TWP Timber and Wood Products Research Centre

GENERAL ACCESS FLOORING TESTING FACILITY

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SUMMARY

A facility for the structural testing of General Access Flooring panels has been constructed and is operational. Testing is in accordance with the British Performance Specification for Platform Floors, Department of the Environment, August, 1985, tests T1.00 to T16.00 for Full Access Floors. The facility is available through the TWP Centre at the Capricornia Institute, Rockhampton. At least 16 panels and 65 pedestals must be supplied for all sixteen tests to be performed.

LIST OF FIGURES

INTRODUCTION

In response to a request from the Australian Particleboard Research Institute in December 1985, the current project was commenced on 1 March 1986 under APRI Project No. 5-05 : General Access Flooring. The development of a facility for the structural testing of access floor panels was allocated 5.5 months and has been completed on time. Corresponding CIAE identification is Project No. T74/520.

The Department of the Environment in the U.K. published a Performance Specification for Platform Floors in August 1985 which is regarded as being a suitable standard for the assessment of the performance of general access flooring panels in Australia. The testing facility which has been developed allows evaluation of panel properties in accordance with the following methods of test from the DOE specification:

Test No.	Description
T1.00	Concavity and Convexity
T2.00	Twist
T3.00	Panel Squareness
T4.00	Pull-off Strength of Edge Strip
T5.00	Test for Free Play in Pedestal
T6.00	Air Leakage Rate
T7.00	300 mm Square Loading Test
T8.00	25 mm Square Point Loading Test
T9.00	Four Point Loading Test
T10.00	Uniformly Distributed Load Test
T11.00	Safety Factor Load Tests
T12.00	Soft Body Impact Test
T13.00	Hard Body Impact Test
T14.00	Pedestrian Dynamic Load Test
T15.00	Pedestal Strength - Horizontal Load
T16.00	Pedestal Strength - Vertical Load

At least 16 panels and 65 pedestals are required to complete all 16 tests. A description of the complete test facility follows.

TEST FACILITY

Description

The facility has been constructed so almost all of the 16 major tests required can be performed on the one test rig. The rig consists of a 200 mm thick slab of reinforced concrete 1200 mm wide and 2400 mm long. Steel masonry-anchors have been inserted into the concrete at appropriate positions so various components can be affixed to the slab for each test. Figure 1 shows the rig as it normally appears with steel uprights and beams attached for 24 hour loading, together with the equipment for the pedestrian dynamic test.

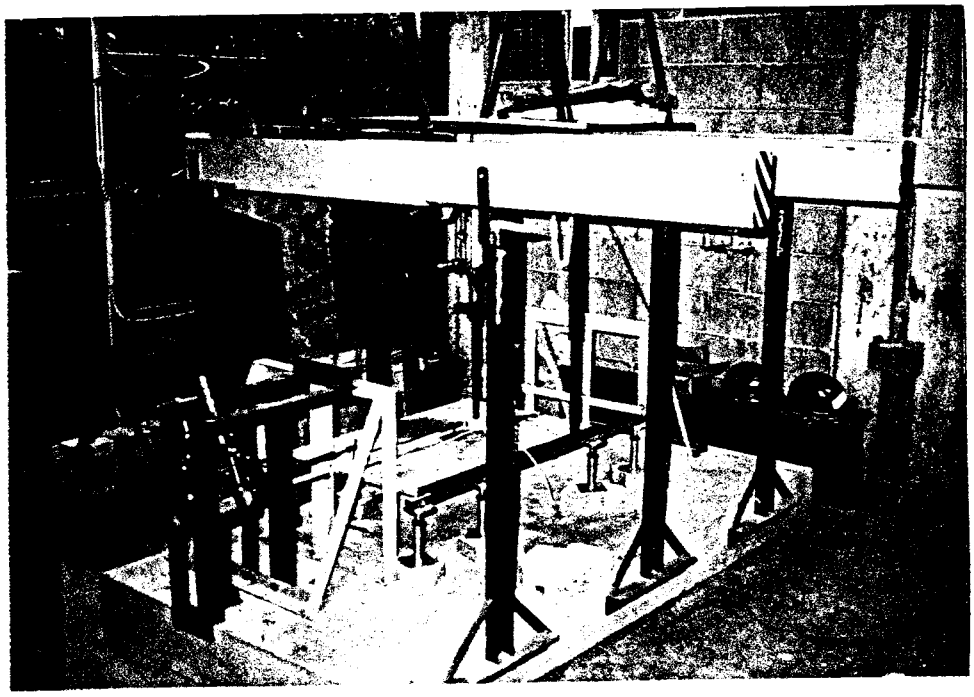

Figure 1 : Test Rig

A system of panels and their supporting pedestals is mounted on the rig using small concrete pads as shown in Fig. 1. The pads are 150 x 150 x 50 mm thick. A pedestal is glued to a pad and the pad is subsequently firmly fixed to the large concrete slab by two 12 mm steel bolts. In this manner, the slab does not have to be cleaned of adhesive after each test but a rigid connection is obtained between the slab and pedestal as is required by the DOE specification.

Tests T2.00, T3.00, T4.00 and T6.00 are not carried out on the rig shown in Fig. 1. Test T3.00 (Squareness) requires only a tape measure accurate to 0.5 mm, and test T4.00 (Pull-off Edge Strip) requires a 5N weight. The plane surface required for test T2.00 (Twist) is obtained with a separate concrete block 100 mm thick and 700 mm square and containing four machined steel studs. Test T6.00 (Air Leakage) has a sealed timber box with pressure and flow monitoring devices attached. Figure 2 shows the concrete block and timber box.

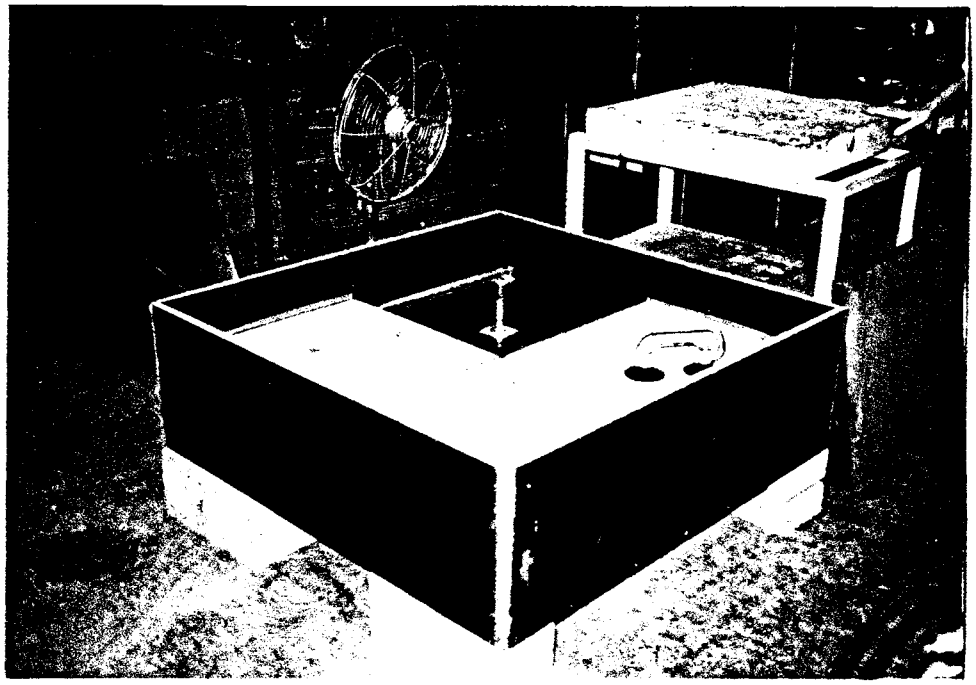

Figure 2 : Test Rigs for Twist and Air Leakage

Dimension Tests

Tests T1.00 to T3.00 in the DOE specification are used for assessment of the concavity, twist and squareness of the panels submitted for evaluation.

T1.00 consists of mounting a panel on four corner pedestals affixed to the concrete slab, and using a bridge and dial gauge to check for cupping or bowing of the panel. Maximum distortion is reported to 0.01 mm accuracy.

T2.00 checks for panel twist by measuring how much the panel is non-planar relative to the four reference points on the concrete block as shown in Fig. 2. The four points are stainless steel studs cast into the concrete block and machined to provide four "corners" of a surface planar to within 0.01 mm in 600 mm. Maximum twist is reported to 0.01 mm accuracy.

T3.00 requires measurement of the lengths of the two diagonals of a panel to an accuracy of 0.5 mm. "Out of squareness" is assessed by the percentage difference between the two diagonals.

Pedestal Tests

DOE tests T5.00, T15.00 and T16.00 are for evaluation of the performance of the pedestals intended to support the panels in service.

T5.00 consists of mounting a pedestal on the concrete slab and applying a horizontal 5N load successively in opposite directions to the head of the pedestal and measuring any deflection to 0.01 mm.

T15.00 requires a similarly mounted pedestal to sustain a horizontal load applied to the head of the pedestal such that a bending moment of 90Nm occurs at its base. Permanent deflection of the head is reported to 0.01 mm accuracy.

T16.00 uses a 50 mm steel cube for the application of a given vertical load to the pedestal head through overlying panels. The pedestal is mounted on the concrete slab and is examined after testing for permanent deformation or collapse.

Air Leakage Rate

In case the under-floor space beneath access flooring is to be used as a plenum for air conditioning, test T6.00 is used for measuring leakage of air through joints between panels. The present test facility uses an open top box 1205 x 1205 mm in plan and 400 mm deep, constructed of faced 18 mm thick particleboard and sealed along all joints - illustrated in Fig. 2. Four panels resting on pedestals are fitted into the box and the small gap around the perimeter sealed. Air from a fan passes through a sheet metal "funnel" into a 600 mm long 100 mm square tube in which is a flow-measuring orifice. Air pressures inside the box and across the orifice are monitored by a micro manometer.

24 Hour Tests

Tests T7.00, T8.00, T9.00 and T10.00 require panels to be loaded in various ways for 24 hours. T7.00 to T9.00 are essentially concentrated load tests with the load applied through a 300 mm square plate, a 25 mm steel cube, and four 25 mm steel cubes respectively. Hence the means by which the load is developed is the same for all three, illustrated in Fig. 1. Figure 1 shows three steel box beams protruding from the region above the concrete slab. The triangular shaped frames above the beams are hung from the beams during a 24 hour test, and are loaded with concrete blocks. Each beam is a lever providing a 3:1 amplification of the dead weight of the blocks in the hangers. An adjustable rod beneath each beam applies the "amplified" load to a panel through whatever applicator is required. A precisely known, unchanging load is thus simply achieved. Deflections are monitored at the beginning and end of the 24 hour period by a dial gauge to 0.01 mm accuracy.

Test T10.00 is conducted in the same way as the above except the load is uniformly distributed ("UDL"). The distributed load is achieved by use of a system of spreader plates in accordance with the DOE specification. A constant 24 hour load is applied in the same way, and deflections measured in the same manner, as described above.

(Test T11.00, Safety Factor Load, is an extension of each of the above tests. The test requires that whatever load is to be sustained by a panel for 24 hours, the panel must subsequently carry two or three times that load for five minutes without significant damage.)

Impact Tests

Two types of assessment of impact resistance are required in tests T12.00 (Soft Body) and T13.00 (Hard Body). A sand-filled canvas bag weighing a total of 40 kg is dropped from 1 m height in test T12.00, while in T13.00 a 4.5 kg 50 mm diameter piece of steel is dropped from 600 mm. Permanent deformation and any other damage are reported for both tests.

Pedestrian Dynamic Test

Of all the structural tests, T14.00 of the DOE Specification is the most difficult and time-consuming to implement. In order to simulate the effects of pedestrian traffic on access panels, 250000 cycles of combined vertical and horizontal load on a panel are required. Each cycle of loading occurs as follows:

a vertical load of 1kN is applied to a 100 mm diameter steel disc resting on a 3 mm thick rubber pad in the middle of a supported panel;

a horizontal load of 170N is applied to the steel disc in one direction then in the opposite direction; finally the vertical load is removed. Since each cycle must take 3 seconds to complete, almost nine days of non-stop testing are necessary.

In the present facility, vertical and horizontal loads are applied by two 50kN Enerpac jacks, both of which are individually controlled by closed-loop hydraulic servo-control systems. The two closed-loop systems are in turn supplied with their respective control functions by a microcomputer programmed in BASIC and in Assembler coding. Communication between the computer and the closed-loop circuits is via 12-bit analog-to-digital and digital-to-analog converters. Vertical and horizontal deflections to be measured at the start and finish of the nine days of testing are monitored using displacement transducers to 0.01 mm accuracy.

The panel is subsequently required to pass test T8.00.

Figure 2 illustrates the loading arrangement of jacks, frames, etc, while Figure 3 below shows the computer and electronic servo-control equipment.

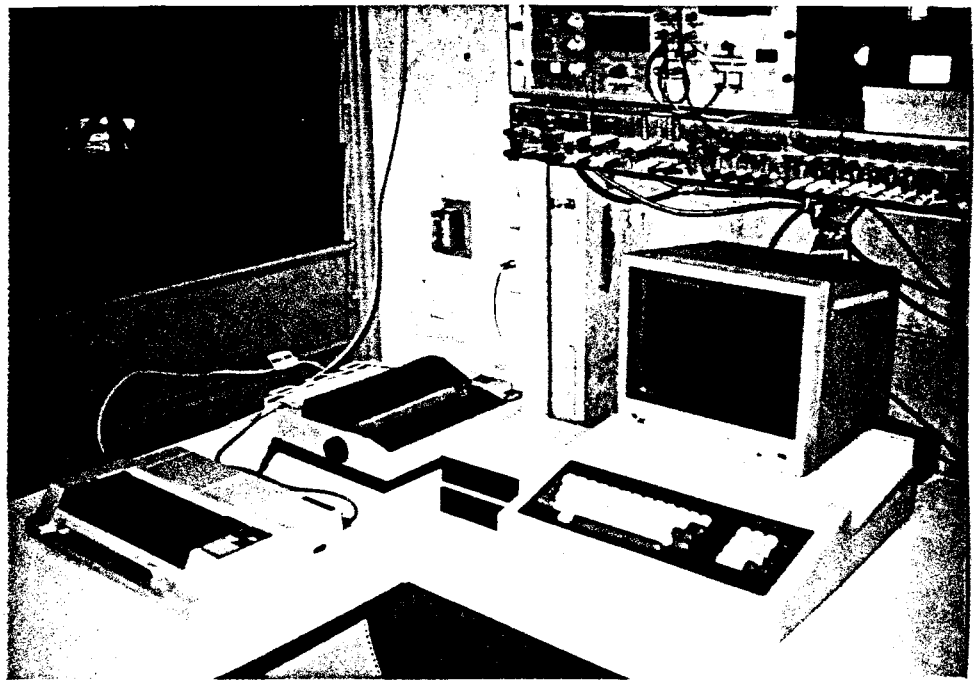

Figure 3 : Computer Control of Pedestrian Test

Calibration

All devices used for measurement have been calibrated against known standards within the CIAE. NATA-rated A-grade testing machines and weights have been used for calibration of load sensing transducers. Distance measuring devices such as dial gauges, tape measures, resistive transducers and micrometers are calibrated using a metroscope and gauge blocks. Air pressure and flow rate measuring devices are checked against equipment calibrated regularly.

Reporting Results

Reporting of the results obtained from the sixteen structural and dimensional tests is by means of a set of standard forms. A sample of the eight pages of forms is contained in the Appendix. All test data are entered on the forms together with maximum allowable values and any appropriate comments on panel behaviour.

Limitations of the Facility

Since the most common size of access floor panels is 600 x 600 mm, and since the DOE Performance Specification is written for this size (and for 750 x 750 mm) in particular, the test facility has been constructed to suit 600 x 600 mm. Larger size panels up to 1200 x 1200 can be tested, but some modifications to the facility would be necessary, and therefore may require more time for testing than the standard size. Furthermore, application of the DOE Specification to panels larger than 750 x 750 mm is not possible for some tests, so acceptance of such panels' performance would require the use of an alternative specification.

ACKNOWLEDGEMENTS

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Dr. A.F. Halligan, APRI, for technical inputs.

Messrs. D.P. Hanley, C.G. McDowall and R.H. Thomas, CIAE, for assistance in technical development of the facility.

REFERENCES

1. "Performance Specification, Platform Floors", Method of Building, Department of the Environment, Property Services Agency, U.K., August 1985.

APPENDIX

Standard Forms for Reporting

Test Results and Comments

TWP

Timber and Wood Products
Research Centre

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HEAD: DENNIS P. HANLEY

GENERAL ACCESS FLOORING TEST REPORT

SUMMARY ASSESSMENT SHEET

Supplier :
Date Supplied :
Description :

General Assessment :

Test No.	Conformance to DOE Performance Specification U.K., August 1985
T1.00. Concavity	
T2.00. Twist	
T3.00. Squareness	
T4.00. Edge Strip	
T5.00. Ped. Play	
T6.00. Air Leak	
T7.00. 300 mm Plate	
T8.00. 25 mm Plate	
T9.00. Four Point	
T10.00. UDL Load	
T11.00. Safe Load	
T12.00. Soft Body	
T13.00. Hard Body	
T14.00. Pedestrian	
T15.00. Pedest. Hor.	
T16.00. Pedest. Ver.	

Approved:.....Date / /

ACCESS FLOORING TEST RESULTS SHEETS

For:

Tests conform to the British DOE Performance Specification on "Platform Floors", August, 1985.

* * * * * * * *

Test No. and Title			Test Results				
		Panel No.	1	2	3	4	5
T1 :	Max Concavity or Convexity		mm	mm	mm	mm	mm
	Max. allowable =	0.75 mm					
		mm					
	Air Temp =	C; Rel. Humidity =		% at time of test.			
T2:	Max Twist		mm	mm	mm	mm	mm
	Max. allowable =	mm					
	Air Temp =	C; Rel. Humidity =		% at time of test.			
T3:	Out of Square	Diag.AD =	mm	mm	mm	mm	mm
		Diag.BC =	mm	mm	mm	mm	mm
		Ad - BC =	mm	mm	mm	mm	mm
		(AD-BC)/BC*100 =	%	%	%	%	%
	Max. allowable =	0.6%					
	Module size =	mm					
	Air Temp =	C; Rel. Humidity =		% at time of test.			

Approved: ..... Date / /

T4 : Edge Strip Description

Panel Edge No.	1	2	3	4
Length peeled off in 5 min.	mm	mm	mm	mm

Max. allowable peeling = Nil
Air Temp = C; Rel. Humidity = % at time of test.

T5: Pedestal Free Play

Description :

Height of Pedestal : mm

	Pedestal 1	Pedestal 2
Total movement	mm	mm
Movement/100mm	mm	mm

Max. allowable = 1.00mm/100mm
Air Temp = C; Rel. Humidity = % at time of test.

T6 : Air Leakage Rate

Description of Joint :

Air Pressure (mm wg)	Leakage Rate (litre/metre/min)
2.5	
5.0	
7.5	
10.0	
12.5	
15.0	
17.5	
20.0	
22.5	
25.0	

Max. allowable leakage = Unspecified (test indicative only)
Air Temp = C; Rel. Humidity = % at time of test.

Approved : ..... Date / /

T7 : 300 mm Square Loading. (Load = kN)

Structural Grade of System:

	Panel 1 (Centre)	Panel 2 (Edge)	Panel 2 (Edge)
Defl. after 23 hours (A)	mm	mm	mm
Defl. after 24 hours (B)	mm	mm	mm
Max. allowable defl. (A), (B)	mm	mm	mm
Diff. (B) - (A)	mm	mm	mm

(Max. allowable diff. in (B) - (A) = 0.2mm)

Residual defl. after 2 hours	mm	mm	mm

(Max. allowable residual defl. = 0.5mm)

Permanent indentation	mm	mm	mm

(Max. allowable indentation = 0.15mm)

Other damage :

Safety Factor Test Load = kN. System did/did not collapse.
Damage sustained :

Air Temp. = C; Rel. Humidity = % at time of test.

T8 : Point Loading (Load = kN)

Structural Grade of System :

	Panel 1 (Centre)	Panel 2 (Edge)	Panel 2 (Edge)	Panel 3 (Corner)	Panel 4 ( )
Defl. after 23 hours (A)	mm	mm	mm	mm	mm
Defl. after 24 hours (B)	mm	mm	mm	mm	mm
Max. allowable defl. (A), (B)	mm	mm	mm	mm	mm
Diff. (B)-(A)	mm	mm	mm	mm	mm

(Max. allowable diff. in (B)-(A) = 0.02mm)

Residual defl. after 2 hours	mm	mm	mm	mm	mm

(Max. allowable residual defl. = 0.5mm)

Permanent indentation	mm	mm	mm	mm	mm

(Max. allowable indentation = 0.15mm)

Other Damage :

Safety Factor Test Load = kN. system did/did not collapse.
Damage sustained:

Air Temp = C; Rel. Humidity = % at time of test.

Approved : ..... Date / /

T9 : Four Point Loading. (Load = 11 kN)

Applies only to Structural Grade : Extra Heavy

	Panel 1 (Centre)	Panel 2 (Edge)	Panel 2 (Edge)
Defl. after 23 hours (A)	mm	mm	mm
Defl. after 24 hours (B)	mm	mm	mm
Max. allowable defl. in (A), (B)	mm	mm	mm
Diff. (B) - (A)	mm	mm	mm
	(Max. allowable diff. in (B) - (A) = 0.02mm)		
Residual defl. after 2 hours	mm	mm	mm
	(Max. allowable residual defl. = 0.5mm)		
Permanent indentation	mm	mm	mm
	(Max. allowable indentation = 0.15mm)		

Other Damage :

Safety Factor Test Load = 22kN. System did/did not collapse.
Damage sustained :

Air Temp = C; Rel. Humidity = % at time of test.

T10 : Uniformly Distributed Load. (Load = kN/m2)

Structural Grade of System :

	Panel 1 (Centre)	Panel 1 (Edge)
Defl. after 23 hours (A)	mm	mm
Defl. after 24 hours (B)	mm	mm
Max. allowable defl. in (A), (B)	mm	mm
Diff. (B) - (A)	mm	mm
	(Max. allowable diff. in (B) - (A) = 0.02mm)	
Residual defl. after 2 hours	mm	mm
	(Max. allowable residual defl. = 0.5mm)	

Other Damage :

Safe. Factor Test Ld. = kN/m2. System did/did not collapse.
Damage sustained :

Air Temp = C; Rel. Humidity = % at time of test.

Approved : ..... Date / /

T12 : Soft Body Impact. (Weight = 40 kg)

Module size of panel = mm. Height of system = mm.

	System Collapse Yes/No	Damage Report
Impact 1 (Centre)		
Impact 2 (Edge)		

System must NOT collapse.

Air Temp = C; Rel. Humidity = % at time of test.

T13 : Hard Body Impact. (Weight = 4.5kg)

Module size = mm. Height of system = mm

	System Collapse Yes/No	Damage Report
Impact 1 (Centre)		
Impact 2 (Edge)		
Impact 3 (Edge)		
Impact 4 (Corner)		

System must NOT collapse.

Air Temp. = C; Rel. Humidity = % at time of test.

Approved : ..... Date / /

T14 : Pedestrian Dynamic Test.

Structural Grade of System :

Module size = mm. Height of System = mm

	Mean Deflections Horizontal	Vertical
First 10 cycles (F)	mm	mm
Last 10 cycles (L)	mm	mm
Max. allowable (F),(L)	1.5 mm	1.0 mm
Diff. (L) - (F)	mm	mm
Max. allowable (L)-(F)	0.5 mm	0.33 mm

Air Temp = C; Rel. Humidity = % at time of test.

Damage Report :

Point Load Test on Full Panel (Test T8.00)

Structural Grade of System :

Load = kN at panel centre.

Defl. after 23 hours (A)	mm
Defl. after 24 hours (B)	mm
Max. allowable defl. (A), (B)	mm
Diff. in defl. (B) - (A)	mm
Max. allowable diff. (B) - (A)	0.02 mm
Residual defl. after 2 hours	mm
Max. allowable residual defl.	0.5 mm
Permanent indentation	mm
Max. allowable indentation	0.15 mm

Air Temp = C; Rel. Humidity = % at time of test.

Damage Report :

Approved : ..... Date / /

T15 : Pedestal Strength - Horizontal Load

Pedestal Height = mm
Applied Load = kg

	Permanent Deformation	Permanent Defm./100mm of pedestal height
Pedestal 1	mm	mm/100mm
Pedestal 2	mm	mm/100mm
Max. allowable	mm	mm/100mm

Air Temp = C; Rel. Humidity = % at time of test.

Damage Report :

T16 : Pedestal Strength - Vertical Load

Structural Grade of System :

Load at Centre of Pedestal Head.

Load = kN

	System Collapse Yes / No	Damage Report
Pedestal 1 :		
Pedestal 2 :		

Load on One Quadrant of Pedestal Head.

Load = kN

	System Collapse Yes / No	Damage Report
Pedestal 1 :		
Pedestal 2 :		

Air Temp = C; Rel. Humidity = % at time of test.

Approved : ..... Date / /