

TEST DESCRIPTION

PROJECT NAME: Johnson v Riddell

PROJECT NUMBER: PH09966

TEST DATE: January 5, 2006

TEST TYPE: Football Helmet Testing

ANTHROPOMORPHIC TEST DEVICES (ATDs): Modified 50th-percentile-male Hybrid-III

INSTRUMENTATION: Triaxial head accelerometer set
Six-axis upper neck load transducer
Six-axis lower neck load transducer

PHOTOGRAPHY: One stationary high-speed video camera
One stationary real-time video camera
Still photographs

TEST DESCRIPTION: A custom test fixture was fabricated to suspend an anthropomorphic test device (ATD) in a pendulum fashion using three wire ropes. This fixture allowed the ATD to be released from a known height and swung headfirst into a fixed barrier. The barrier impact surface consisted of a 1-inch-thick rubber sheet with a durometer reading of 60 Shore "A". This was attached to the test fixture with clamps during tests 1-5, and it was attached with three 1.5-inch by 8-inch strips of hook-and-loop (velcro) material during tests 6-33.

The ATD's arms and legs were removed and a light-weight lumbar adapter and pedestrian pelvis were installed, resulting in a final test weight of 88.8 pounds. In each test, the ATD was positioned at impact with its neck approximately parallel to the floor; it was then raised to a pre-determined height and released using an electric winch and an air-hook release. Data and video for each test were triggered with a ground-based optical eye and reflective tape attached to the ATD.

Four size "medium" helmets were tested including a Riddell VSR-3 (silver), a Riddell VSR-4 (purple), a Riddell VSR-3 modified with a VSR-4 headpad (red), and a Schutt DNA (white).

Tests were conducted from several release heights, with or without helmets, and with helmet air chambers inflated or non-inflated (refer to the "Summary of Results" table in the *Test Results* section of this report). Helmets were fitted to the ATD head in a consistent manner, and after each helmeted test, the helmet was removed and inspected.

**ANTHROPOMORPHIC TEST DEVICE
SPECIFICATION SHEET**

PROJECT NO: PH09966	PROJECT NAME: JOHNSON V RIDDELL	TEST DATE: 1/5/2006
VEHICLE YEAR: N/A	VEHICLE MAKE: N/A	VEHICLE MODEL: N/A
DUMMY SEATING POSITION: N/A	RESTRAINT TYPE: N/A	
BASE DUMMY: H3-50	ID NO: 1850	CAL DUE: 5/31/06

SPECIFICATIONS & MODIFICATIONS	
HEAD & NECK:	NONE
THORAX & ARMS:	REMOVED ARMS
LUMBAR & PELVIS:	INSTALLED LIGHTWEIGHT LUMBAR ADAPTOR AND PEDESTRIAN PELVIS
LEGS & FEET:	REMOVED LEGS
PRE-TEST MEASUREMENTS:	NONE

BALLASTING & WEIGHT DISTRIBUTION (lb)			
	BASE SEGMENT WEIGHT	ACTUAL BALLAST ADDED	FINAL SEGMENT WEIGHT
HEAD & NECK ASSEMBLY:	13.4	0.0	13.4
THORAX ASSEMBLY:	37.9	0.0	37.9
ARMS (LEFT & RIGHT):	18.8	-18.8	0.0
LUMBAR & PELVIS:	50.8	-13.3	37.5
LEGS & FEET (LEFT & RIGHT):	51.4	-51.4	0.0
TOTAL DUMMY WEIGHT:	172.3	-83.5	88.8

INSTALLED INSTRUMENTATION
HEAD: Ax, Ay, Az
UPPER NECK: Fx, Fy, Fz, Mx, My, Mz
LOWER NECK: Fx, Fy, Fz, Mx, My, Mz

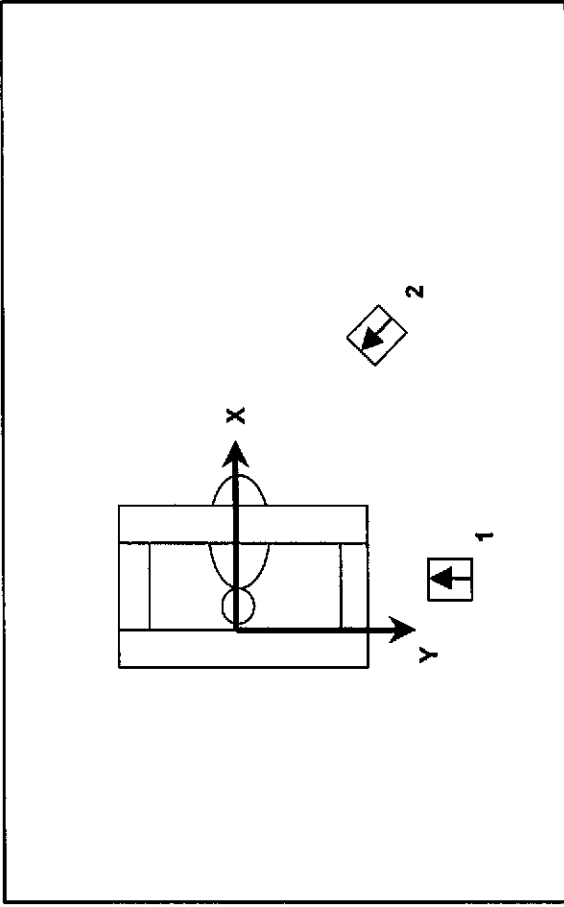
COMMENTS
NONE

POST-TEST INSPECTION	
REPAIRS & OBSERVATIONS:	
NO APPARENT DAMAGE	
DATE INSPECTED: 1/5/06	PREPARED BY: RT

CAMERA SET-UP RECORD

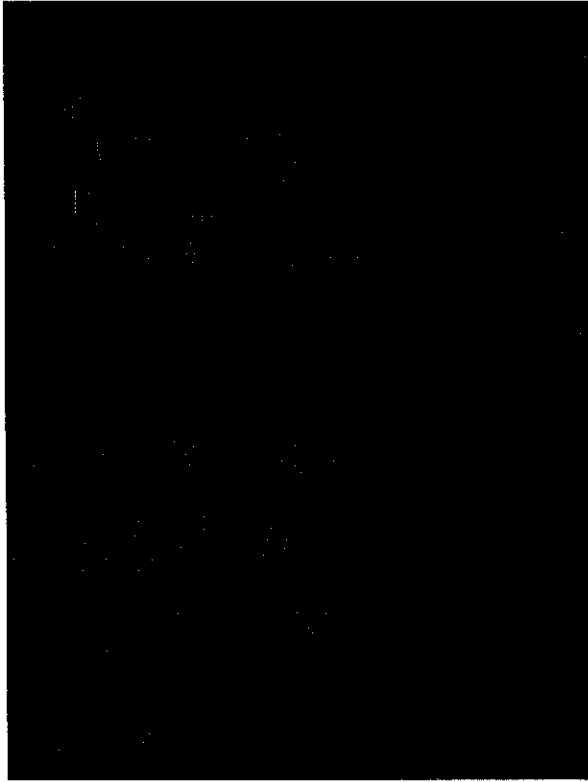
PROJECT NO:	PH09966	TEST DATE:	1/5/2006
PROJECT NAME:	JOHNSON V RIDDELL		
TEST TYPE:	FOOTBALL HELMET TESTING		
TARGET VEHICLE (T):	N/A		
BULLET VEHICLE (B):	N/A		
TEST SPEEDS (T):	N/A	(B):	N/A
COMMENTS:	NONE		

LEGEND: OVERHEAD PIT ONBOARD GROUND PANNING

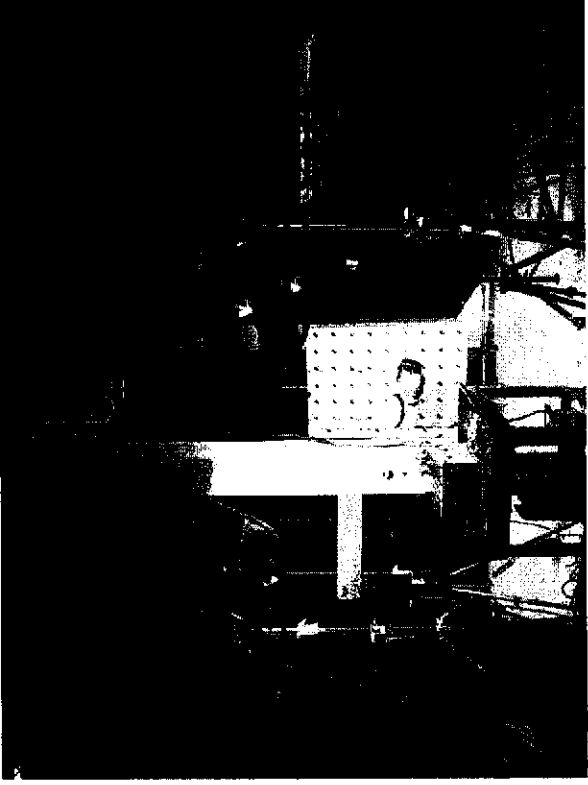


NOTES: ALL DIMENSIONS IN FEET. NOT TO SCALE. DISTANCES APPROXIMATE. Z-AXIS MEASURED UP FROM GROUND.

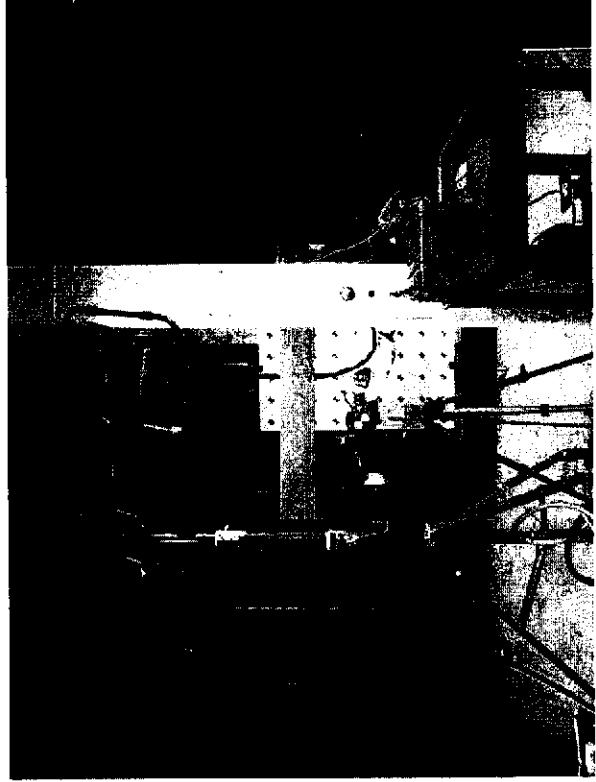
LOC NO	CAMERA TYPE	FIELD OF VIEW	IMPACT DISTANCE (X)	CENTERLINE DISTANCE (Y)	CAMERA HEIGHT (Z)	SET SPEED (fps)	LENS SIZE (mm)
1	HSV	CLOSE-UP VIEW, HEAD AND NECK	1.5	9.0	4.0	500	25
2	VIDEO	OVERALL VIEW, OBLIQUE	7.0	7.0	4.0	RT	--



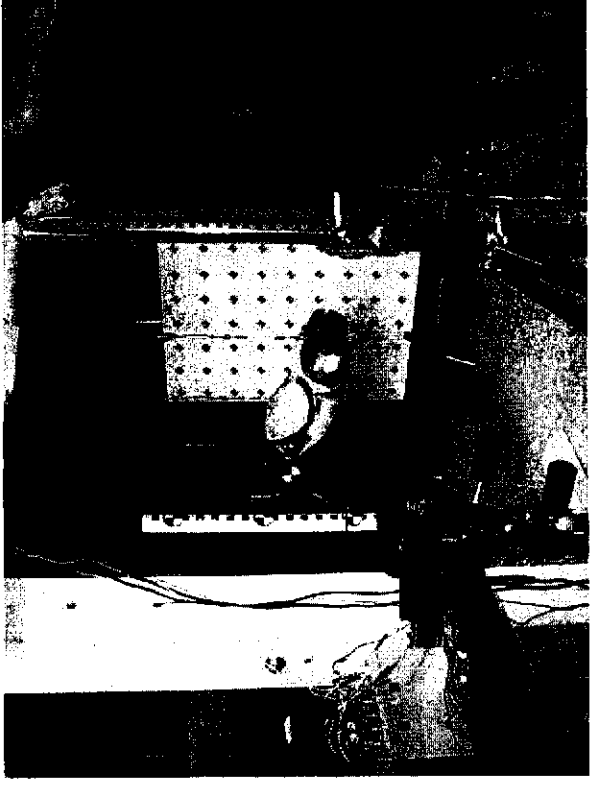
PH09966 H0F0-01338PH_0001



PH09966 H0F0-01338PH_0002



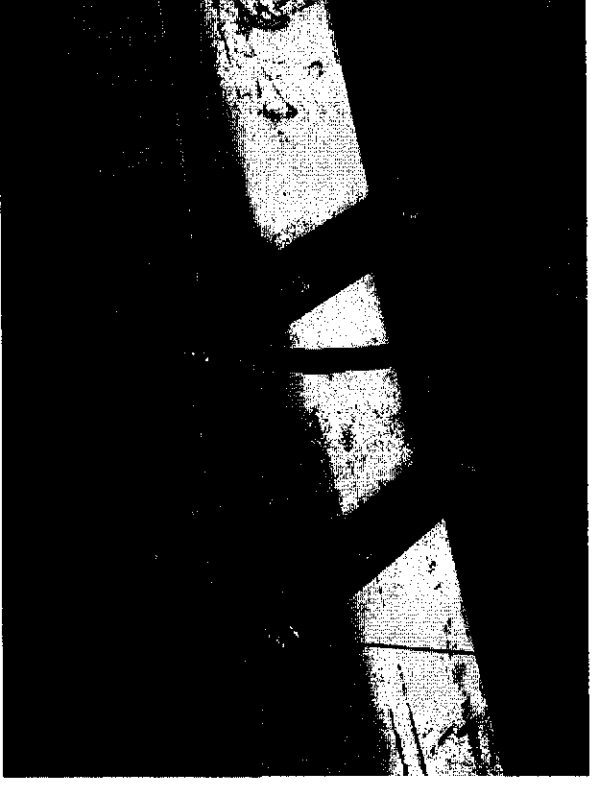
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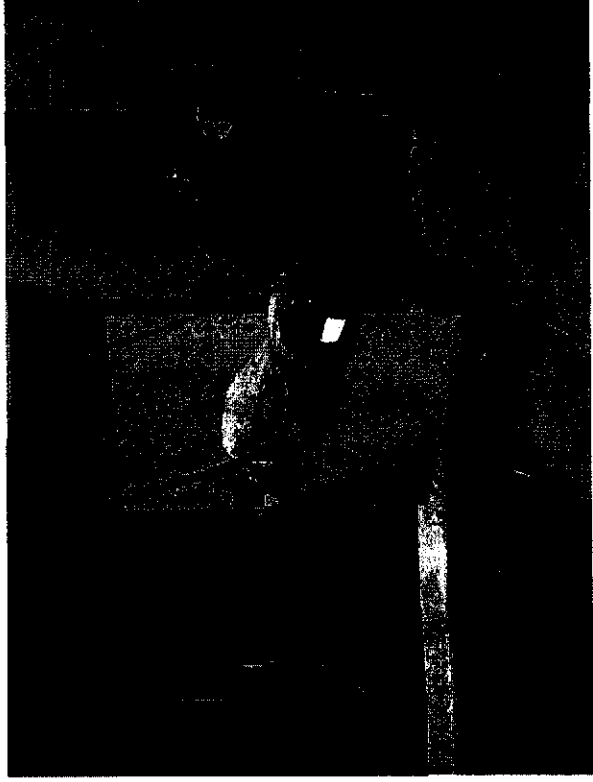
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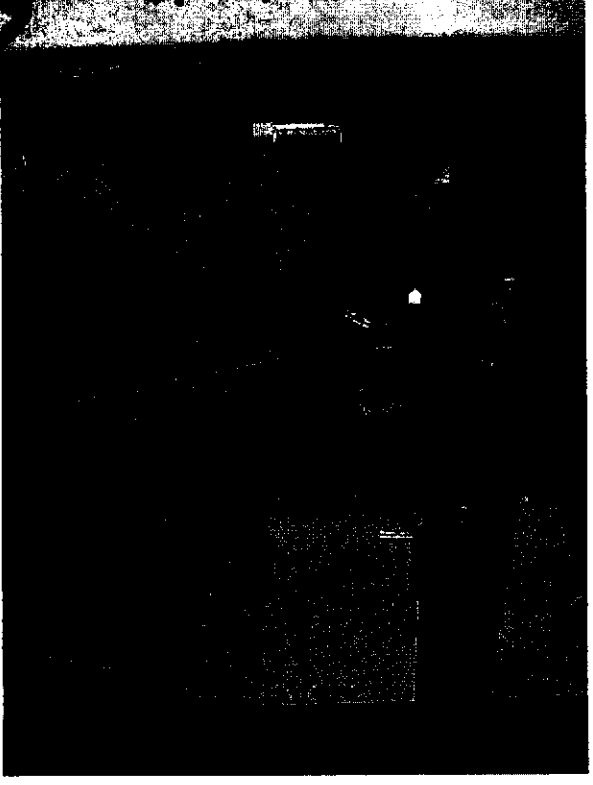
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PH09966 H0F0-01338PH_0008

SUMMARY OF RESULTS

Test No.	Description	Comments	Upper Neck Load		Lower Neck Load		Head Peak Resultant Acceleration [g]
			Peak Compression Cell [lbf]	Cell [lbf]	Peak Compression Cell [lbf]	Cell [lbf]	
Test 1	No helmet, 3.4-inch drop	Rubber sheet clamped to fixture*	905.4	800.1			24.9
Test 2	No helmet, 3.4-inch drop	None	868.1	758.4			25.1
Test 3	No helmet, 6.8-inch drop	None	1452.4	1208.4			58.8
Test 4	No helmet, 10.2-inch drop	None	1705.1	1405.2			82.0
Test 5	No helmet, 13.6-inch drop	None	2000.7	1636.4			99.5
Test 6	No helmet, 3.4-inch drop	Rubber sheet velcro'd to fixture*	841.0	741.3			20.7
Test 7	No helmet, 6.8-inch drop	None	1275.9	1065.5			44.9
Test 8	No helmet, 10.2-inch drop	None	1570.3	1294.8			65.3
Test 9	No helmet, 13.5-inch drop	None	1876.3	1521.8			81.9
Test 10	Riddell VSR-3 without air, 3.4-inch drop	None	255.5	232.9			6.0
Test 11	Riddell VSR-3 without air, 6.8-inch drop	None	631.6	575.0			9.4
Test 12	Riddell VSR-3 without air, 10.2-inch drop	None	975.0	825.6			15.4
Test 13	Riddell VSR-3 without air, 13.6-inch drop	None	1104.2	930.7			18.3
Test 14	Riddell VSR-3 with air, 3.4-inch drop	6 pumps of air off head	290.0	262.4			6.4
Test 15	Riddell VSR-3 with air, 3.4-inch drop	6 pumps of air on head, 8 sec prior to test	326.0	297.6			6.9
Test 16	Schutt DNA without air, 3.4-inch drop	None	401.0	366.6			5.1
Test 17	Schutt DNA without air, 6.8-inch drop	None	856.6	759.4			14.0
Test 18	Schutt DNA without air, 10.2-inch drop	None	1158.2	954.9			23.4
Test 19	Schutt DNA without air, 13.6-inch drop	None	1287.7	1058.8			28.5
Test 20	Schutt DNA with air, 3.4-inch drop	2 pumps of air per chamber, off head	378.4	348.1			4.7
Test 21	Schutt DNA with air, 6.8-inch drop	Air retained from prior test	823.7	724.9			12.6
Test 22	Schutt DNA with air, 10.2-inch drop	Air retained from prior test	1093.7	906.1			20.8
Test 23	Schutt DNA with air, 13.6-inch drop	Air retained from prior test	1191.4	994.7			25.0
Test 24	Riddell VSR-4 without air, 3.4-inch drop	None	385.2	350.5			6.3
Test 25	Riddell VSR-4 without air, 6.8-inch drop	None	796.7	700.3			12.6
Test 26	Riddell VSR-4 without air, 10.2-inch drop	None	1058.8	877.0			18.3
Test 27	Riddell VSR-4 without air, 13.6-inch drop	None	1189.6	980.4			22.3
Test 28	Riddell VSR-4 with air, 3.4-inch drop	4 pumps of air off head	338.5	306.6			4.8
Test 29	Riddell VSR-4 with air, 5.8-inch drop**	Air retained from prior test	637.1	581.0			9.2
Test 30	Riddell VSR-4 with air, 10.2-inch drop	Air retained from prior test	1049.5	873.5			16.1
Test 31	Riddell VSR-4 with air, 13.6-inch drop	Air retained from prior test	1247.1	1020.7			22.1
Test 32	Modified Riddell VSR-3 with air, 3.4-inch drop	11 pumps of air on head, 23 sec prior to test	328.4	301.7			7.5
Test 33	Modified Riddell VSR-3 with air, 3.4-inch drop	4 pumps of air on head, 5 sec prior to test	313.0	286.1			5.1

* A rubber impact surface was attached to the fixture with clamps during Tests 1-5. It was attached with hook-and-loop material (velcro) during Tests 6-33.

** Drop height for Test 29 deviates from typical drop heights used elsewhere in this test.