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Lacrosse Helmet Shield Prototype

Lexi Shield LLC
Client: Hervie Lamb
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Date of Report: 12 April 2016

Reported By: Chris D'Amario, Engineer

Reviewed By: Rob Kinsler, Chief, Technical Operations

Test Method and supporting ND001-13m15c and Modified 041-11m15 documentation:

Job number: HPWLI 000005596

Test Item receipt date, shipping method, identification information, and inspection results: Test items were received on 11 April 2016. Items were inspected upon receipt and no anomalies were discovered. Received was 1 Cascade R Lacrosse helmet with lex shield attachment.

Date of testing, test range, and testing performed by: Testing commenced at the H.P. White Laboratory, Inc. facilities at 3114 Scarboro Road, Street MD on 12 April 2016 by Chris D'Amario.

Date testing completed, sample disposal, return shipping method: Testing concluded on 13 April 2016.

Test data transmittal method and storage location: This test report and test data were transmitted via email in a manner compliant with ISO 17025 requirements. Permanent electronic and hardcopy files are maintained in HPWLI data storage systems, filed by Job Number.

Revision Number: 1



Testing was performed on samples provided by the client. H.P. White Laboratory, Inc. holds no responsibility for sample selection methods. This report is based on data obtained from testing only the samples submitted, and should NOT be interpreted as an endorsement by H.P. White Laboratory, Inc. of the continuing quality or performance of any other items of the same, or similar, design. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government. This testing was performed by H.P. White Laboratory, Inc. to client specification, and the test results are the property of the client, who holds all rights of reproduction or publication of this report and related test data.

STANDARDS USED:

ND001-13m15c *Standard Test Method and Equipment Used in Evaluating the Performance Characteristics of Protective Headgear/Equipment* .

ND041-11m15 *Standard Performance Specification for Newly Manufactured Lacrosse Helmets with Faceguard*

AUTHORIZATION:

The tests were authorized by Hervie Lamb and Bill Middleton

SPECIMEN DESCRIPTION:

The tests were performed on a specimen identified by the client as a Lacrosse Goalie Helmet shield that was mounted per customers instructions on a Cascade R lacrosse helmet. The sample previously described, was received in pristine condition on 11 April 2016 and evaluated on 11 April 2016. The testing was performed at H.P. White Laboratory, Inc. located in Street, MD.

SUMMARY:

Only a subset of the requirements were tested per customer's instruction. This consisted of testing two impact locations, NOCSAE positions 19 and 20. A total of 5 drops at each velocity specified in ND041-11m15 were tested at each location. Baseline testing was done prior to testing with the shield adapter attached.

Position 19 at the lower velocity gave the greatest percent decrease in Severity Index and was subject to additional tests. A total of 22 drops at this location and velocity were tested with and without the shield to provide a statistically valid evaluation at the 90% confidence level that there is a 90% Bernoulli success probability.

Additional testing using the air cannon was performed. This included baseline testing and testing the helmet with the shield. Impact location was at position 19 and lacrosse balls were shot at 80 mph.

Baseline and Helmet with shield were subject to hot conditioned testing as called out in ND041-11m15. This included impact attenuation at location positions 19 and 20, at 5.46 +3% m/s.

Datasheets, photographs, comments, and analysis are included with this document.

CONCLUSION:

The helmet with the shield attached performed 44% better than the baseline helmet without the shield when impacted on location position 19 at 3.46 +3% m/s. During the high velocity drops on position 19, the baseline helmet impact attenuation exceeded the maximum allowable severity index of 1200 on several of the drops. When repeated with the shield attached, the average severity index was 908.

When impacted with a lacrosse ball on position 19 at 80 mph, the helmet with the shield performed 65% better.

Overall there is a significant difference in impact performance on this Cascade R lacrosse helmet at position 19 between a baseline helmet and a helmet with the lexi shield attached.

Prepared by

H.P. White Laboratory, Inc.



Chris D'Amario
Engineer

Reviewed By

H.P. White Laboratory, Inc.



Rob Kinsler
Chief, Technical Operations

NOCSAE Headform Size: Medium

Section 7 (modified) Impact Attenuation Tests

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 19	3.46 - 3.56	3.48	173	72
1	Position 19	3.46 - 3.56	3.46	135	62
1	Position 19	3.46 - 3.56	3.54	152	69
1	Position 19	3.46 - 3.56	3.48	149	69
1	Position 19	3.46 - 3.56	3.49	155	68
1*	Position 19	3.46 - 3.56	3.48	115	58
1*	Position 19	3.46 - 3.56	3.46	121	60
1*	Position 19	3.46 - 3.56	3.51	139	66
1*	Position 19	3.46 - 3.56	3.51	140	65
1*	Position 19	3.46 - 3.56	3.46	138	65

Notes: *Sample 1 with attachment

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 19	4.88 - 5.03	5.12	577	122
1	Position 19	4.88 - 5.03	4.89	593	129
1	Position 19	4.88 - 5.03	4.85	499	119
1	Position 19	4.88 - 5.03	4.92	583	124
1	Position 19	4.88 - 5.03	4.92	554	120
1*	Position 19	4.88 - 5.03	4.96	332	89
1*	Position 19	4.88 - 5.03	4.89	390	101
1*	Position 19	4.88 - 5.03	4.95	432	109
1*	Position 19	4.88 - 5.03	4.89	436	111
1*	Position 19	4.88 - 5.03	4.89	441	108

Notes: *Sample 1 with attachment
 Velocities in red are not within velocity requirement

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 19	5.46 - 5.62	5.55	1173	184
1	Position 19	5.46 - 5.62	5.59	1268	192
1	Position 19	5.46 - 5.62	5.50	1105	171
1	Position 19	5.46 - 5.62	5.59	1249	190
1	Position 19	5.46 - 5.62	5.58	1359	201
1*	Position 19	5.46 - 5.62	5.58	840	153
1*	Position 19	5.46 - 5.62	5.64	866	156
1*	Position 19	5.46 - 5.62	5.55	938	163
1*	Position 19	5.46 - 5.62	5.64	929	165
1*	Position 19	5.46 - 5.62	5.55	966	163

Notes: *Sample 1 with attachment
 Velocities in red are not within velocity requirement. Severity Index in red is not within 1200 SI limit

NOCSAE Headform Size: Medium

Section 7 (modified) Impact Attenuation Tests

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 20	3.46 - 3.56	3.48	174	77
1	Position 20	3.46 - 3.56	3.45	154	72
1	Position 20	3.46 - 3.56	3.48	161	76
1	Position 20	3.46 - 3.56	3.51	149	70
1	Position 20	3.46 - 3.56	3.49	144	69
1*	Position 20	3.46 - 3.56	3.48	78	52
1*	Position 20	3.46 - 3.56	3.48	76	53
1*	Position 20	3.46 - 3.56	3.46	78	54
1*	Position 20	3.46 - 3.56	3.46	81	55
1*	Position 20	3.46 - 3.56	3.50	88	55

Notes: *Sample 1 with attachment
 Velocities in red are not within velocity requirement

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 20	4.88 - 5.03	4.92	341	94
1	Position 20	4.88 - 5.03	4.80	349	97
1	Position 20	4.88 - 5.03	4.86	340	98
1	Position 20	4.88 - 5.03	4.85	354	98
1	Position 20	4.88 - 5.03	4.83	350	95
1*	Position 20	4.88 - 5.03	4.90	276	88
1*	Position 20	4.88 - 5.03	4.89	266	86
1*	Position 20	4.88 - 5.03	4.80	278	89
1*	Position 20	4.88 - 5.03	4.86	277	88
1*	Position 20	4.88 - 5.03	4.89	285	88

Notes: *Sample 1 with attachment
 Velocities in red are not within velocity requirement

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 20	5.46 - 5.62	5.55	602	129
1	Position 20	5.46 - 5.62	5.61	597	129
1	Position 20	5.46 - 5.62	5.55	631	134
1	Position 20	5.46 - 5.62	5.54	677	142
1	Position 20	5.46 - 5.62	5.55	667	139
1*	Position 20	5.46 - 5.62	5.57	543	125
1*	Position 20	5.46 - 5.62	5.64	562	130
1*	Position 20	5.46 - 5.62	5.63	568	127
1*	Position 20	5.46 - 5.62	5.59	606	134
1*	Position 20	5.46 - 5.62	5.63	613	134

Notes: *Sample 1 with attachment
 Velocities in red are not within velocity requirement

NOCSAE Headform Size: Medium

Section 7 (modified) Impact Attenuation Tests

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 19	3.46 - 3.56	3.48	152	72
1	Position 19	3.46 - 3.56	3.46	131	65
1	Position 19	3.46 - 3.56	3.49	119	65
1	Position 19	3.46 - 3.56	3.48	143	69
1	Position 19	3.46 - 3.56	3.44	135	69
1	Position 19	3.46 - 3.56	3.51	121	63
1	Position 19	3.46 - 3.56	3.46	136	67
1	Position 19	3.46 - 3.56	3.48	134	67
1	Position 19	3.46 - 3.56	3.51	126	63
1	Position 19	3.46 - 3.56	3.44	128	65
1	Position 19	3.46 - 3.56	3.43	112	60
1	Position 19	3.46 - 3.56	3.50	125	67
1	Position 19	3.46 - 3.56	3.50	128	66
1	Position 19	3.46 - 3.56	3.53	132	68
1	Position 19	3.46 - 3.56	3.46	113	62
1	Position 19	3.46 - 3.56	3.51	124	66
1	Position 19	3.46 - 3.56	3.54	131	67
1	Position 19	3.46 - 3.56	3.54	111	61
1	Position 19	3.46 - 3.56	3.49	129	66
1	Position 19	3.46 - 3.56	3.46	128	68
1	Position 19	3.46 - 3.56	3.46	133	68
1	Position 19	3.46 - 3.56	3.48	122	64

Notes: Velocities in red are not within velocity requirement

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1*	Position 19	3.46 - 3.56	3.48	52	48
1*	Position 19	3.46 - 3.56	3.43	72	52
1*	Position 19	3.46 - 3.56	3.51	70	49
1*	Position 19	3.46 - 3.56	3.50	65	46
1*	Position 19	3.46 - 3.56	3.46	73	49
1*	Position 19	3.46 - 3.56	3.48	62	49
1*	Position 19	3.46 - 3.56	3.46	73	48
1*	Position 19	3.46 - 3.56	3.48	72	54
1*	Position 19	3.46 - 3.56	3.44	68	46
1*	Position 19	3.46 - 3.56	3.45	68	48
1*	Position 19	3.46 - 3.56	3.45	68	53
1*	Position 19	3.46 - 3.56	3.49	71	49
1*	Position 19	3.46 - 3.56	3.41	76	49
1*	Position 19	3.46 - 3.56	3.51	79	50
1*	Position 19	3.46 - 3.56	3.46	72	50
1*	Position 19	3.46 - 3.56	3.53	84	53
1*	Position 19	3.46 - 3.56	3.46	75	51
1*	Position 19	3.46 - 3.56	3.48	75	51
1*	Position 19	3.46 - 3.56	3.48	79	51
1*	Position 19	3.46 - 3.56	3.45	75	50
1*	Position 19	3.46 - 3.56	3.46	71	53
1*	Position 19	3.46 - 3.56	3.51	83	54

Notes: Velocities in red are not within velocity requirement

Section 7 (modified) Impact Attenuation Tests

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (mph)	Velocity (mph)	Severity Index	Peak G's
1	Position 19	80 mph	83.55	54	76
1	Position 19	80 mph	85.01	75	85
1	Position 19	80 mph	84.07	47	73
1	Position 19	80 mph	83.05	51	77
1	Position 19	80 mph	82.44	41	73
1*	Position 19	80 mph	84.07	22	63
1*	Position 19	80 mph	82.44	18	57
1*	Position 19	80 mph	-	18	57
1*	Position 19	80 mph	-	18	53
1*	Position 19	80 mph	-	17	53
Notes: *Sample 1 with attachment Velocities not captured during shots 3,4 and 5 for sample 1*					

Section 7 (modified) Impact Attenuation Tests

Required High Temperature: 100 ± 3 °F

Actual Temperature: 102.2 °F

Ambient Impacts					
Sample #	Impact Location	Velocity Requirement (m/s)	Velocity (m/s)	Severity Index	Peak G's
1	Position 19	5.46 - 5.62	5.56	1050	174
1	Position 20	5.46 - 5.62	5.55	738	154
1*	Position 19	5.46 - 5.62	5.62	921	164
1*	Position 20	5.46 - 5.62	5.55	572	131
Notes: *Sample 1 with attachment					

Photographs



Figure 1: Location position 19 for baseline



Figure 2: Location position 19 for helmet with shield



Figure 3: Location position 20 for baseline



Figure 4: Location position 20 for helmet with shield

ANALYSIS:

The severity indexes on location position 19 at 3.46 +3% m/s were further examined to determine if there is a statistically significant difference between the baseline helmet and the helmet with the shield adapter installed.

SUMMARY

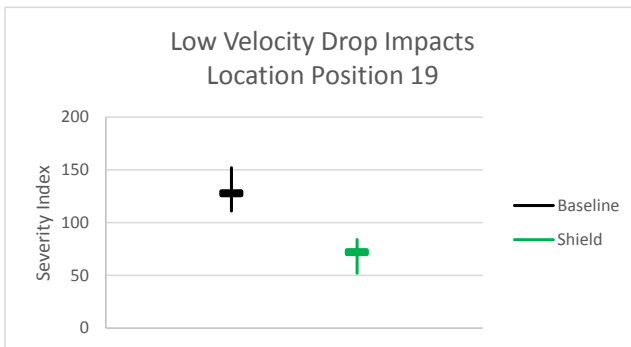
Groups	Count	Sum	Average	Variance
Baseline	22	2813	127.86364	94.02814
With Shield	22	1583	71.954545	48.14069

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	34384.09	1	34384.091	483.7079	1.14E-24	4.072654
Within Groups	2985.545	42	71.084416			
Total	37369.64	43				

Since the F ratio of 483.7079 is greater than the *F crit* value and the p-value is less than 0.05, the data is significantly different between the baseline helmet and the helmet with the shield attached to the front. The helmet with the shield attached performed 44% better than the baseline helmet without the shield when impacted on location position 19 at 3.46 +3% m/s.

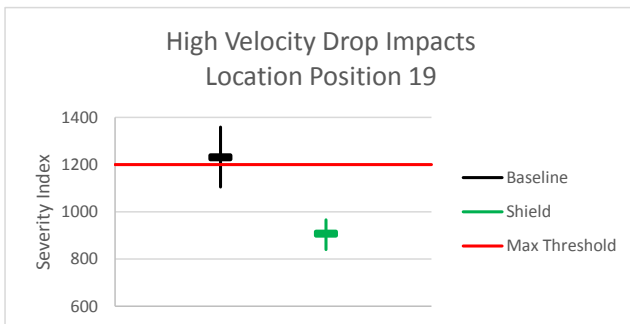
$$\% \text{ Decrease} = \frac{\text{Average Baseline} - \text{Average With Shield}}{\text{Average Baseline}} = \frac{127.8636 - 71.95455}{127.8636} * 100\% = 43.73\%$$



When impacted with a lacrosse ball on the front of the helmet at 80 mph, the helmet with the shield performed 65% better.

$$\% \text{ Decrease} = \frac{\text{Average Baseline SI} - \text{Average with Shield SI}}{\text{Average Baseline SI}} = \frac{53.6 - 18.6}{53.6} * 100\% = 65.30\%$$

During the high velocity drops on position 19, the baseline helmet impact attenuation exceeded the maximum allowable severity index of 1200 on several of the drops. When repeated with the shield attached, the average severity index was 908.



Overall there is a significant difference in impact performance on this Cascade R lacrosse helmet at position 19 between a baseline helmet and a helmet with the Lexi Shield attached.