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WEATHERING TESTS ON PROTECTIVE HELMETS APPROVED TO AUSTRALIAN S--ETC(U)  
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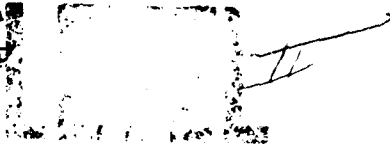
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Structures Technical Memorandum 320

WEATHERING TESTS ON PROTECTIVE HELMETS APPROVED TO AUSTRALIAN STANDARD AS 1698 (FOR VEHICLE USERS) INTERIM REPORT NO. 2

S.R. SARRAILHE

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Structures Technical Memorandum 320

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TO AUSTRALIAN STANDARD AS 1698 (FOR VEHICLE USERS),

INTERIM REPORT NO. 2

S.R. SARRAILHE

SUMMARY

This interim report describes the results of impact tests on helmets after seven months exposure to the weather. No deterioration in performance was detected. The tests were part of an investigation which is planned to continue for three years with further tests to be carried out one year, eighteen months, two years and three years after commencement of the exposure.

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POSTAL ADDRESS: Chief Superintendent, Aeronautical Research Laboratories,  
P.O. Box 4331, Melbourne, Victoria, 3001, Australia.

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16. ABSTRACT:

This interim report describes the results of impact tests on helmets after seven monthsexposure to the weather. No deterioration in performance was detected. The tests were part of an investigation which is planned to continue for three years with further tests to be carried out one year, eighteen months, two years and three years after commencement of the exposure.

The work is sponsored by the Office of Road Safety, Department of Transport.

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1. INTRODUCTION

This report describes the results of penetration tests carried out in January 1980, on helmets which had been exposed to the weather for approximately seven months and, for comparison, on control helmets which had been in storage.

The methodology, test procedure and the results of the pre-exposure tests were given in the first interim report (Sarrailhe and Thomas 1979).

The work is part of a three year program supported by the Office of Road Safety, Department of Transport.

2. THE HELMETS

Six samples of each of seven different models of helmet were tested. The descriptions of six of the models were given in the first interim report but helmets of the seventh type were added after that report had been prepared and so the particulars are given in Table 1. The main particulars of all the helmets are summarized in Table 2.

3. EXPOSURE PERIOD

Most of the helmets were exposed from 13th of June 1979. The only exceptions were three Shoei ZV helmets which were exposed from 20th July 1979. All were transferred to the laboratory for testing on the 7th of January 1980 and reinstated on the roof on the 10th January, 1980.

4. VISUAL INSPECTION

Most of the G.R.P.\* helmets had lost some of their "gloss" and had a white powdery "bloom". This could be wiped off and a reasonable gloss restored. The crowns of the helmets were affected most but the whole test area showed some evidence of weathering. The polycarbonate helmets still had a good gloss.

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\* G.R.P.: Glass fibre reinforced plastic.

The Standards Association labels on the outside of the helmets had deteriorated, shown on Fig. 1 and some had come off completely. The external label with the makers model number on the Eldorado helmets had deteriorated but the other labels, decorative strips and retroflective labels were intact.

The Standards Association is aware of the problem with its labels and since mid 1979 has issued a new type with "guaranteed" durability. None of these new labels were used on the helmets under investigation.

#### 5. TEST PROCEDURE

The shape of the conical striker was checked and found to be correct.

The helmets were impacted low on the left side at the '+60' level ( $60^{\circ}$  to the vertical axis). The Stadium helmets had been subjected to a single impact at the front position at this angle during the pre-exposure tests, but the circumference was large enough to allow additional impacts in the same region without overcrowding or interaction.

#### 6. RESULTS

All helmets except the Stadium helmets prevented the point of the striker from reaching the headform in all the tests.

The stored and the exposed Stadium helmets allowed penetration to the headform when the striker fell 3 metres but not when it fell 2 metres. The point contacted the headform in three out of 4 impacts on exposed helmets and one out of four impacts on the stored helmets. The difference is unlikely to be due to degradation, because the type of deformation was similar in all the tests. The point also contacted the headform in four out of ten impacts at the  $0^{\circ}$  level during the pre-exposure tests as shown in Table 3.

It was concluded that there was no evidence of deterioration in the performance of any of the helmets.

Neither the depth of penetration nor the sizes of the holes were measured. Deformation of the polycarbonate shells was ductile and appeared to be localized as shown in Fig. 2. The holes in the G.R.P. shells were generally small and some of the smallest are shown on Fig. 3. The largest holes produced during both the January 1980 tests and in the pre-exposure tests were in the Bell helmets as shown in Fig. 4. The G.R.P. shell adjacent to the hole had delaminated but this would absorb energy and minimise the forces transmitted to the head.

The deceleration of the striker will be measured during the next series of impact tests, to allow the impact force to be assessed.

As no deterioration was detected the two reference helmets were not tested.

7. CONCLUSION

Seven months exposure to the weather did not cause any detectable change in the performance of the helmets.

REFERENCE

Sarrailhe, S.R. and Thomas, G.A. (1979)  
Weathering Tests on Protective Helmets Approved  
to Australian Standard AS 1698 (for vehicle users)  
Interim Report No. 1. Structures Technical  
Memorandum 306.  
Aeronautical Research Laboratories, Melbourne,  
Australia. November 1979.



TABLE 1

HELMET WEATHERING TRIALS

HELMET DETAILS

Make: Shoei                      Model: ZV                      Shell: Glass Fibre, Aromatic Polyamide  
Liner: Expanded Polystyrene                      Fibre and Polyester Resin

Helmet	Colour	Production Date	SAA Serial No.	Size	Length mm	Width mm	Mass mm	Circumference mm
A	Maroon	Dec. '77	A12927	M	282	230	1080	810
B	Blue	Jan. '78	A49579	L	286	240	1140	836
C	Maroon	Dec. '77	A13012	L	288	240	1160	838
D	Blue	Jan. '78	A49583	L	288	240	1113	830
E	Maroon	Dec. '77	A12934	M	282	231	1102	812
F	Blue	Jan. '78	A49576	L	287	241	1128	837
G	Maroon	Dec. '77	A12899	M	282	232	1153	812

TABLE 2

HELMET WEATHERING TRIALSHELMET DETAILSSUMMARY ON HELMET DATA

HELMET	Colour	Production Date	Shell-Standard	Size	Length mm	Width mm	Mass gm	Circum mm
ARAI	White	July '78	G.R.P.	Small	270	230	1190	795
RM6	Yellow	Dec. '78	Z90.71	Medium	275	230	1200	802
	Red			Large	275	230	1200	808
ARAI	White	Aug. '77	G.R.P.	Small	275	232	1244	800
875	Yellow	Dec. '78	Snell 75	Medium	283	238	1291	827
	Orange			Large	283	238	1320	835
HELL Super Magnum	White	-	G.R.P. Snell 70	Small	269	222	1230	775
	Orange			Large	291	239	1362	815
CENTURION 100	Blue	Feb. '77 (all)	Pc	3	275	234	1117	800
				4			1140	
MIDORADO MH1	Yellow	May '77	Pc	Small	280	236	1237	820
	White	Dec. '77	-	Medium			1284	
STADIUM 9	Yellow	Nov. '76	Pc	3	265	229	1005	750
	White	Jan. '77	-	4			1020	
SHOEI TV	Blue	Dec. '77	G.R.P. + Aromatic Polyimide Snell 75	Medium	282	230	1100	815
	Maroon	Jan. '78		Large	287	240	1150	830

Remarks:

G.R.P. - Glass Reinforced Plastic

Pc - Polycarbonate

Standard shown is additional to AS 1698

TABLE 3

PENETRATION TESTS. STADIUM PROJECT 9.

x or X: Striker penetrated to headform.

o or O: Striker did not penetrate to headform.

Impact level location	-60		-40		-20		+00		+40		+60	
	F	B	F	B	F	B	F	B	F	B	F	B
<u>Impact survey</u>												
Helmet A												
Date: 27.4.79												
3 m drop, note 1	x	o	x	o	o	o			o	o		
2 m drop												
<u>Continuing tests</u>												
Months of exposure		0						7				
Exposure from								13.6.79				
until								7.1.80				
Test period from		27.4.79						8.1.80				
until		2.5.79						10.1.80				
<u>Exposed helmet D</u>												
3 m drop	o	o						o	x			
2 m drop									o			
<u>Exposed helmet E</u>												
3 m drop, note 3	x	o						X	x			
3 m drop, note 3										o		
3 m drop, note 4								o				
<u>Exposed helmet F</u>												
3 m drop	x	o						X	o			
2 m drop, note 3								no test				
2 m drop, note 4								o				
<u>Exposed helmet G</u>												
3 m drop	x	o						o	o			
2 m drop, note 3								no test				
2 m drop, note 4								o				

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1. x or o: impact at F or B (30° to transverse plane).
2. X or O: impact in front of, between, or behind F or B.
3. 2 m drop at date shown at head of column.
4. 2 m drop before exposure (13.6.79).

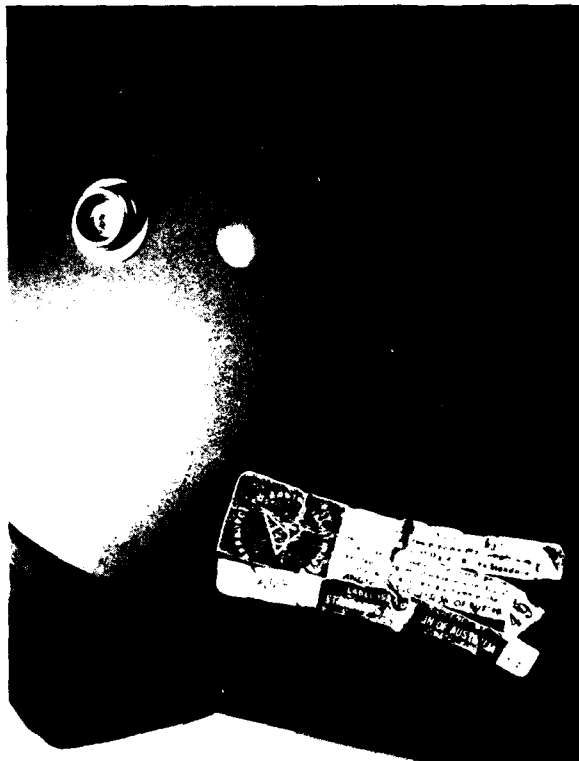


FIG. 1 DETERIORATION OF SAA LABEL

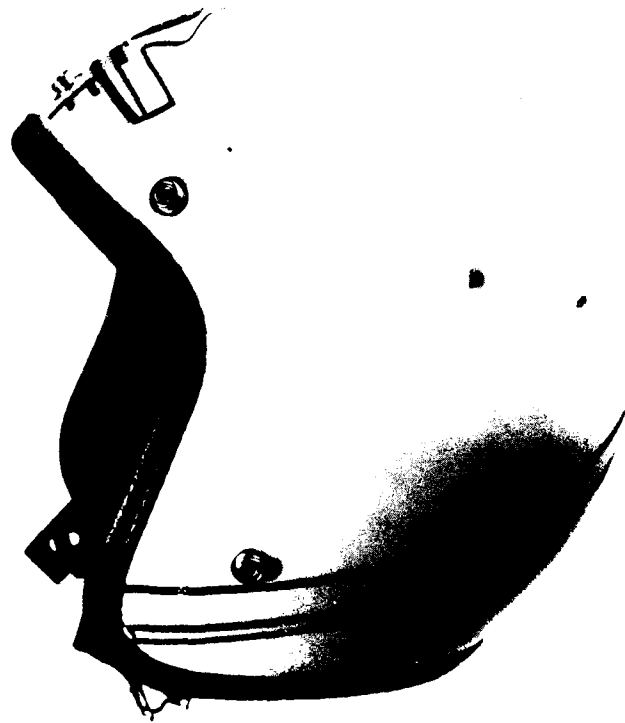


FIG.2 STADIUM HELMET WITH EXTRA IMPACT AT THE '+ 60' LEVEL.  
POLYCARBONATE SHELL.  
Front : 2m drop pre-exposure  
Centre : 3m drop January 1970  
Back : 3m drop January 1980



FIG.3 ARAI S75 G.R.F. SHELL



FIG.4 BELL SUPER MAGNUM G.R.P. SHELL

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