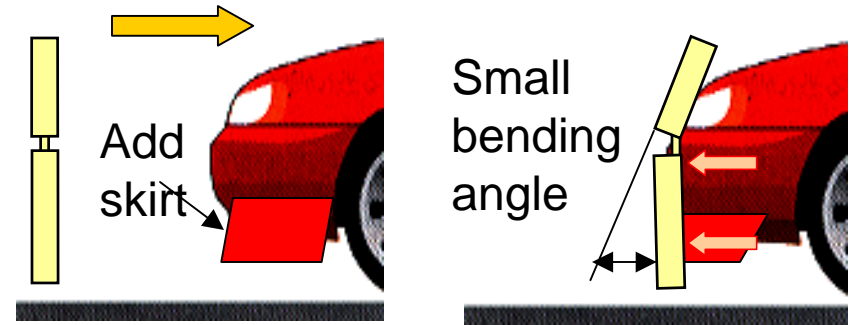
Others:243mm

Counter measures for Lower Leg Requirements

Typical Current Passenger Car



Improved car

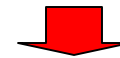


Practically 60mm Energy Absorbing bumper needed

High bumper test requirement

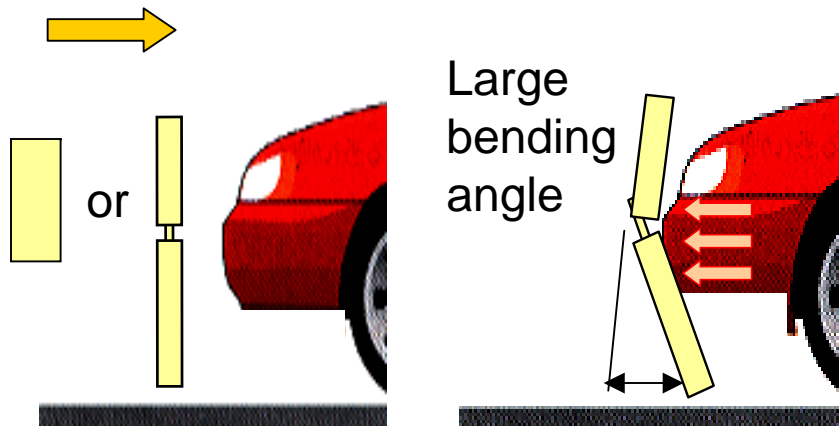
@ Max. Load 7.5KN

@Max. Bending Moment 510Nm



Practically 120mm Energy Absorbing bumper needed

Typical SUV



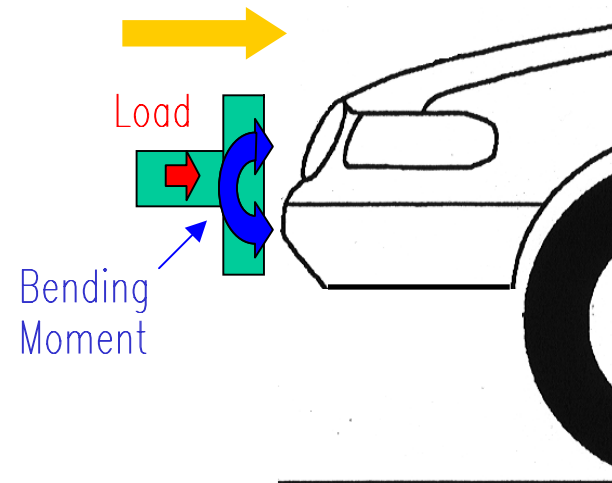
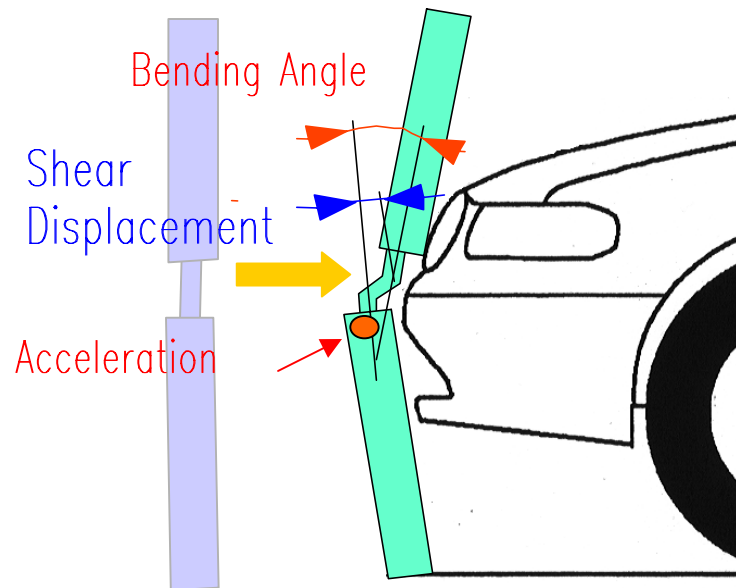
Typical passenger cars can meet the angle requirement, because they can have lower load path at the skirt. However, SUV cannot have such lower load path and have difficulties to meet the angle requirement.



Conclusions

- SUV, because of their basic design, cannot include a lower load path for the lower leg test
- SUV therefore need the option of the upper leg bumper test
- Typical Lower Bumper Reference Line for SUV start at 340 mm up to 500 mm
- In order to cover a representative portion of existing SUV's, such option (lower or upper leg to bumper test) should therefore be possible for LBRL between around 400 and 500 mm

LEGFORM IMPACT TEST & HIGH BUMPER IMPACT TEST



Comparison of Both Tests

High Bumper Test Results (Upper Leg Impactor)

Red = Over

Blue = Meet

		Bumper Length	Load	Bending moment
Production SUV	Model A	55mm	13.11 kN	965.0 Nm
	Model B	90mm	9.18 kN	654.5 Nm
Modified Bumper	Model B'	105mm	6.32 kN	391.6 Nm
Criteria (draft Phase2)			7.5 kN	510 Nm

Close to 80%

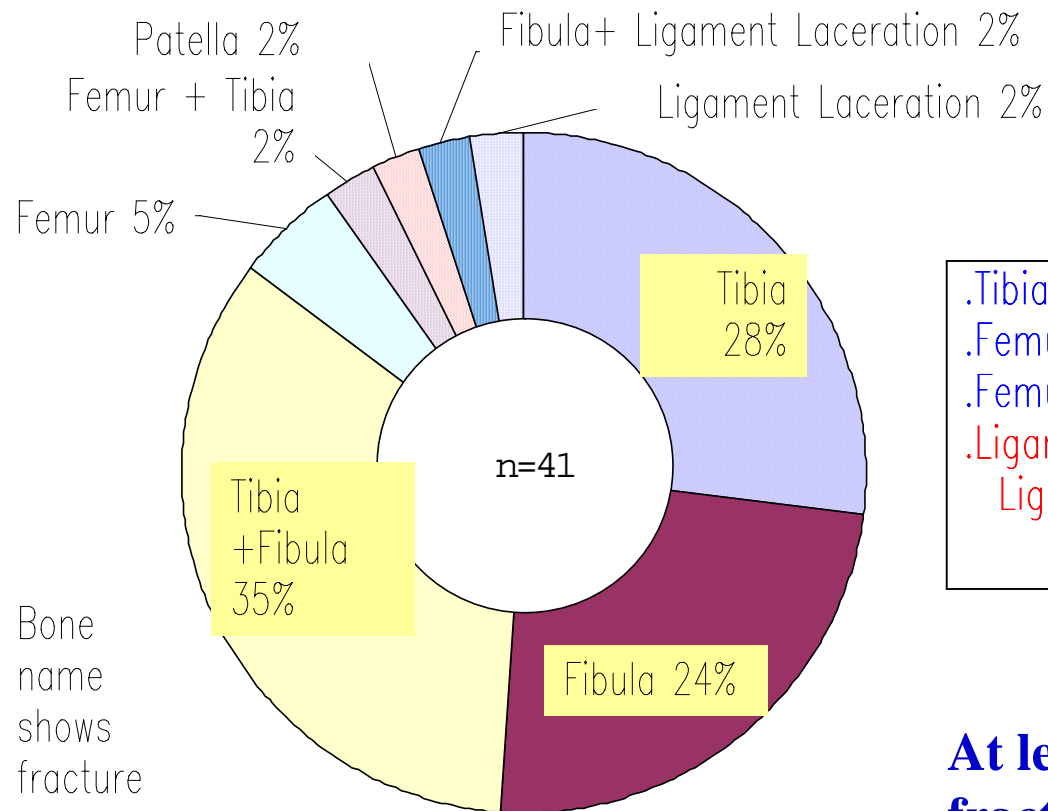
TRL Leg Form Impactor Test Results

		Bumper Length	Bending Angle	Shear disp.	Acceleration
Production	Model A	55mm	32.5deg.	No Data	226.6G
	Model B	90mm	33.5deg.	7.2mm	199.9G
Modified Bumper	Model B'	105mm	30.9deg.	4.4mm	155.7G
Criteria (draft Phase2)			19deg.	6mm	170G

Counter measure for high bumper test could not largely reduce the bending angle, but reduce acceleration and shear displacement up to the required level by LFI test.

Leg Injury Distribution

JAPAN

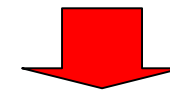


Distribution of AIS 2+ Leg Injuries

by ITARDA report issued 2005

117 pedestrian accidents in 1993-2003,
bonnet type passenger car

.Tibia, Fibula, Tibia + Fibula	87%
.Femur	.%
.Femur + Tibia	.%
.Ligament Laceration, Ligament Laceration + Fibula	4 %



At least, tibia, fibula or femur fractures which share large part of AIS2+ leg injuries could be expected to be reduced by the high bumper test application.

Conclusions

- @ The lower leg to bumper test is not feasible for high bumper vehicles.
- @ High bumper vehicles need to have energy absorbing bumpers in order to meet the upper leg to bumper test.
- @ Energy absorbing bumpers will reduce real world leg injuries as also seen in the lower leg acceleration criterion.

END