SECRETARÍA DE COMUNICACIONES Y TRANSPORTES

DIRECCIÓN GENERAL DE SERVICIOS TÉCNICOS
Dirección de Vialidad y Proyectos
Subdirección de Evaluación de Proyectos

3.3.306.-07/11

México, D.F. a 10 de febrero de 2011

ING. JOSÉ ARNULFO BARRERA GUTIÉRREZ
Gerente de Ventas Construcción México
Forjas Metálicas, S.A. de C.V.
P r e s e n t e .

Me refiero a la información correspondiente a dos sistemas de barreras de protección y de dos amortiguadores de impacto, fabricados o distribuidos por la empresa Forjas Metálicas (FORMET), que se recibió para la opinión de esta Dirección General, la cual se describe a continuación:

JESÚS

1. Barrera metálica de tres crestas fabricado por FORMET, el cual está integrado por una barrera de tres crestas de lámina galvanizada calibre 12 (2.6mm), conforme a la Norma AASHTO M-180, Clase A. Tipo I (cumple con la norma N-CMT-5-02-001/05. Calidad de Defensas), sujetas a postes de sección tipo viga IPR de 6"x4"x0.1.73 m de (12.7 kg/ml) a cada 1.905 m, con separador sección viga IPR de 6"x4"x0.554 m de (12.7kg/ml), reflejante trapezoidal a base de lámina galvanizada en frio calibre 16 con papel reflejante alta intensidad, y tornillos cabeza hexagonal de 5/8" x 1½", arandelas de 5/8" y tuerca de 5/8", todo el sistema galvanizado por inmersión en caliente. Asimismo, se menciona que esta barrera fue sometida a pruebas de impacto, conforme a los lineamientos establecidos por la Administración Federal de Carreteras (FHWA) con las condiciones del National Cooperative Highway Research Program Report NCHRP 350, y que cumple con el nivel 3; situación que se avala mediante escrito de aceptación por la FHWA del 10 de agosto de 2005.

2. Barreras metálicas de dos y tres crestas que utilizan la tecnología del mini separador denominado Gregory Mini Spacer (GMS), del cual FORMET es distribuidor en México, este sistema puede estar integrado tanto por defensa metálica de dos crestas, así como, de tres crestas de lámina galvanizada calibre 12 (2.6 mm) ó 10 (3.42 mm), conforme a la Norma AASHTO M-180, clase A y B, tipo I (cumple con la norma N-CMT-5-02-001/05. Calidad de Defensas), el sistema se instala sujeto a postes de viga W6 x 8.5 (viga de 6" x 4"), mediante tornillos de 5/8" x 1 ¼", tuercas de 5/8" con resaque, el mini separador (GMS Releasing Fastener) de 5/16 x 1½." Asimismo, se menciona que estas barreras fueron sometidas a pruebas de impacto, conforme a los lineamientos establecidos por la Administración Federal de Carreteras (FHWA) con las condiciones del National Cooperative Highway Research Program Report NCHRP 350, y que cumplen con el nivel 3; situación que se avala mediante escritos de aceptación por la FHWA de fechas 27 de octubre de 2006, 21 de marzo de 2007, 21 de diciembre de 2007, 26 de marzo de 2008 y 16 de julio de 2008.

FORMET

Recibí original
Ing. J. Arnulfo Barrera G.
11/Feb/2011

RECIBIDO
11 FEB 2011
SUBSECRETARÍA DE INFRAESTRUCTURA
HORA:

...2

3. Sistema terminal de amortiguamiento para barrera metálica basado en tensión, denominado X-Tensión, del cual FORMET es distribuidor en México, este sistema está integrado por barrera de dos crestas de lamina galvanizada calibre 12 (2.6mm), conforme a la Norma AASHTO M-180, Clase A. Tipo I (cumple con la norma N-CMT-5-02-001/05. Calidad de Defensas), la cual se sujeta a un cabezal, postes de viga IPR de 6"x4"x1.83 m, separadores de madera de 6" x 8" x 14" o plástico de 7" x 4" x 14", tornillos de acuerdo al diseño de la terminal que cumplan con ASTM A307, tirante metálico y cables de acero de ¾" de diámetro, colocados en el sentido longitudinal, abarcando la longitud total de la terminal. Asimismo, se menciona que este sistema fue sometido a pruebas de impacto, conforme a los lineamientos establecidos por la Administración Federal de Carreteras (FHWA) con las condiciones del National Cooperative Highway Research Program Report NCHRP 350, y que cumple con el nivel 3; situación que se avala mediante escrito de aceptación por la FHWA del 5 de noviembre de 2007.

4. Sistema amortiguador de impacto denominado TAU-II, del cual FORMET es distribuidor en México, este sistema se forma con marcos metálicos que colapsan de manera independiente, estos son guiados y soportados por cables de acero de alta resistencia galvanizados.

   Este sistema se integra por los siguientes componentes: dos cables de no menos de 25 mm de diámetro galvanizados de acuerdo a la norma ASTM A603, un respaldo, un anclaje frontal, soportes frontal e intermedios separados para formar bahías y que forman parte del marco colapsable, estos componentes fabricados en acero ASTM A 36 son galvanizados por inmersión en caliente de acuerdo a ASTM A 123. Los marcos colapsables son formados por los soportes frontal e intermedios y los paneles laterales deslizables con defensa de tres crestas de lámina galvanizada calibre 10 (3.42 mm), son fabricados conforme a la Norma AASTHO M 180, clase B, tipo 1 (cumple con la norma N-CMT-5-02-001/05.- Calidad de Defensas), con los marcos arriba mencionados se forman bahías o secciones de compresión, en donde se colocan cartuchos de absorción de energía, fabricados con polietileno de alta densidad de formulación especial para uso exterior y en la parte frontal del sistema se coloca una placa frontal o nariz hecha a base de poliuretano. Existen dos tipos de cartuchos de absorción de energía con diferente resistencia al impacto. Asimismo, se menciona que este sistema fue sometido a pruebas de impacto, conforme a los lineamientos establecidos por la Administración Federal de Carreteras (FHWA) con las condiciones del National Cooperative Highway Research Program Report NCHRP 350, y que cumple con el nivel 3; situación que se avala mediante escritos de aceptación por la FHWA del 4 de junio del 2004, 9 de diciembre de 2003, 20 de diciembre de 2002 y 14 de septiembre de 2001.

En el futuro, si algún contratista ofrece colocar los sistemas de barreras o amortiguadores de impacto referidos, sólo será necesario verificar que los productos que se instalen cumplan con las especificaciones del fabricante, descritas de forma general en los párrafos anteriores.

Aprovecho la ocasión para enviar a Ud. un cordial saludo.

A t e n t a m e n t e
El Director General

ING. JUAN M. OROZCO Y OROZCO

C.c.p.- Subsecretario de Infraestructura.- Presente.
Director de Vialidad y Proyectos.- Oficinas.

GGMG

Av. Coyoacán 1895, Col. Acacias, C.P. 03240, México D.F.
Tel: 57 23 93 00 ext. 15902, 15502, e-mail: gmanzo@sct.gob.mx

December 9, 2003

Refer to: HSA-10/CC75B

Owen S. Denman, P.E.
President
Barrier Systems, Incorporated
180 River Road
Rio Vista, California 94571-1208

Dear Mr. Denman:

In your November 3 letter, you requested formal Federal Highway Administration acceptance of a "family" of crash cushion designs called the Universal TAU-II Crash Cushion System. The primary difference from the original parallel-sided TAU-II designs was the introduction of variable-width diaphragms that result in a 5-degree outward flare of the attenuator side panels to allow direct shielding of hazards up to 2.6 m (8.5 feet) in width. Included with your letter were copies of Safe Technologies, Incorporated, October 2003 report, "NCHRP Report 350 Crash Test Report – Barrier Systems, Incorporated. Wide TAU-II Crash Cushion System" and CD-ROMs and VHS tapes of the certification tests that were run. In preliminary discussions with members of my staff, it was mutually agreed that selected tests on both the narrowest and widest versions of the wide TAU-II would be sufficient to accept less critical configurations of these two designs as also meeting NCHRP Report 350 evaluation criteria. The two configurations tested and the summary test results are shown in Enclosures 1 through 7.

Based on these test results, I agree that the TAU-II configurations shown in Enclosure 8 may be considered acceptable for use on the National Highway System with the following *caveats*:

- The four designs tested to Report 350 (including earlier TL-2 and TL-3 tests of the parallel-sided designs), and all those in between, may be considered to meet all pertinent evaluation criteria for the speeds listed. This includes the systems in Enclosure 8 for impact speeds of 70, 80, 90 and 100 km/h that have 3, 4, 5, 6, 7 or 8 bays, respectively.
- The tested 10-bay parallel-sided configuration met Report 350 evaluation criteria for the head-on impact with the 2000P truck at a nominal speed of 110 km/h (70 mph). The remaining designs shown under the 110 km/h heading may also be assumed to have adequate capacity to stop the pickup truck impacting head-on at 110 km/h within the occupant risk limits recommended in NCHRP Report 350 and to satisfy **all** test requirements at the standard TL-3 impact speed of 100 km/h.

- Based on favorable comparisons of predicted OIV's and ridedown accelerations with actual values from your previous 70-km/h test of the parallel-sided TL-2 design, I will also accept the 50 km/h and 60 km/h system designs shown in Enclosure 8 based upon predicted OIV and G values being lower than Report 350 preferred values.

Sincerely yours,

/***Original signed by***/

John R. Baxter, P.E.
Director, Office of Safety Design
Office of Safety

8 Enclosures

FHWA:HSA-10:RPowers:tb:x61320:12/3/03
File: h://directory folder/rpowers/CC75B(UniversalTAUII)

cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;
R. Powers, HSA-10)

Appendix D (cont.)

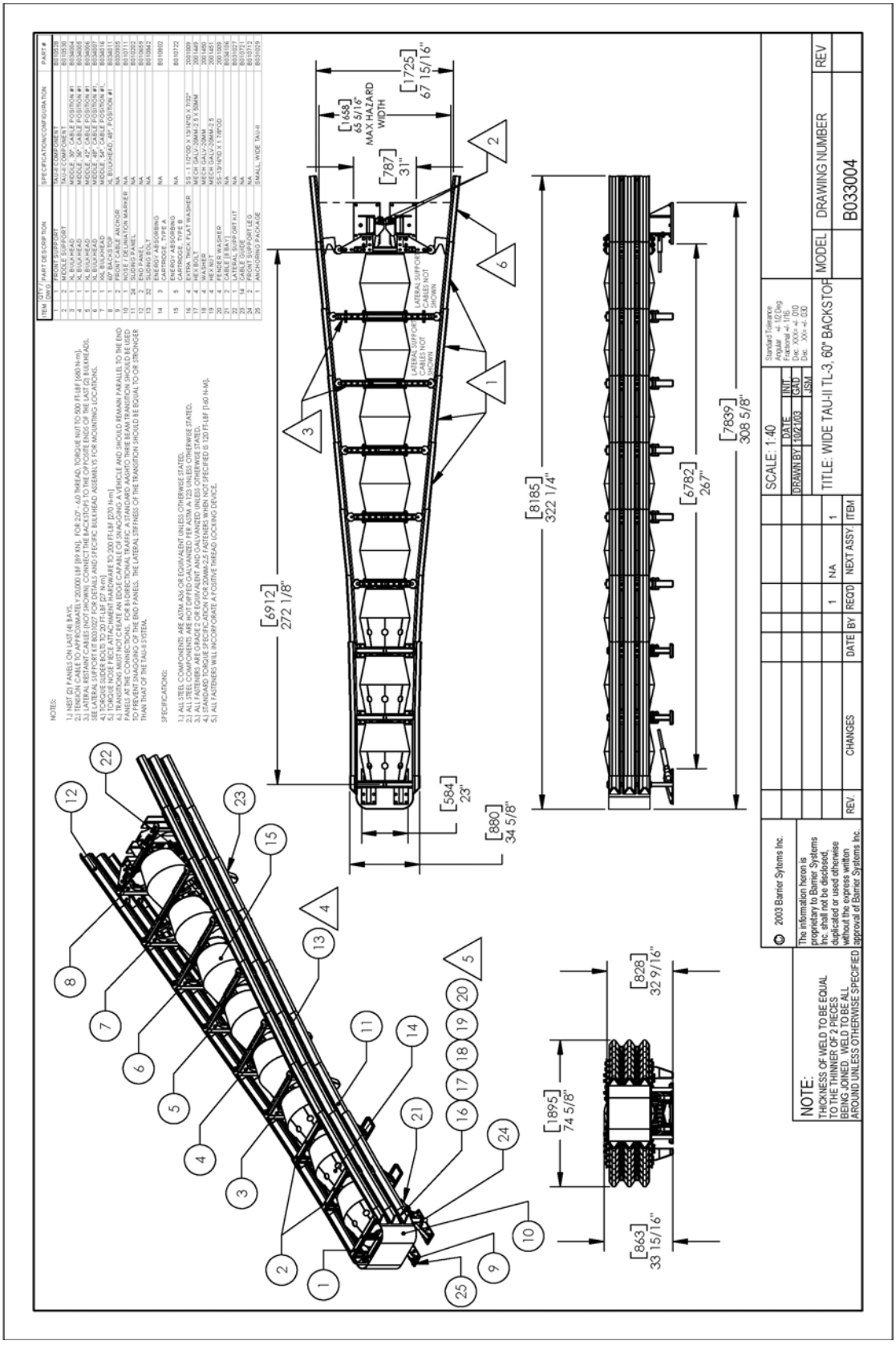
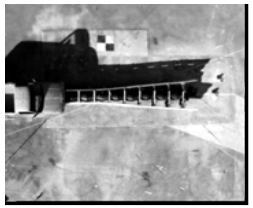


Illustration D-3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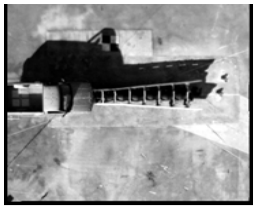
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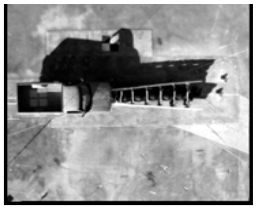
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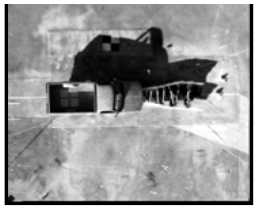
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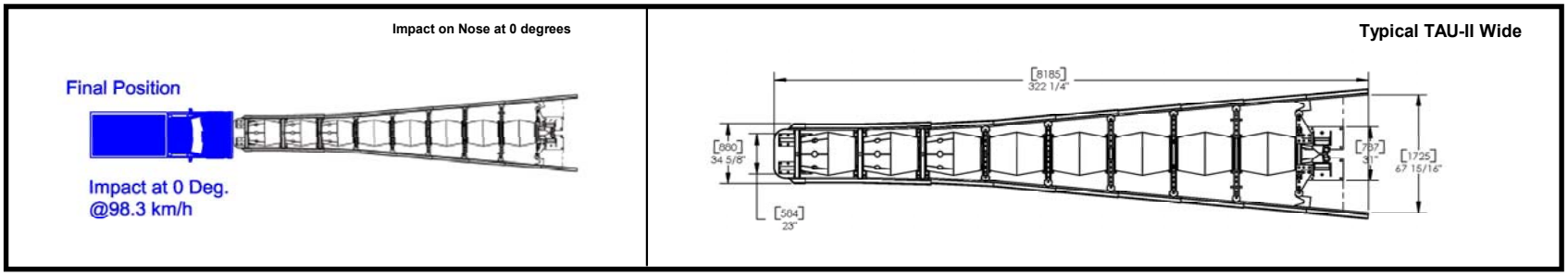


General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-31**
Test No..... **STI Test #WTU11**
Date..... 10/20/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Narrowest tested is 7.84 m (8-bay system)
Size and/or dimension
of key elements..... Height 863 mm, Widest max hazard width 1.66 meters

Test Vehicle

Type..... Production Model
Designation..... 2000P
Model..... 1989, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 1994
Test Inertial..... 2000
Dummy(s)..... n/a
Gross Static..... 2000

Impact Conditions

Speed (km/h)..... 98.3
Angle (deg)..... 0
Impact Severity (kJ)..... 749.3

Exit Conditions

Speed (km/h)..... n/a
Angle (deg)..... n/a

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 8.8
y-direction..... 0.1
Ridedown Acceleration (g's)
x-direction..... -11.1
y-direction..... -3.0
THIV (km/h)..... 31.5
PHD (g's)..... 11.2
ASI..... 0.88

Test Article Deflection (mm)

Dynamic..... n/a
Permanent..... 244

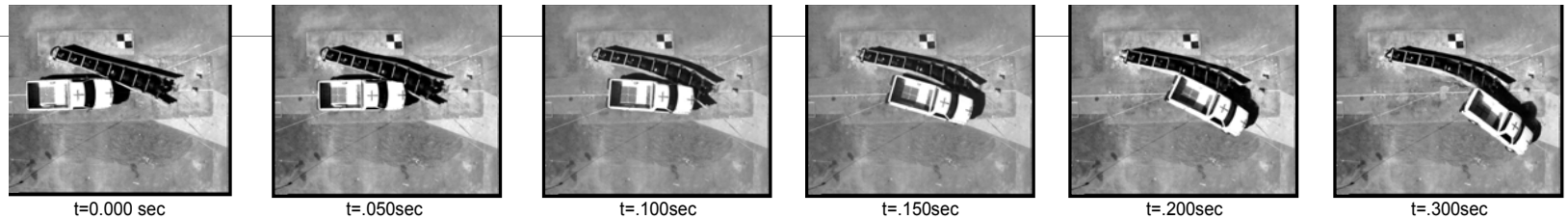
Vehicle Damage

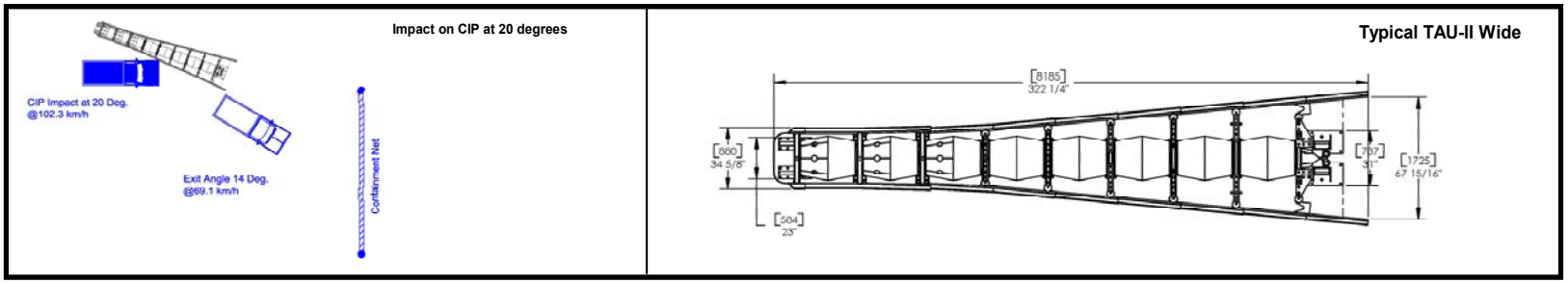
Exterior
VDS..... FC-3
CDC..... 12FDEW3
Interior
OCDI..... AS0000000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... -2.6
Maximum Pitch Angle..... -4.9
Maximum Yaw Angle..... -6.8

Figure 16. Summary of Results





General Information

Test Agency	**SAFE TECHNOLOGIES, INC.**
Test Designation	**NCHRP Report 350 3-38**
Test No	**STI Test #WTU12**
Date	10/23/2003

Test Article

Type	Barrier Systems, Inc. TAU-II Wide Crash Cushion
Installation Length	Narrowest tested is 7.84 m (8-bay system)
Size and/or dimension of key elements	Height 863 mm, Widest max hazard width 1.66 meters

Test Vehicle

Type	Production Model
Designation	2000P
Model	1988, GMC 3/4 ton pickup
Mass (kg)	
Curb	1858
Test Inertial	1970
Dummy(s)	n/a
Gross Static	1970

Impact Conditions

Speed (km/h)	102.3
Angle (deg)	20
Impact Severity (kJ)	93

Exit Conditions

Speed (km/h)	69.1
Angle (deg)	14

Occupant risk Values

Impact Velocity (m/s)	
x-direction	5.3
y-direction	-6.9
Ridedown Acceleration (g's)	
x-direction	-7.8
y-direction	15.9
THIV (km/h)	29
PHD (g's)	16
ASI	1.27

Test Article Deflection (mm)

Dynamic	452
Permanent	0

Vehicle Damage

Exterior	
VDS	FL-5
CDC	11FYEW4
Interior	
OCDI	AS0002000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle	-18.6
Maximum Pitch Angle	-4.8
Maximum Yaw Angle	53.0

Figure 21. Summary of Results Test

Appendix D

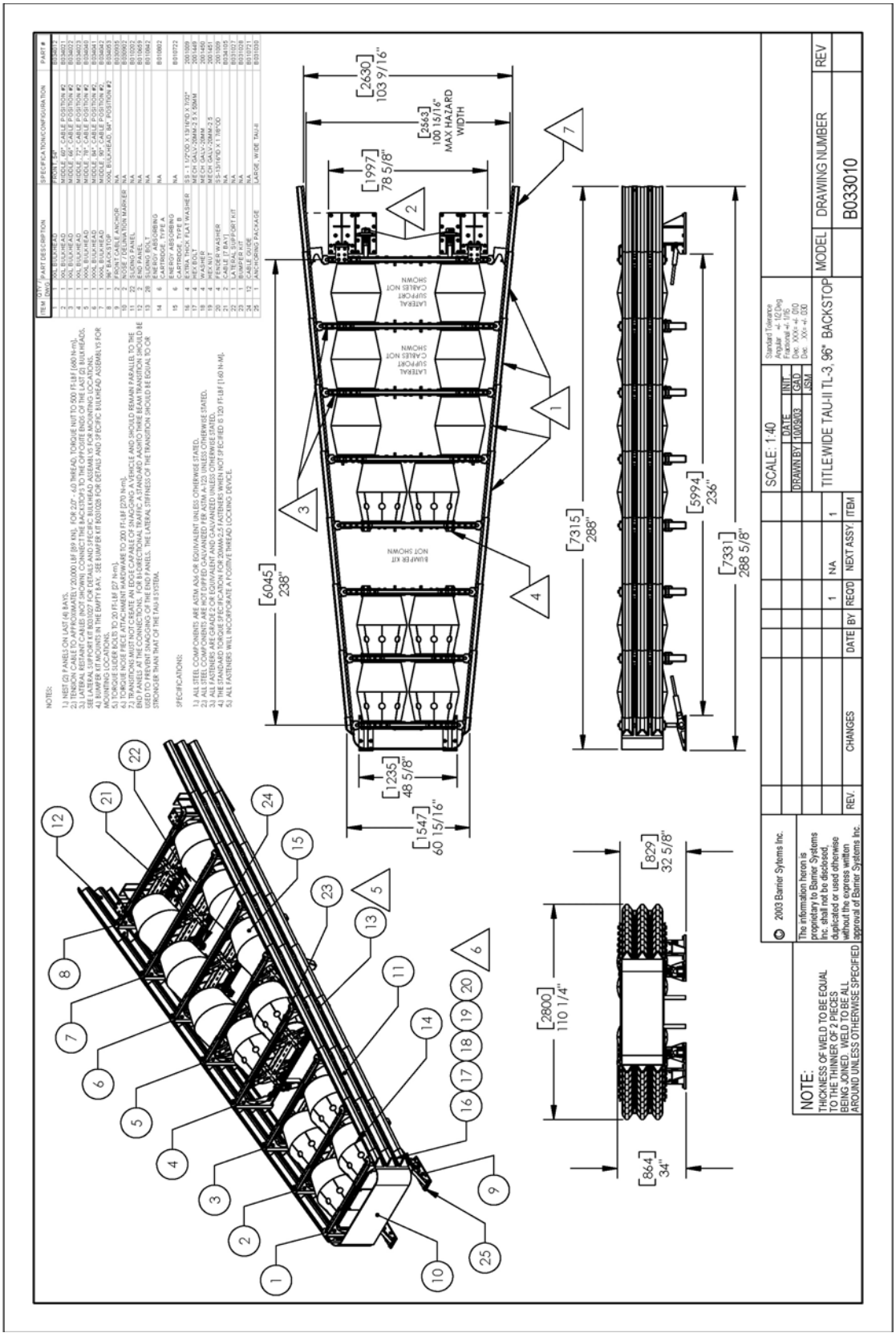
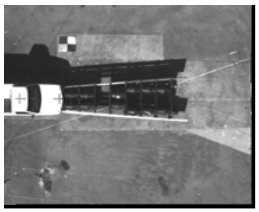


Illustration D-2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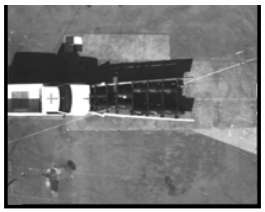
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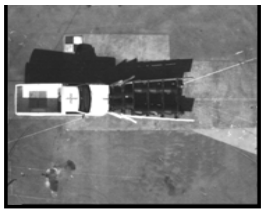
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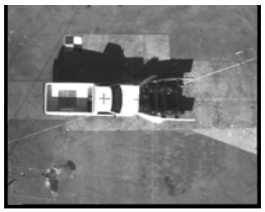
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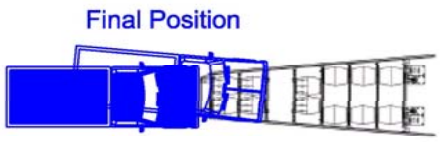
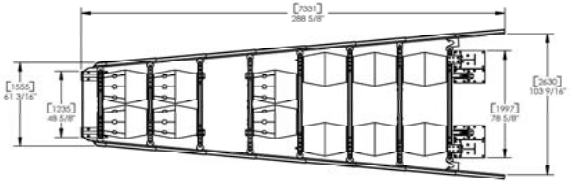
Impact on Nose at 0 degrees



Typical TAU-II Wide



General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-31**
Test No..... **STI Test #WTU04**
Date..... 8/12/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Widest tested is 7.33 meters (7-bay system)
Size and/or dimension
of key elements..... Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type..... Production Model
Designation..... 2000P
Model..... 1992, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 1881
Test Inertial..... 1987
Dummy(s)..... n/a
Gross Static..... 1987

Impact Conditions

Speed (km/h)..... 98.8
Angle (deg)..... 0
Impact Severity (kJ)..... 748.5

Exit Conditions

Speed (km/h)..... n/a
Angle (deg)..... n/a

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 8.8
y-direction..... -0.3
Ridedown Acceleration (g's)
x-direction..... -16.6
y-direction..... -5
THIV (km/h)..... 31.7
PHD (g's)..... 16.8
ASI..... 0.96

Test Article Deflection (mm)

Dynamic..... n/a
Permanent..... 167

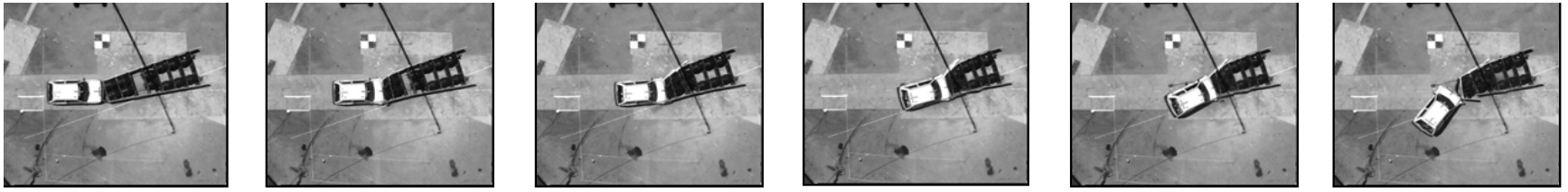
Vehicle Damage

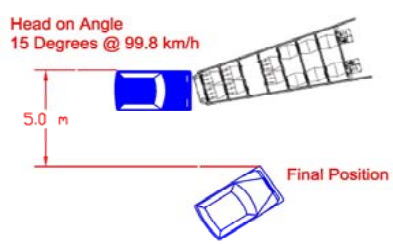
Exterior
VDS..... FC-3
CDC..... 12FDEW2
Interior
OCDI..... AS0001000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... 0.9
Maximum Pitch Angle..... -5.5
Maximum Yaw Angle..... 6.0

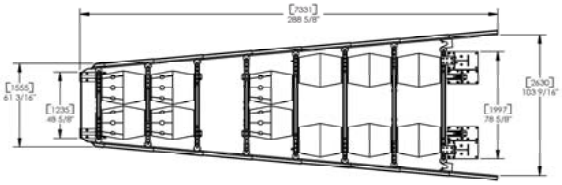
Figure 6. Summary of Results





Impact on Nose at 15 degrees

Typical TAU-II Wide



General Information

Test Agency	**SAFE TECHNOLOGIES, INC.**
Test Designation	**NCHRP Report 350 3-32**
Test No	**STI Test #WTU03**
Date	8/8/2003

Test Article

Type	Barrier Systems, Inc. Wide TAU-II Crash Cushion
Installation Length	Widest tested is 7.33 meters (7-bay system)
Size and/or dimension of key elements	Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type	Production Model
Designation	820C
Model	1990, Ford Festiva
Mass (kg)	
Curb	807
Test Inertial	820
Dummy(s)	75
Gross Static	892

Impact Conditions

Speed (km/h)	99.8
Angle (deg)	15
Impact Severity (kJ)	313.9

Exit Conditions

Speed (km/h)	n/a
Angle (deg)	n/a

Occupant risk Values

Impact Velocity (m/s)	
x-direction	11.8
y-direction	-0.5
Ridedown Acceleration (g's)	
x-direction	-20.0
y-direction	-6.9
THIV (km/h)	42.7
PHD (g's)	20.2
ASI	1.59

Test Article Deflection (mm)

Dynamic	n/a
Permanent	630 (panel)

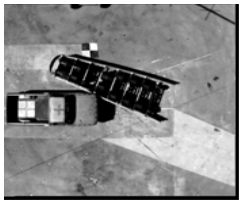
Vehicle Damage

Exterior	
VDS	LC-2
CDC	12FDEW2
Interior	
OCDI	AS0001000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle	8.1
Maximum Pitch Angle	-16.9
Maximum Yaw Angle	-59.0

Figure 1. Summary of Results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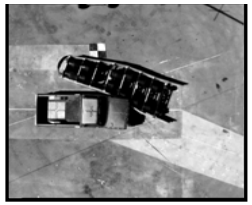
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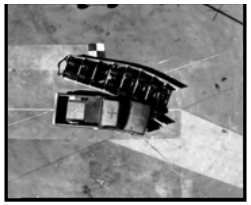
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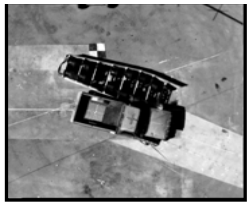
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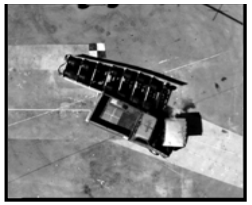
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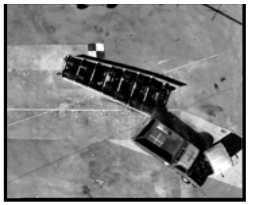
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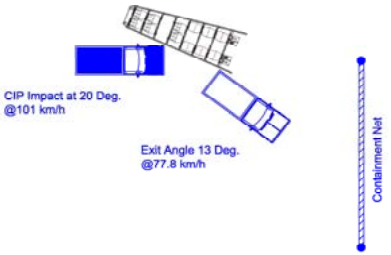
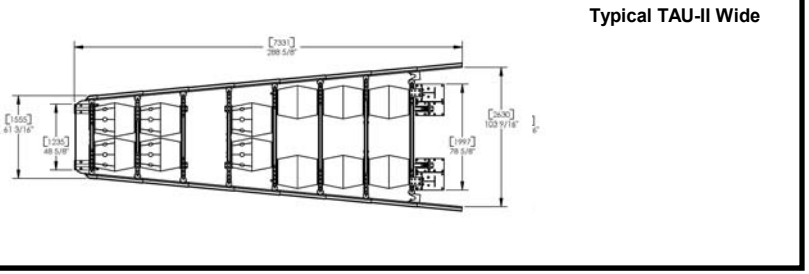




General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-38**
Test No..... **STI Test #WTU10**
Date..... 10/13/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Widest tested is 7.33 meters (7-bay system)
Size and/or dimension
of key elements..... Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type..... Production Model
Designation..... 2000kg
Model..... 1976, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 2149
Test Inertial..... 2036
Dummy(s)..... n/a
Gross Static..... 2036

Impact Conditions

Speed (km/h)..... 101
Angle (deg)..... 20
Impact Severity (kJ)..... 93.9

Exit Conditions

Speed (km/h)..... 77.8
Angle (deg)..... 13

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 4.8
y-direction..... -7.6
Ridedown Acceleration (g's)
x-direction..... -11.5
y-direction..... 14.5
THIV (km/h)..... 29.3
PHD (g's)..... 18.6
ASI..... 1.49

Test Article Deflection (mm)

Dynamic..... 317
Permanent..... 0

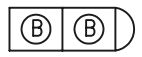
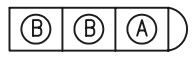
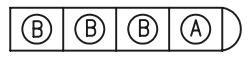
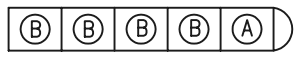
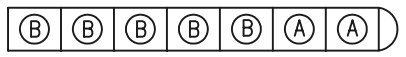
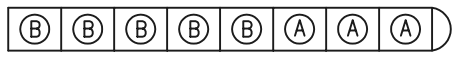
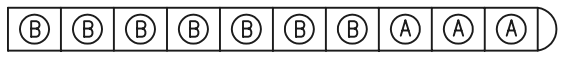
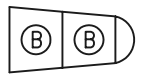
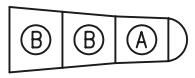
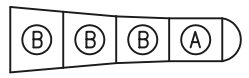
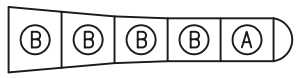
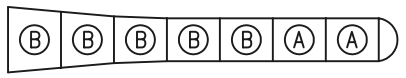
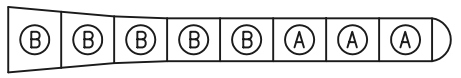
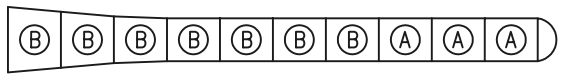
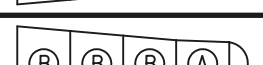
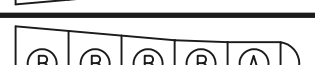
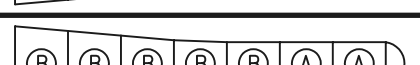
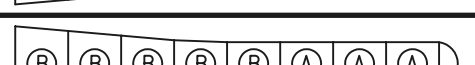
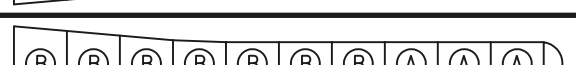
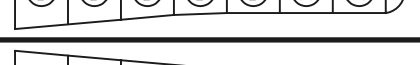
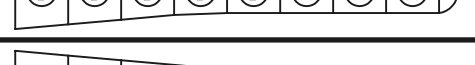
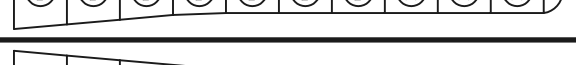
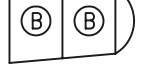
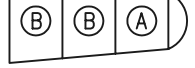
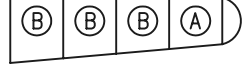
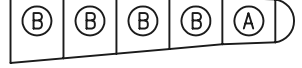
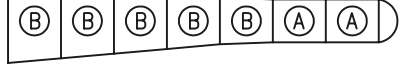
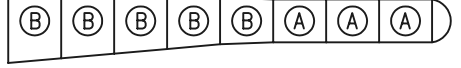
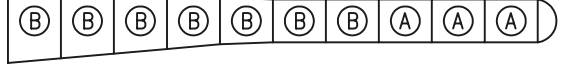
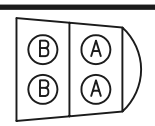
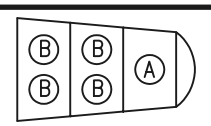
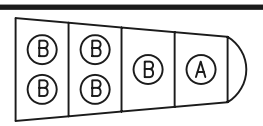
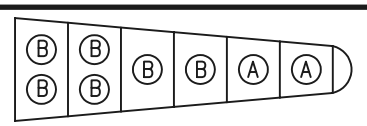
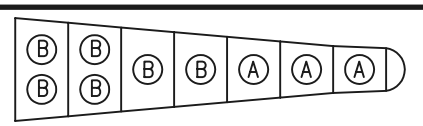
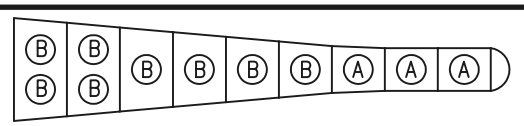
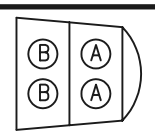
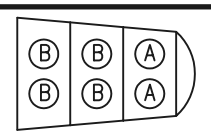
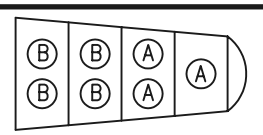
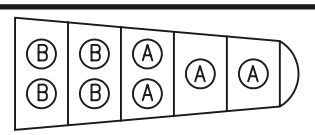
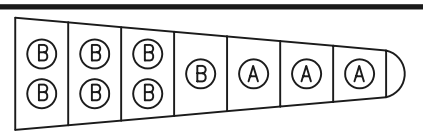
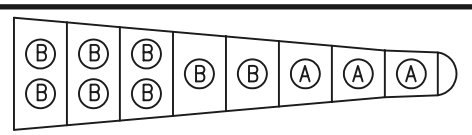
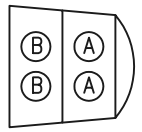
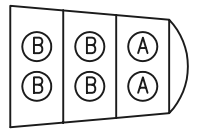
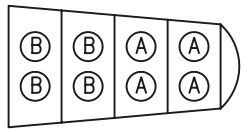
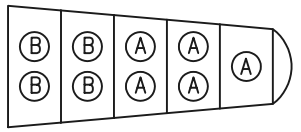
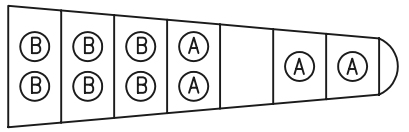
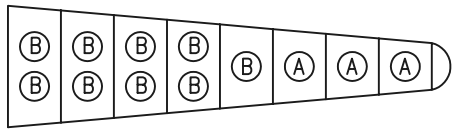
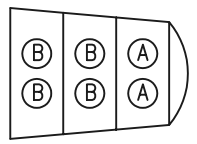
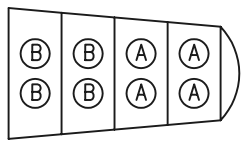
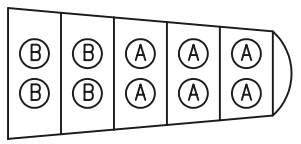
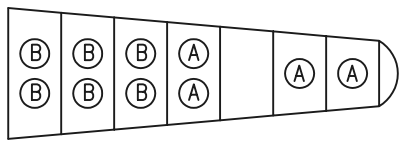
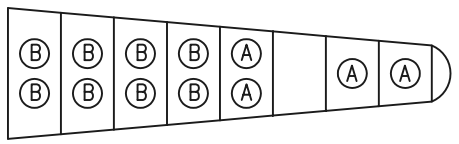
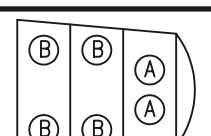
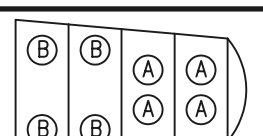
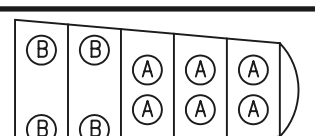
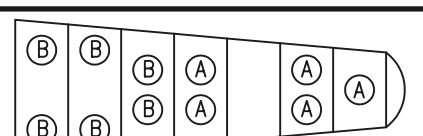
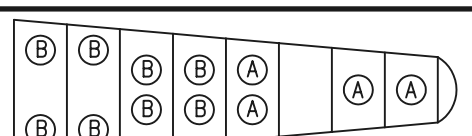
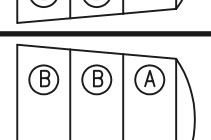
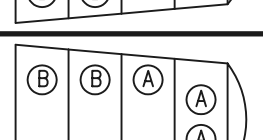
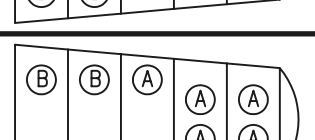
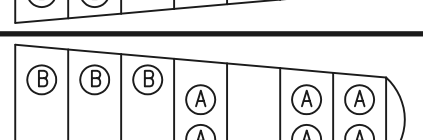
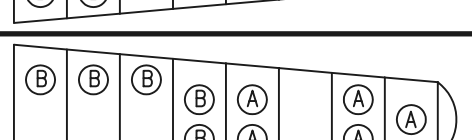
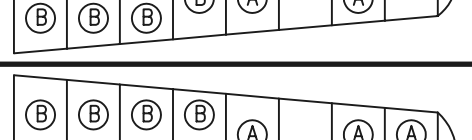
Vehicle Damage

Exterior
VDS..... FL-6
CDC..... 11FYEW5
Interior
OCDI..... AS0000100

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... -14.7
Maximum Pitch Angle..... -5.6
Maximum Yaw Angle..... 54.4

Figure 11. Summary of Results Test

BACKSTOP WIDTH	SYSTEM CAPACITY 50 KPH	60 KPH	70 KPH	80 KPH	90 KPH	100 KPH	110 KPH
PARALLEL							
42" BACKSTOP							
48" BACKSTOP							
54" BACKSTOP							
60" BACKSTOP							
66" BACKSTOP							
72" BACKSTOP							
78" BACKSTOP							
84" BACKSTOP							
90" BACKSTOP							
96" BACKSTOP							
102" BACKSTOP							

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REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
A	50 KPH CORRECT	12/1/03	GAD	1	NA	1

SCALE: 1=80

	DATE	INIT.
DRAWN BY	10/31/03	GAD
CHKD BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE : TAU-II SYSTEM CONFIGURATION MATRIX

MODEL	DRAWING NUMBER	REV.
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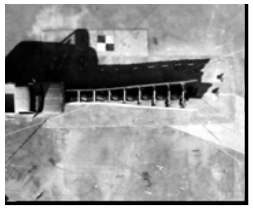
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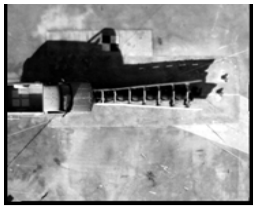
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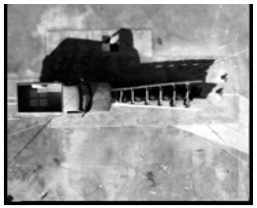
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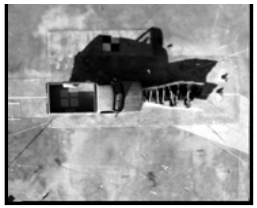
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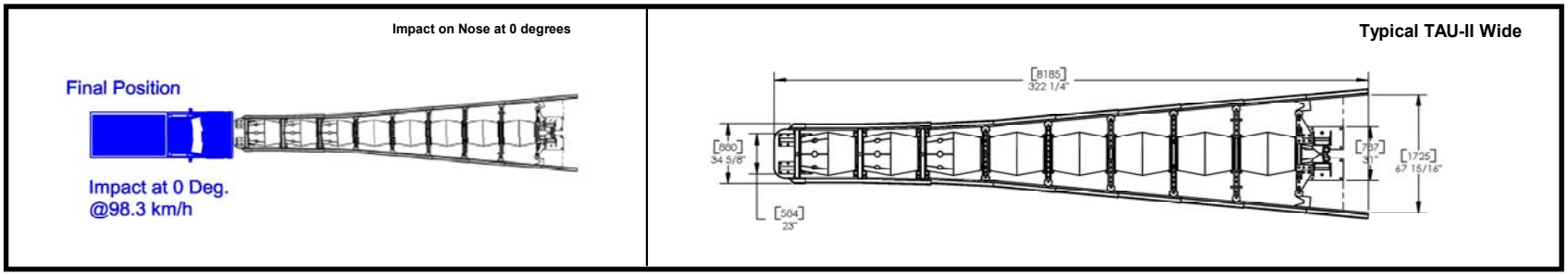


General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-31**
Test No..... **STI Test #WTU11**
Date..... 10/20/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Narrowest tested is 7.84 m (8-bay system)
Size and/or dimension
of key elements..... Height 863 mm, Widest max hazard width 1.66 meters

Test Vehicle

Type..... Production Model
Designation..... 2000P
Model..... 1989, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 1994
Test Inertial..... 2000
Dummy(s)..... n/a
Gross Static..... 2000

Impact Conditions

Speed (km/h)..... 98.3
Angle (deg)..... 0
Impact Severity (kJ)..... 749.3

Exit Conditions

Speed (km/h)..... n/a
Angle (deg)..... n/a

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 8.8
y-direction..... 0.1
Ridedown Acceleration (g's)
x-direction..... -11.1
y-direction..... -3.0
THIV (km/h)..... 31.5
PHD (g's)..... 11.2
ASI..... 0.88

Test Article Deflection (mm)

Dynamic..... n/a
Permanent..... 244

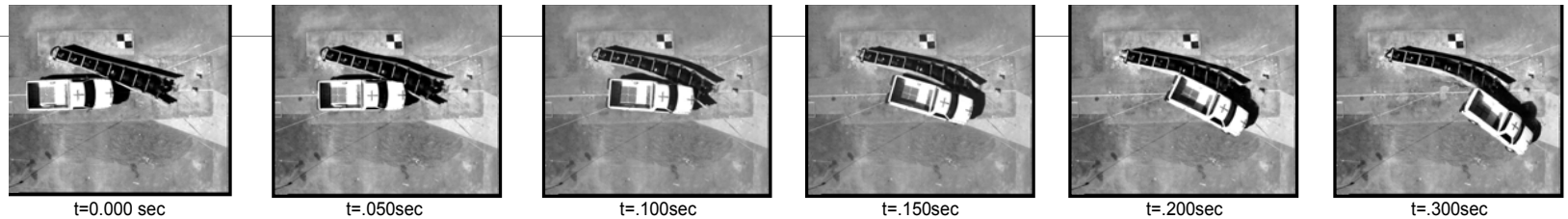
Vehicle Damage

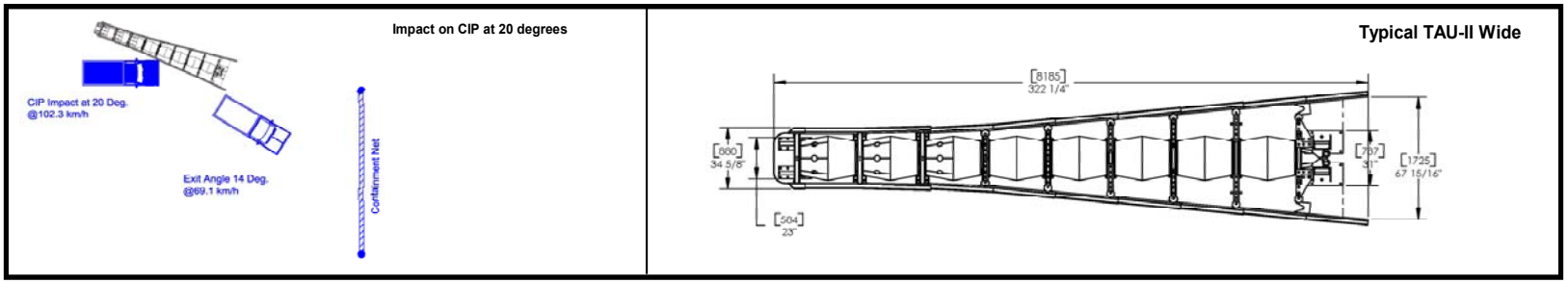
Exterior
VDS..... FC-3
CDC..... 12FDEW3
Interior
OCDI..... AS0000000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... -2.6
Maximum Pitch Angle..... -4.9
Maximum Yaw Angle..... -6.8

Figure 16. Summary of Results





General Information

Test Agency	**SAFE TECHNOLOGIES, INC.**
Test Designation	**NCHRP Report 350 3-38**
Test No	**STI Test #WTU12**
Date	10/23/2003

Test Article

Type	Barrier Systems, Inc. TAU-II Wide Crash Cushion
Installation Length	Narrowest tested is 7.84 m (8-bay system)
Size and/or dimension of key elements	Height 863 mm, Widest max hazard width 1.66 meters

Test Vehicle

Type	Production Model
Designation	2000P
Model	1988, GMC 3/4 ton pickup
Mass (kg)	
Curb	1858
Test Inertial	1970
Dummy(s)	n/a
Gross Static	1970

Impact Conditions

Speed (km/h)	102.3
Angle (deg)	20
Impact Severity (kJ)	93

Exit Conditions

Speed (km/h)	69.1
Angle (deg)	14

Occupant risk Values

Impact Velocity (m/s)	
x-direction	5.3
y-direction	-6.9
Ridedown Acceleration (g's)	
x-direction	-7.8
y-direction	15.9
THIV (km/h)	29
PHD (g's)	16
ASI	1.27

Test Article Deflection (mm)

Dynamic	452
Permanent	0

Vehicle Damage

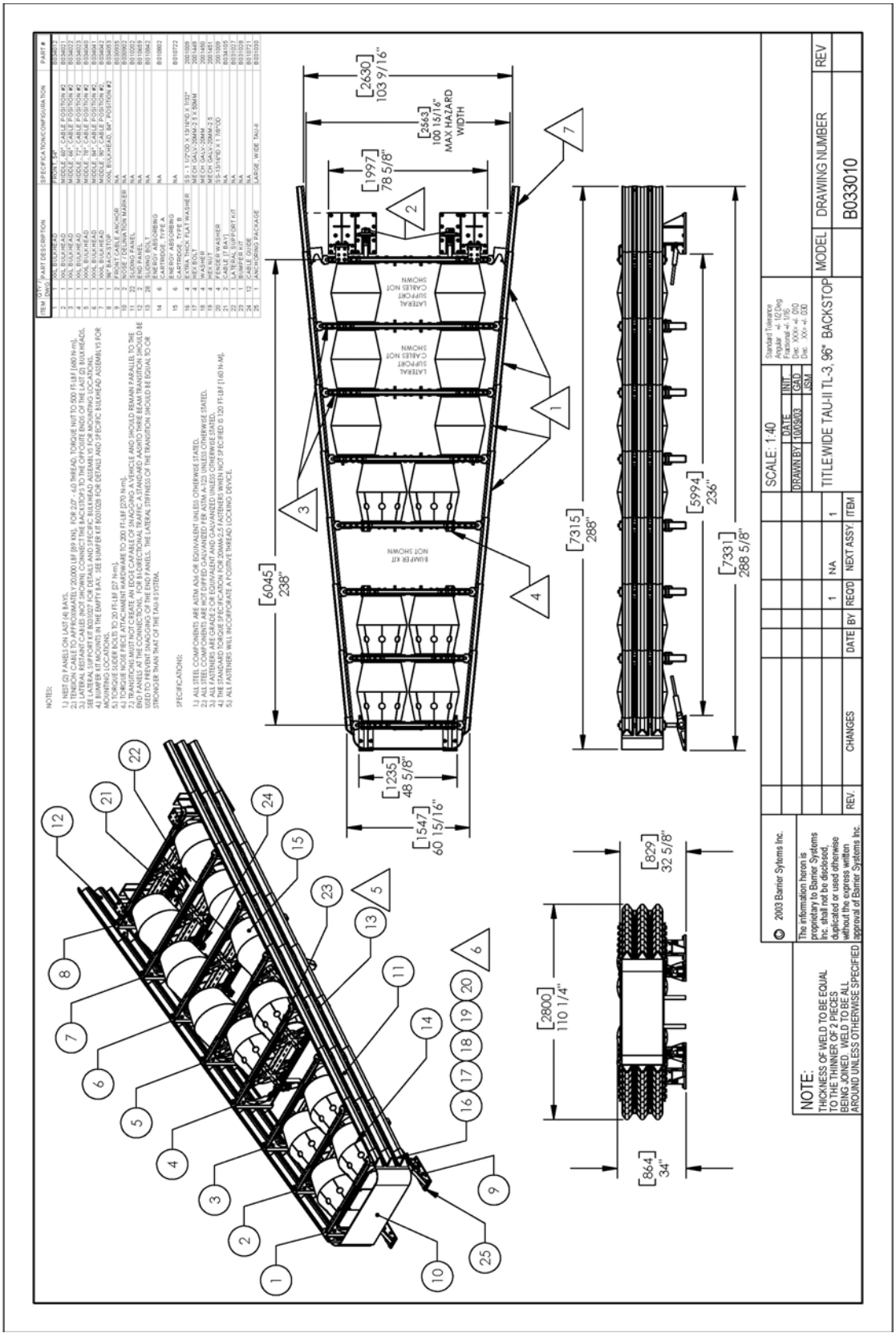
Exterior	
VDS	FL-5
CDC	11FYEW4
Interior	
OCDI	AS0002000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle	-18.6
Maximum Pitch Angle	-4.8
Maximum Yaw Angle	53.0

Figure 21. Summary of Results Test

Appendix D



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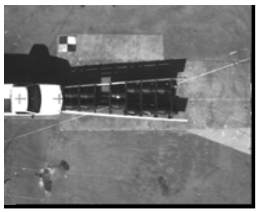
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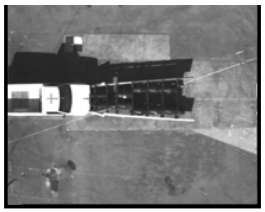
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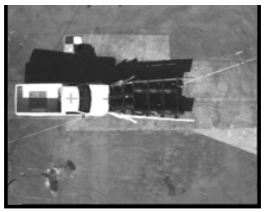
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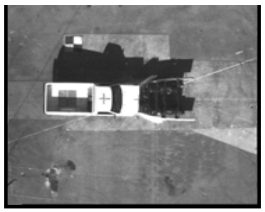
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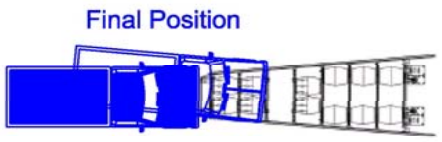
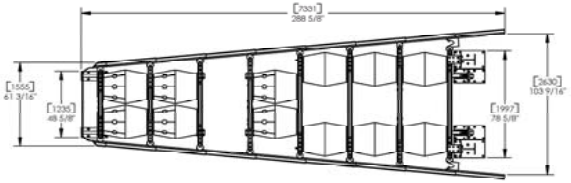
Impact on Nose at 0 degrees



Typical TAU-II Wide



General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-31**
Test No..... **STI Test #WTU04**
Date..... 8/12/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Widest tested is 7.33 meters (7-bay system)
Size and/or dimension
of key elements..... Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type..... Production Model
Designation..... 2000P
Model..... 1992, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 1881
Test Inertial..... 1987
Dummy(s)..... n/a
Gross Static..... 1987

Impact Conditions

Speed (km/h)..... 98.8
Angle (deg)..... 0
Impact Severity (kJ)..... 748.5

Exit Conditions

Speed (km/h)..... n/a
Angle (deg)..... n/a

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 8.8
y-direction..... -0.3
Ridedown Acceleration (g's)
x-direction..... -16.6
y-direction..... -5
THIV (km/h)..... 31.7
PHD (g's)..... 16.8
ASI..... 0.96

Test Article Deflection (mm)

Dynamic..... n/a
Permanent..... 167

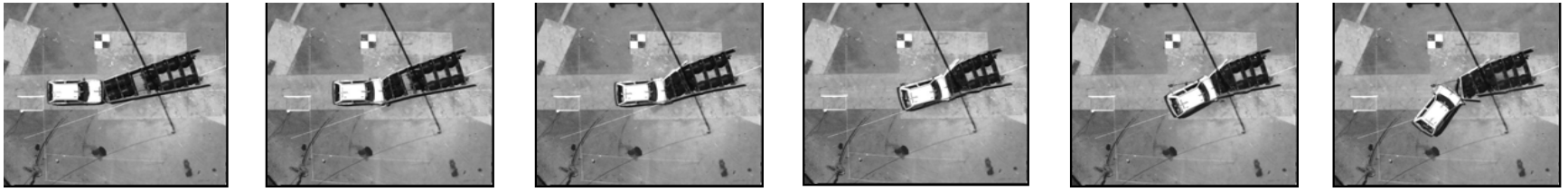
Vehicle Damage

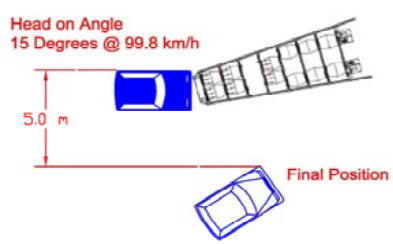
Exterior
VDS..... FC-3
CDC..... 12FDEW2
Interior
OCDI..... AS0001000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... 0.9
Maximum Pitch Angle..... -5.5
Maximum Yaw Angle..... 6.0

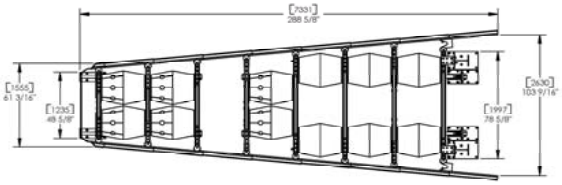
Figure 6. Summary of Results





Impact on Nose at 15 degrees

Typical TAU-II Wide



General Information

Test Agency	**SAFE TECHNOLOGIES, INC.**
Test Designation	**NCHRP Report 350 3-32**
Test No	**STI Test #WTU03**
Date	8/8/2003

Test Article

Type	Barrier Systems, Inc. Wide TAU-II Crash Cushion
Installation Length	Widest tested is 7.33 meters (7-bay system)
Size and/or dimension of key elements	Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type	Production Model
Designation	820C
Model	1990, Ford Festiva
Mass (kg)	
Curb	807
Test Inertial	820
Dummy(s)	75
Gross Static	892

Impact Conditions

Speed (km/h)	99.8
Angle (deg)	15
Impact Severity (kJ)	313.9

Exit Conditions

Speed (km/h)	n/a
Angle (deg)	n/a

Occupant risk Values

Impact Velocity (m/s)	
x-direction	11.8
y-direction	-0.5
Ridedown Acceleration (g's)	
x-direction	-20.0
y-direction	-6.9
THIV (km/h)	42.7
PHD (g's)	20.2
ASI	1.59

Test Article Deflection (mm)

Dynamic	n/a
Permanent	630 (panel)

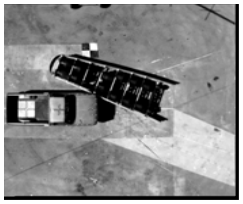
Vehicle Damage

Exterior	
VDS	LC-2
CDC	12FDEW2
Interior	
OCDI	AS0001000

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle	8.1
Maximum Pitch Angle	-16.9
Maximum Yaw Angle	-59.0

Figure 1. Summary of Results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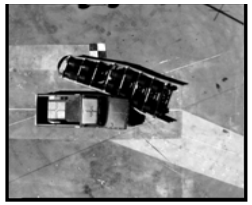
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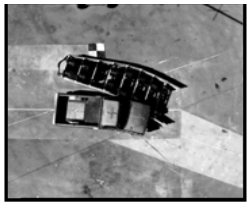
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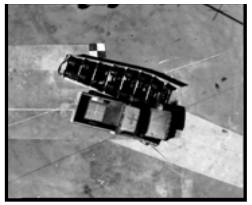
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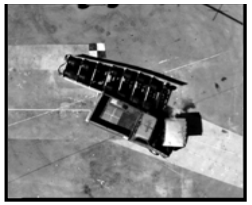
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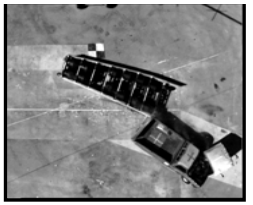
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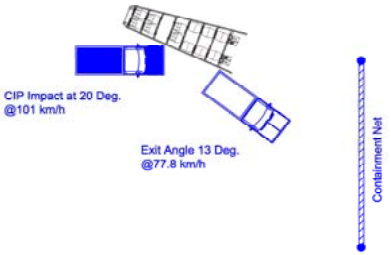
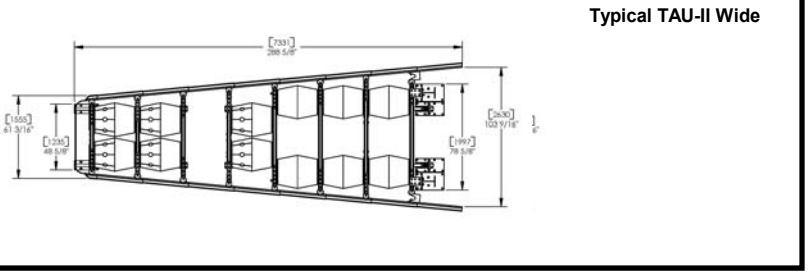




General Information

Test Agency..... **SAFE TECHNOLOGIES, INC.**
Test Designation..... **NCHRP Report 350 3-38**
Test No..... **STI Test #WTU10**
Date..... 10/13/2003

Test Article

Type..... Barrier Systems, Inc.
TAU-II Wide Crash Cushion
Installation Length..... Widest tested is 7.33 meters (7-bay system)
Size and/or dimension
of key elements..... Height 864 mm, Widest max hazard width 2.63 meters

Test Vehicle

Type..... Production Model
Designation..... 2000kg
Model..... 1976, Chevrolet 3/4 ton pickup

Mass (kg)
Curb..... 2149
Test Inertial..... 2036
Dummy(s)..... n/a
Gross Static..... 2036

Impact Conditions

Speed (km/h)..... 101
Angle (deg)..... 20
Impact Severity (kJ)..... 93.9

Exit Conditions

Speed (km/h)..... 77.8
Angle (deg)..... 13

Occupant risk Values

Impact Velocity (m/s)
x-direction..... 4.8
y-direction..... -7.6
Ridedown Acceleration (g's)
x-direction..... -11.5
y-direction..... 14.5
THIV (km/h)..... 29.3
PHD (g's)..... 18.6
ASI..... 1.49

Test Article Deflection (mm)

Dynamic..... 317
Permanent..... 0

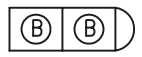
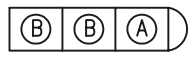
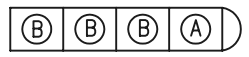
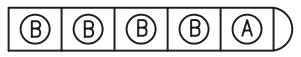
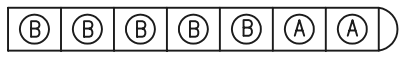
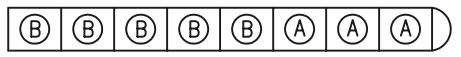
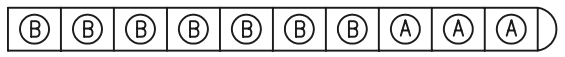
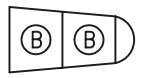
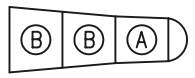
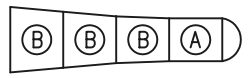
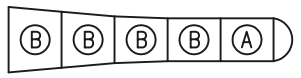
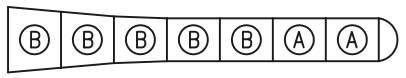
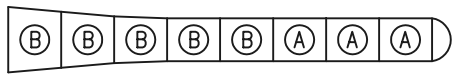
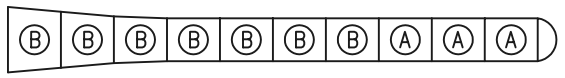
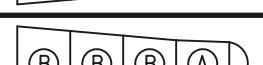
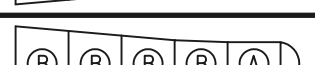
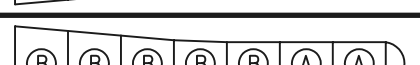
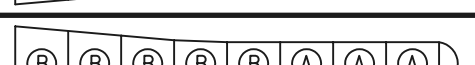
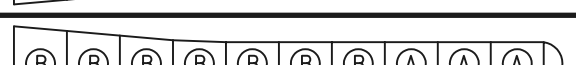
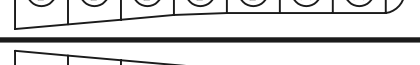
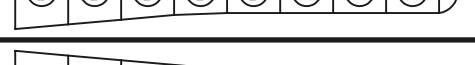
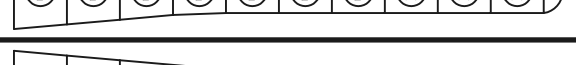
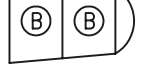
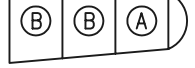
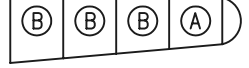
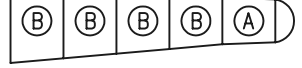
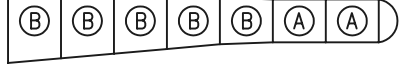
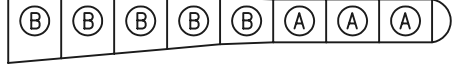
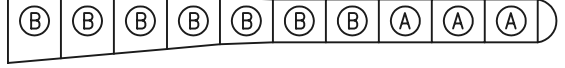
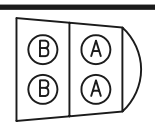
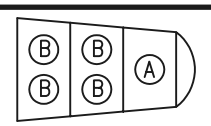
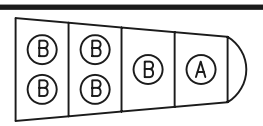
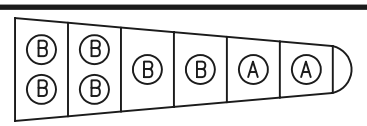
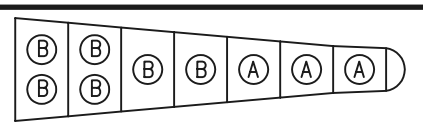
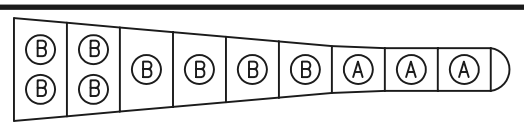
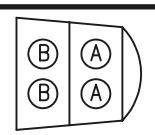
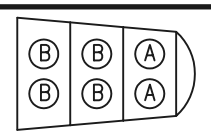
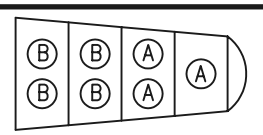
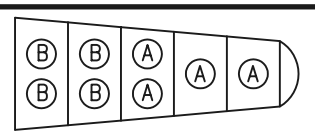
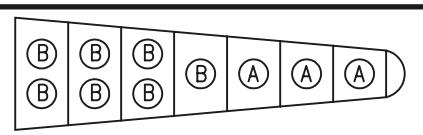
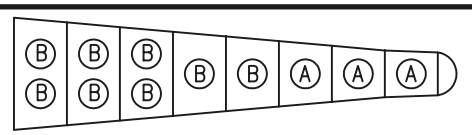
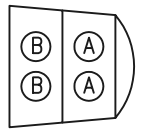
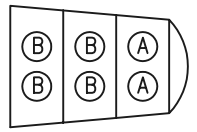
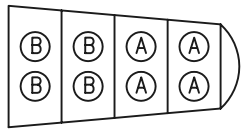
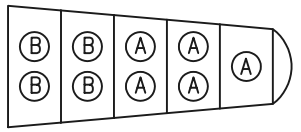
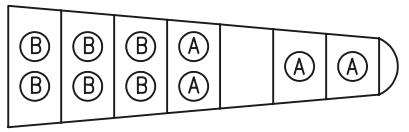
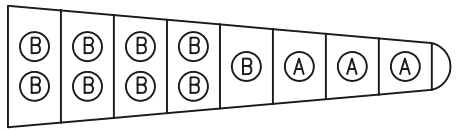
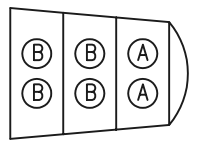
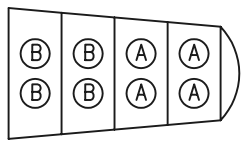
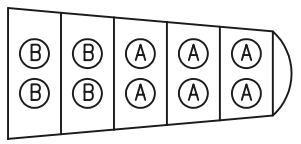
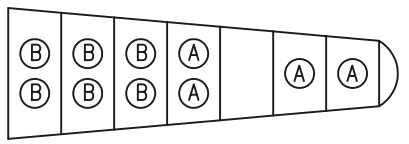
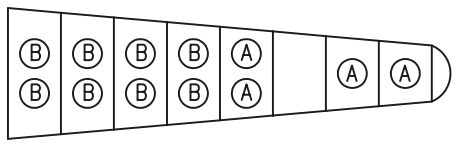
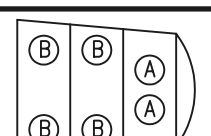
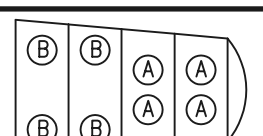
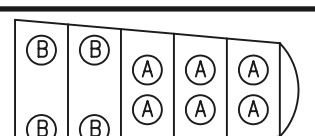
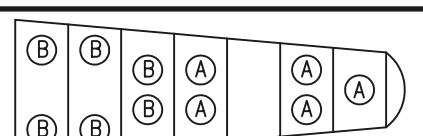
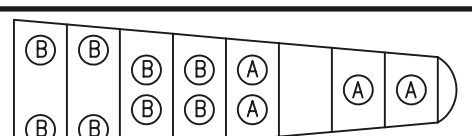
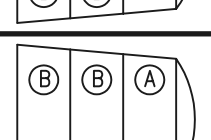
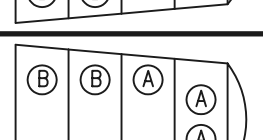
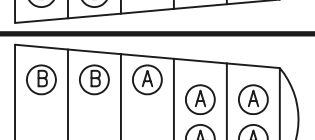
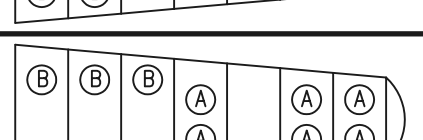
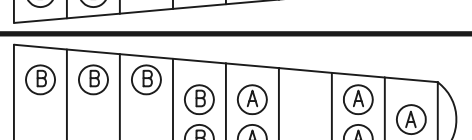
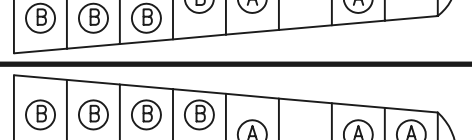
Vehicle Damage

Exterior
VDS..... FL-6
CDC..... 11FYEW5
Interior
OCDI..... AS0000100

Post-Impact Vehicular behavior (deg - gyro @ c.g.)

Maximum Roll Angle..... -14.7
Maximum Pitch Angle..... -5.6
Maximum Yaw Angle..... 54.4

Figure 11. Summary of Results Test

BACKSTOP WIDTH	SYSTEM CAPACITY 50 KPH	60 KPH	70 KPH	80 KPH	90 KPH	100 KPH	110 KPH
PARALLEL							
42" BACKSTOP							
48" BACKSTOP							
54" BACKSTOP							
60" BACKSTOP							
66" BACKSTOP							
72" BACKSTOP							
78" BACKSTOP							
84" BACKSTOP							
90" BACKSTOP							
96" BACKSTOP							
102" BACKSTOP							

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REV.	CHANGES	DATE	BY	REQ'D	NEXT ASSY.	ITEM
A	50 KPH CORRECT	12/1/03	GAD	1	NA	1

SCALE: 1=80

	DATE	INIT.
DRAWN BY	10/31/03	GAD
CHKD BY		

Standard Tolerance
Angular ± 1/2°
Fractional ± 1/16
Dec .XXX= ± .010
Dec .XX= ± .030

TITLE : TAU-II SYSTEM CONFIGURATION MATRIX

MODEL	DRAWING NUMBER	REV.
	D031101	A