Insurance Institute for Highway Safety
Crashworthiness Evaluation

Crash Test Report
2001 Ford Taurus (CF09009B)

Vehicle identification number:	1FAFP55U41A250759
Body style:	Large 4-door sedan
Engine/transmission:	Transverse 3.0-liter V6, 4-speed automatic, front-wheel drive

Standard crashworthiness features:

Frontal airbags, dual-stage depending on crash severity, belt use, and driver seat position
Frontal airbags also have separate deployment thresholds for belted and unbelted occupants
Dual-locking shoulder belts (front outboard and all rear seating positions)
Shoulder belt height adjusters (front outboard seating positions only)
Seat belt crash tensioners in buckle (front outboard seating positions only)
Seat belt force-limiting mechanisms (front outboard seating positions only)
Lap/shoulder belt, center rear seating position
Shoulder belt retractors (right front and all rear) are convertible from emergency to automatic locking
LATCH system for child restraints (outboard rear seating positions)

Optional safety features:

Seat-mounted combination head and thorax side airbags (front seating positions) (test vehicle not equipped)
Adjustable brake and accelerator pedals (test vehicle equipped)
Antilock brakes, 4-wheel (test vehicle equipped)
Daytime running lights (test vehicle not equipped)

Vehicle specifications (provided by manufacturer):

Wheelbase:	276 cm
Overall length:	502 cm
Overall width:	185 cm
Curb weight:	1,522 kg

Vehicle specifications (measured):

Curb weight:	1,468 kg
Test weight:	1,545 kg (62% front, 38% rear)
Overall width:	185 cm

Nominal test parameters:

56.3 km/h and 28% overlap into 2005 Ford Taurus

Dummy Seating Protocol:

IIHS Guidelines for Using the UMTRI ATD Positioning Procedure for ATD and Seat Positioning (Version V)

Crash test date: June 23, 2009

Figure 1
Precrash and Postcrash Side Views — 2001 Ford Taurus

Summary

A 2001 Ford Taurus was crashed into a 2005 Ford Taurus in a collinear frontal offset configuration on June 23, 2009. The 2001 Ford Taurus was traveling at 56.1 km/h and the 2005 Ford Taurus was traveling at 55.9 km/h with a 28 percent overlap on the driver side for both vehicles. A Hybrid III 50th percentile male dummy was positioned in the driver seat with the lap/shoulder belt fastened. Figure 2 shows the dummy's postcrash overall position in the vehicle.

The pretest setup followed the IIHS Crashworthiness Evaluation Offset Barrier Crash Test Protocol (version XIII); however, the collinear car-to-car crash configuration for this test required some deviations from the protocol, which include:

- Removal of the fuel tank (resulting in a somewhat reduced test weight);
- A targeted 28 percent overlap with its crash partner (Figure 3); and
- The test was conducted at a nominal speed of 56.3 km/h; and
- The normal Hybrid III dummy ankles were replaced with a prototype design developed by First Technology Safety Systems and Denton ATD for the Society of Automotive Engineers Hybrid III Dummy Family Task Force. The updated design is intended to eliminate signal noise that can result from metal-to-metal contact between the ankle joint ball shaft and the ankle bumper retainer.

Measures of intrusion taken after the crash indicated the lower instrument panel in front of the dummy moved rearward 5-7 cm. Resultant intrusion in the driver footwell measured 13 cm at the footrest and 11-13 cm at other places on the toepan (Table 1). All doors remained closed during the crash. The driver door aperture shortened 6 cm, as measured at the lower edge of the window. After the crash, the driver door required tools to open; all other doors opened with ease.

The driver dummy was restrained by a three-point lap/shoulder belt and an airbag. During the crash, the dummy's head loaded the fully inflated airbag. During rebound, the top of the head contacted the roof rail and window frame at about the same time the rear of the head contacted the B-pillar. Late in the crash, after data collection had ended, the rear of the head contacted the driver head restraint. After the crash, the upper end of the steering column had moved upward 5 cm and rearward 3 cm. Table 2 summarizes the timing of airbag deployment and dummy kinematic events.

Tables 3-6 contain summaries of the peak dummy injury measures. The peak resultant head acceleration from the contact with the roof rail and B-pillar was 40 g. The maximum right lower tibia L-M moment was –180 Nm, significantly contributing to the right lower tibia index of 0.94. The maximum right tibia axial force was -4.8 kN.

Figure 2
Dummy and Vehicle Interior, Postcrash — 2001 Ford Taurus

Figure 3
Video Frame Capture, Precrash —
2005 Ford Taurus (left) and 2001 Ford Taurus (right)

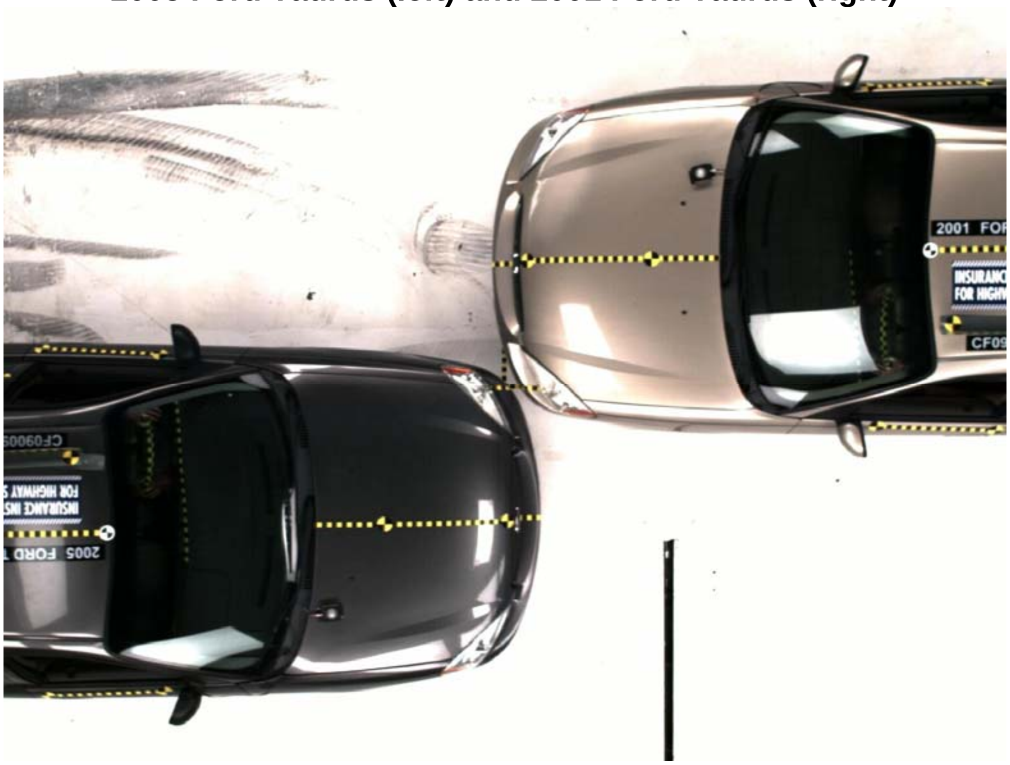

Table 1 Residual Measurements of Intrusion Relative to Driver Seat — 2001 Ford Taurus				
Selected Locations*	**Longitudinal**	**Lateral**	**Vertical**	**Resultant**
Steering column (cm)	–3	–3	5	7
Left lower instrument panel (cm)	–7	–5	4	9
Right lower instrument panel (cm)	–5	–5	4	8
Brake pedal (cm)	–9	–5	4	11
Left toepan (cm)	–9	–9	4	13
Center toepan (cm)	–6	–7	5	11
Right toepan (cm)	–8	–8	4	12
Footrest (cm)	–9	–9	3	13
Average displacement of the four seat attachment bolts relative to reference system (cm)	0	–1	0	n/a

* All measurements taken on driver side. From the driver's position, positive is forward, left, and up.

Table 2 Restraint System Performance and Dummy Kinematics — 2001 Ford Taurus	
Event	**Time (ms)**
Activation of seat belt crash tensioner (at buckle)	34
Deployment of driver and right front passenger frontal airbags	42
Airbag fully inflated	68
Face begins to load airbag	74
Top of head contacts roof rail/window frame and rear of head contacts B-pillar	206

Table 3 Head Injury Measurements — 2001 Ford Taurus			
Measure	**Published Tolerance Threshold**	**Result**	**Time (ms)**
Vector resultant acceleration (g), during roof rail and B-pillar contact	80	40	218
Vector resultant acceleration — 3 ms clip (g), during airbag loading	80	36	104-107
Vector resultant acceleration — 3 ms clip (g), during roof rail and B-pillar contact	80	32	218-221
Head Injury Criterion (HIC)	1000	159	86-122
Head Injury Criterion — 15 ms interval (HIC-15)	700	102	100-115

Table 4 Neck Injury Measurements — 2001 Ford Taurus			
Measure	**Published Tolerance Threshold**	**Result**	**Time (ms)**
A-P shear force (kN)	±3.1	–0.6	111
Axial compression force (kN)	4.0	2.9	220
Axial tension force (kN)	3.3	1.0	102
N_{ij} Tension-Extension	1.00	0.16	84
N_{ij} Tension-Flexion	1.00	0.25	122
N_{ij} Compression-Extension	1.00	0.49	220
N_{ij} Compression-Flexion	1.00	0.47	220
Flexion bending moment (Nm)		65	122
Extension bending moment (Nm)		17	235

Table 5 Chest Injury Measurements — 2001 Ford Taurus			
Measure	**Published Tolerance Threshold**	**Result**	**Time (ms)**
Vector resultant spine acceleration — 3 ms clip (g)	60	36	98-101
Rib compression (mm)	–50	–25	99
Viscous criteria (m/s)	1.0	0.1	97
Sternum deflection rate (m/s)	–8.2	–0.7	95

Table 6 Leg and Foot Injury Measurements — 2001 Ford Taurus					
Measure	**Published Tolerance Threshold**	**Left**	**Time (ms)**	**Right**	**Time (ms)**
Femur axial force (kN)	–9.1*	–0.8	78	–1.9	83
Tibia-femur displacement (mm)	–15	–1	81	0	0
Upper Tibia					
L-M moment (Nm)	±225	–56	70	–130	65
A-P moment (Nm)	±225	–52	54	45	64
Vector resultant moment (Nm)	225	58	54	130	65
Index	1.00	0.31	54	0.71	65
Lower Tibia					
L-M moment (Nm)	±225**	–89	58	–180	65
A-P moment (Nm)	±225**	103	71	23	70
Vector resultant moment (Nm)	225**	113	70	181	65
Axial force (kN)	–8.0**	–2.3	53	–4.8	65
Index	1.00	0.51	70	0.94	65
Foot					
A-P acceleration (g)	±150	–137	51	–97	63
I-S acceleration (g)	±150	–86	54	–64	64
Vector resultant acceleration (g)	150	148	51	97	63

* This critical value is for instantaneous loading. Femur loads are also compared with magnitude-duration injury criteria.

** These published thresholds are for fractures of the tibia. Ankle and foot injuries have been associated with bending moments as low as 50-100 Nm, and heel fractures have been associated with axial forces as low as –6.0 kN.

References

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Appendix

Dummy Clearance Measurements

Dummy Clearance Measurements

Test Number:	CF09009B
Vehicle:	2001 Ford Taurus
Seat Type:	Electrically adjusted bucket seat (fore/aft and height) with manually adjusted seat back angle
Upper Belt Anchorage:	Set to 3rd of 5 positions
Steering Column Adjustment:	Set to 3rd of 5 tilt adjustment positions
Foot Pedal Adjustment	Set to fully forward position of fore/aft range

Location	Code	Measure	Location	Code	Measure
Head to header	HH	395	Striker to CG, horizontal	CGH	–13
Nose to rim	NR	465	Striker to CG, lateral	CGL	345
Chest to dash	CD	679	Striker to CG, vertical	CGV	531
Rim to abdomen	RA	269	Striker to knee**	SK	535
Knee to dash, left	KDL	303	Striker to knee angle**	SKA	–2.1°
Knee to dash, right	KDR	255	Striker to H-point, horizontal	SHH	–152
Steering wheel to chest, horizontal	SCH	347	Striker to H-point, vertical	SHV	–118
Steering wheel to chest, reference	SCR	425	Ankle to ankle	AA	331
Hub to chest, minimum	HCM	298	Knee to knee	KK	345
Pelvic angle	PA	27.3°	Arm to door	AD	111
Seat back angle*	SA	22.9°	H-point to door	HD	183
Torso recline angle (H-point to Head CG)	TRA	12.0°	Head to A-pillar	HA	483
Neck bracket angle	NBA	0°	Head to roof	HR	148
Neck angle, seated	NAS	4.5°	Head to side window	HS	295

All distance measurements are in millimeters (mm).
* Indicated value is from vertical, as measured on the head restraint post.
** These measurements were made in a vertical plane containing the striker and parallel to the driver door sill.