



JAMES COOK CYCLONE STRUCTURAL TESTING STATION

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SIMULATION OF CYCLONIC WIND FORCES ON ROOF CLADDINGS BY RANDOM BLOCK LOAD TESTING

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Mahendran, Mahadeva, 1956-

Simulation of cyclonic wind forces on a building

ABSTRACT

Extensive damage to light gauge metal roof claddings during cyclone Tracy led to the

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1. Introduction

Morgan and Beck (1977) and Beck and Morgan (1975) identified fatigue cracking of roofing in the vicinity of fasteners as the major cause of roof cladding failures during

upland. Tornado which hit Dornier in 1974. It is well known how roof cladding failures

pressure data on roof claddings from wind tunnel testing (Melbourne, 1977 and Beck and Stevens, 1979) they recommended a three level low-high loading sequence shown in

Table 1. A new technical record TP440 was published the following year (EPS, 1978)

characteristics of roof claddings developed already. Experimental simulation of avalonia

and the following will be the same as the following:

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

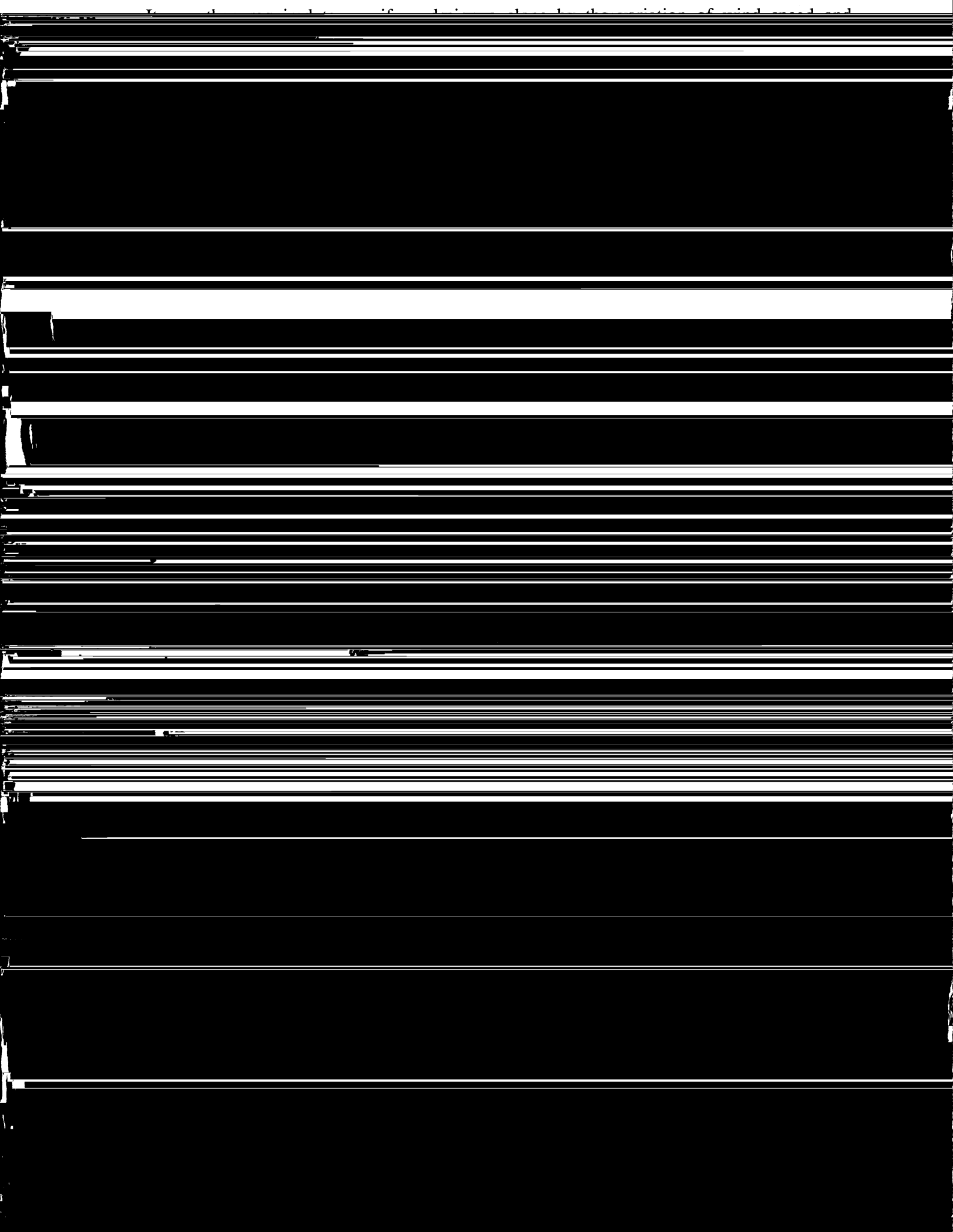
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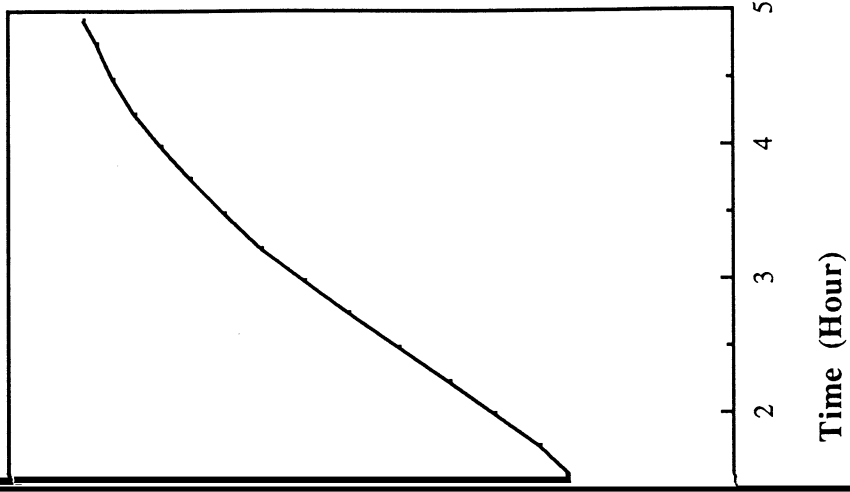
1.0
IDS

k for $\theta = 75^\circ$, Gable End Roof and Rural Terrain

(7)	(8)	(9)	(10)	(11)	(12)	(13)
0.65	0.75	0.85	0.95	1.05	1.15	1.25
0	0	0	0	0	0	0
0	0	0	0	0	0	0
26	0	0	0	0	0	0
122	66	31	5	0	0	0
9	15	15	6	9	1	0
6	1	1	1	0	1	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

n for all wind directions





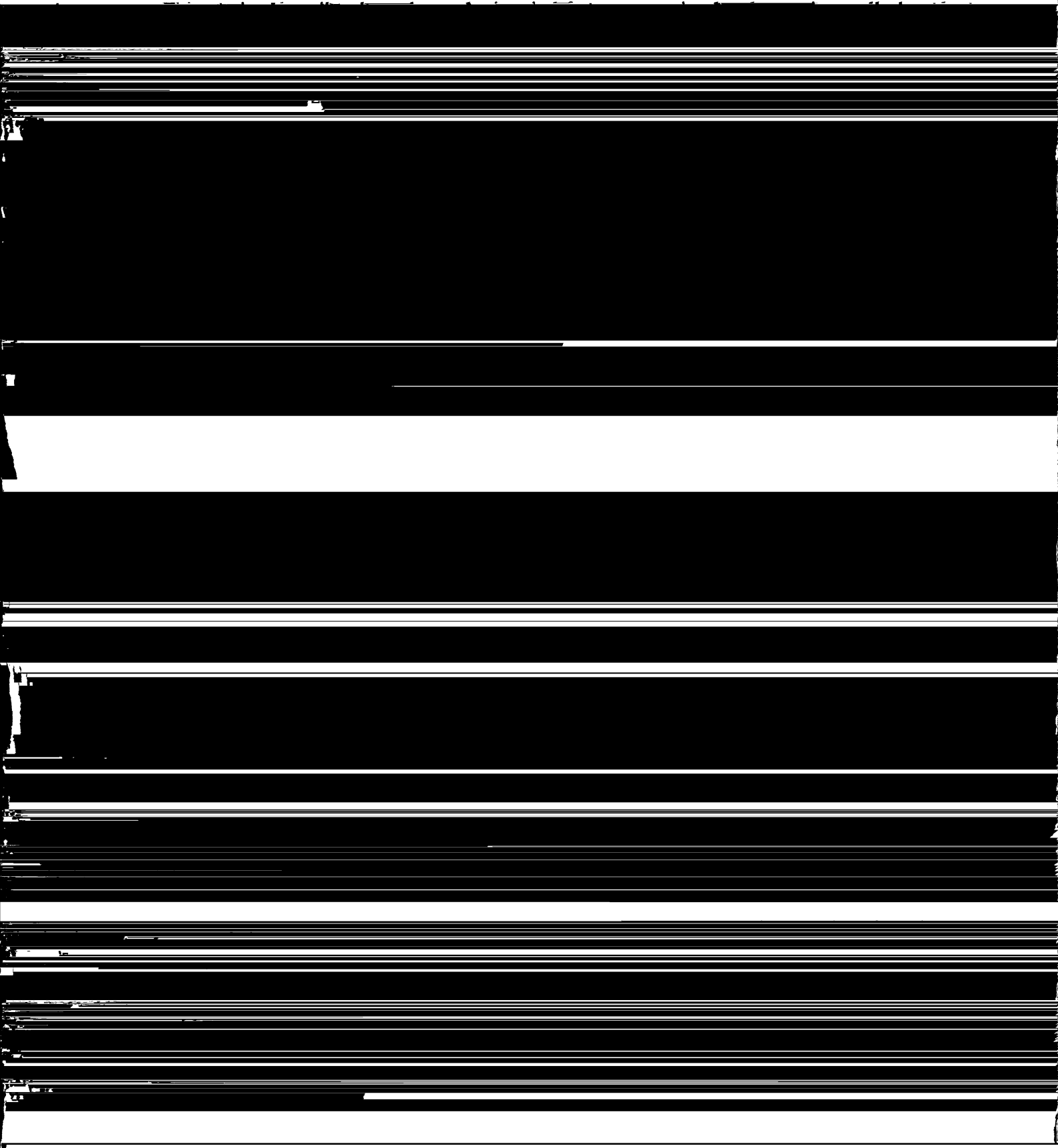
In Cyclone

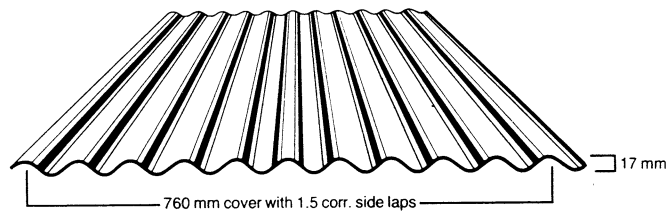
For an analysis time interval of 15 minutes, 21 full scale fatigue wind loading matrices

[illegible]

3. Simulation of Cyclonic Wind Forces by Random Block Load Testing

3.1 General





$$p = 76 \text{ mm}, d = 17 \text{ mm}$$

Custom Orb : BMT - 0.42 mm TCT - 0.47 mm D - 550 N/F

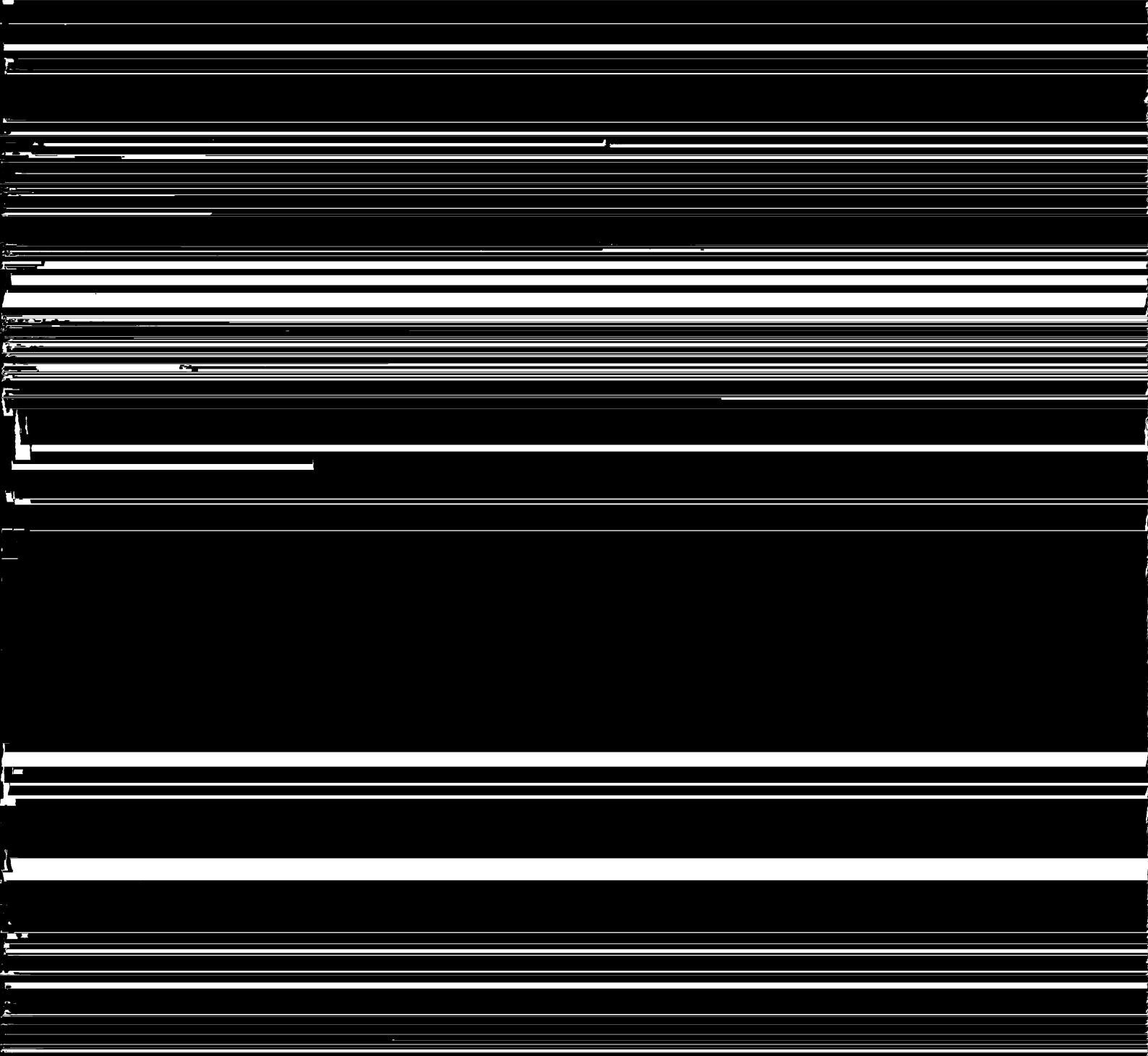
3.2 Random Block Load Testing Method

It is true that a random load testing method will simulate quite well a randomly varying cyclonic wind loading shown in Figure 1. However, in this research project it was decided

Table 5 Cyclone Wind Loading Matrix for Custom Orb (BMT=0.42mm) Roof Cladding

Wind Direction		Wind Speed (km/h)		Wind Pressure (kPa)		Wind Uplift (kPa)	
N	N	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
N	E	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
N	S	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
N	W	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
E	N	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
E	E	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
E	S	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
E	W	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
S	N	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
S	E	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
S	S	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
S	W	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
W	N	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
W	E	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
W	S	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00
W	W	10	10	0.00	0.00	0.00	0.00
		20	20	0.00	0.00	0.00	0.00

random selection from 43 to 89. However, it is noted that the standard number of loading events was still 43 (some of 89 blocks repeating). That is, the 5 blocks of loading in cell 3



2

AMPLITUDE
↑



When the loading blocks were selected randomly, there was discontinuity between many blocks because of the differing magnitudes. Therefore joining events (one half cycle only) were added in the form of ramp loading between the end of one block of loading to the

Wind Loading Matrix for the Design Cyclone at the end of Fourth Hour

	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
5	0.55	0.65	0.75	0.85	0.95	1.05	1.15	1.25
	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0
	26	7	0	0	0	0	0	0
	7	3	1	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0

roof.

3.4 Experimental Method

All the RBL tests were conducted under computer control. A microcomputer connected to

the RBL sequence in terms of Newtons per fastener were fed to the computer using a

Research should be continued in this area using the DDI testing in an attempt to verify the

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Beck V R and Stevens L K (1979) Wind Loading Failures of Corrugated Roof

IV 1 1 C 1 1 C 1 D 1 E 1 F 1 G 1 H 1 I 1 J 1 K 1 L 1 M 1 N 1 O 1 P 1 Q 1 R 1 S 1 T 1 U 1 V 1 W 1 X 1 Y 1 Z 1

Morgan, J.W. and Beck, V.R. (1977) Failure of Sheet-metal Roofing under Repeated