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INTERNATIONAL CONSULTANTS

Central Laboratories Report 04-527918.82-.83

Pedestrian Slip Resistance Testing to AS/NZS 3661.1: 1993 and AS/NZS 4586:2004 For Resene Paints Ltd.

S.M. Potter

Pedestrian Slip Resistance Testing to AS/NZS 3661.1: 1993 and AS/NZS 4586:2004 For Resene Paints Ltd.

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April 2004

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Date: May 2004
Reference: 04-527918.82-.83
Status:

Client: Resene Paints Ltd
PO Box 38242
Wellington Mail Centre
Wellington

Contact: Jeff Jurlina
Phone: 577 0500
Fax: 577 0600

1 INTRODUCTION

Two samples, comprising five specimens each were prepared and supplied by the client for slip resistance testing. They were stated by the client to be an acrylic coating called 'Non-Skid Deck and Path' over chip board. Two colours were supplied: 'Blue Print' and 'Off Piste', they were given Central Laboratories sample numbers 7/04/30 and 7/04/31 respectively.
The client stated that the application rates were a single coat of Quick Dry Acrylic Primer on the chip board at a rate of 12m^2/litre followed by 3 coats of the 'Non-Skid Deck and Path' at a rate of 6 m^2/litre.

This test report has been reissued in March 2006 to include test results in accordance with AS/NZS 4586:2004 Slip Resistance Classification of New Pedestrian Surface materials. Two extra test reports 04-527918.82a and 04-527918.83a have been added to the report.

2 TESTS CARRIED OUT AND BASIS FOR INTERPRETATION

The testing that was applied was in accordance with the joint Australian and New Zealand standard AS/NZS 3661.1 : 1993 "Slip Resistance of Pedestrian Surfaces, Part 1 Requirements" and AS/NZS 4586:2004 "Slip Resistance Classification of New Pedestrian Surface Materials".

The test method of sample and instrument set up for AS/NZS 3661.1:1993 is the same as the method AS/NZS 4586:2004 but the TRL rubber may be used for clay and concrete pavers. The results under AS/NZS 4586:2004 are reported as a British Pendulum Number (BPN), as opposed to a coefficient of friction. The scope of AS/NZS 4586:2004 states that it provides a means of classifying pedestrian surface materials according to their frictional characteristics using 4 different test methods. Namely the wet pendulum test, dry floor friction test, wet barefoot ramp test and wet oil ramp test.

The scope of AS/NZS 3661.1:1993 provides two test methods appropriate to determine the characteristics of surface materials to be conducted either in the laboratory, under conditions in which the surface materials are intended to be installed, or in situ following installation. The test method is selected on the basis of whether the material is to be used in either a wet or dry area. The client requested that the material be tested for the wet condition. The test method is set out in Appendix A of both standards, namely the pendulum friction tester for the wet condition. A brief description of the instrument is as follows.

The TRRL Pendulum (pendulum friction tester) has a rigid swinging arm approximately 450 mm long which contacts the surface with a spring loaded slider about 75 x 20 mm in size, at a speed of about 2 m/sec. This slider is of a specially designed rubber material (Simulated Standard Shoe Sole, the 4S rubber) so that the instrument delivers, as far as possible, a response that is representative of a "typical" pedestrian wearing suitable footwear. This instrument is regarded as equating the action of pedestrians running, hurrying or turning abruptly as, when wet, it replicates the aquaplaning effect that is particularly pronounced on smooth or highly glazed surfaces.

AS/NZS 3661.1:1993 defines wet areas as all external areas plus those internal pedestrian surfaces that are normally wet during use. It further states that water must be excluded from all dry areas, for instance by appropriate design. In its notes, the Standard envisages that regulatory authorities may specify the areas required to be slip resistant and whether they are to be considered "wet" or "dry". AS/NZS 4586:2004 also states that the test methods shall be used for the classification of pedestrian surfaces for use in either the "wet" or "dry" condition.

The results described within this test report are for the materials submitted by the client for testing. Users of this test report should determine the extent to which the submitted materials are representative of the batch or variations from batch to batch from the supplier's quality assurance procedures.
Note that factors such as wear, contamination or cleaning procedures may alter the surface properties and consequently the slip resistance of these materials.

3 FRICTION REQUIREMENTS OF SURFACES

3.1 AS/NZS 3661.1 Friction requirements of surfaces are:

Coefficient of Friction – Wet: When tested in accordance with the method set out in Appendix A, the pedestrian surface shall have a mean coefficient of friction of not less than 0.4 and no specimen in that sample shall be less than 0.35.

Coefficient of Friction – Dry: When tested in accordance with the method set out in Appendix B, the pedestrian surface shall have a mean coefficient of friction of not less than 0.4 and no specimen in that sample shall be less than 0.35.

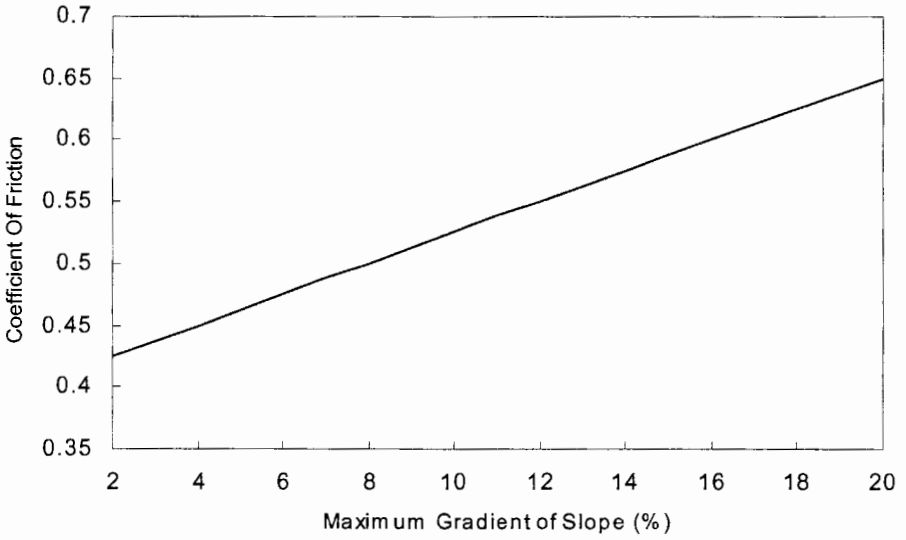
Note: It would generally be expected that surfaces that have been shown to comply with the wet requirement would also comply with the dry requirement.

Ramps and Other Sloped Areas

For all sloped or graded surfaces with a gradient not less than 2%, the minimum required value for the coefficient of friction of either wet or dry surfaces as specified above shall be increased in accordance with the following equation, expressed to an accuracy of 0.01:

$$\mu_m = \frac{100\mu + M}{100 - M\mu}$$

where μ_m = coefficient of friction required for a sloped surface
μ = coefficient of friction obtained on a horizontal surface
M = maximum gradient of slope, in percent



This equation is represented in graphical form below:

Coefficient of Friction Required for a Sloped Surface,
Calculated for $\mu = 0.4$

For example, a surface with a slope of 8% would require a coefficient of friction of 0.5.

Compliance with the slip resistant performance of New Zealand Building Code D1.3.3(d) may be verified by confirming that the walking surface, under the expected conditions of use, has a coefficient of friction (μ) of no less than

$$\mu = 0.4 + 0.0125S$$

where S is the slope of the walking surface expressed as a percentage.

3.2 AS/NZS 4586:2004 - Classification of surfaces.

The classifications are outlined in table below, which has been reproduced from standard.

CLASSIFICATION OF PEDESTRIAN SURFACE MATERIALS ACCORDING TO THE WET PENDULUM TEST

Class	Pendulum* mean BPN	
	Four S Rubber	TRL Rubber
V	>54	>44
W	45-54	40-44
X	35-44	-
Y	25-34	-
Z	<25	-

*While either of these rubbers may be used, the test report shall specify which was used.

Handbook 197:1999 An Introductory Guide to the Slip resistance of Pedestrian Surface Materials contains a flooring selection guide that is based on the wet pendulum and ramp methods. This handbook should be used in conjunction with AS/NZS 4586:2004.

4 RESULTS

Detailed results for each test are in the reports that follow in page 5 and 6 for results reported to AS/NZS 3661:1993 and pages 7 and 8 for results reported to AS/NZS 4586:2004.

Tested By

S.M. POTTER
Technical Officer

Reviewed By

V.K. DRAVITZKI
Research Manager
(Materials and Environmental Science)

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PEDESTRIAN SLIP RESISTANCE TEST REPORT NO. 04-527918.82

Client:	Resene Paints Ltd	Tested By:	
Client's Reference	Order A506584	Date:	6/5/04
Sample No.	7/04/30	Checked By:	
Specimen Size	300mm x 300mm	Date:	7/5/04
No. of Specimens Tested:	Five		

DESCRIPTION OF SAMPLE SUPPLIED BY CLIENT

Manufacturer: Resene
Surface Type: Textured
Colour: Blue Print
Surface Coating: Nil

Material Type: Acrylic on chip board
Common Name: Non-Skid Deck and Path

METHOD

Tests were carried out according to AS/NZS 3661.1 : 1993 Slip Resistance of Pedestrian Surfaces, Part 1 – Requirements, Appendix A "Method for the Measurement of the Coefficient of Friction of Wet Surfaces"

Type of Test: Fixed

Location of Test: Central laboratories

☑ A4 preparation for laboratory testing
☐ A5 preparation for in situ testing

Air Temperature: 20°C

Relative Humidity: 59%

RESULTS

Appendix A : Wet Surfaces

Specimen No.	Test Direction	Mean Coefficient of Friction
7/04/30 -1	N/A	0.74
7/04/30 –2	N/A	0.78
7/04/30 –3	N/A	0.74
7/04/30 –4	N/A	0.74
7/04/30 –5	N/A	0.74
Sample Mean Coefficient of Friction:		**0.75**

REQUIREMENTS

See Page 2 of this test report

Comments:

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PEDESTRIAN SLIP RESISTANCE TEST REPORT NO. 04-527918.83

Client:	Resene Paints Ltd	Tested By:	
Client's Reference	Order A506584	Date:	
Sample No.	7/04/31	Checked By:	
Specimen Size	300mm x 300mm	Date:	
No. of Specimens Tested:	Five		

DESCRIPTION OF SAMPLE SUPPLIED BY CLIENT

Manufacturer: Resene
Surface Type: Textured
Colour: Off Piste
Surface Coating: Nil

Material Type: Acrylic on chip board
Common Name: Non-Skid Deck and Path

METHOD

Tests were carried out according to AS/NZS 3661.1 : 1993 Slip Resistance of Pedestrian Surfaces, Part 1 – Requirements, Appendix A "Method for the Measurement of the Coefficient of Friction of Wet Surfaces"

Type of Test: Fixed

Location of Test: Central laboratories

☑ A4 preparation for laboratory testing
☐ A5 preparation for in situ testing

Air Temperature: 20°C

Relative Humidity: 59%

RESULTS

Appendix A : Wet Surfaces

Specimen No.	Test Direction	Mean Coefficient of Friction
7/04/31 -1	N/A	0.79
7/04/31 –2	N/A	0.79
7/04/31 –3	N/A	0.79
7/04/31 –4	N/A	0.79
7/04/31 –5	N/A	0.74
Sample Mean Coefficient of Friction:		**0.78**

REQUIREMENTS

See Page 2 of this test report

Comments:

PEDESTRIAN SLIP RESISTANCE
TEST REPORT 04-527918.82a

Resene Paints Ltd
P.O Box 38242
Wellington Mail Centre
Wellington

Client:	Resene Paints Ltd	
Sampled by:	Client	
Date received:	May 2004	
Material type:	Paving Paint	
Manufacturer:	Resene Paints Ltd	
Common name:	Non-Skid Deck and Path	
Colour:	Blue Print	
Surface type:	Textured	
Surface Coating:	Nil	
Number of specimens:	Five	
Specimen size	300 x 300	mm

Project no.:	527918.82a
Lab. sample no.:	7/04/30 (1-5)
Client ref. no.:	Order No.A506584

TEST METHOD

AS/NZS 4586:2004 provides means of classifying pedestrian surface materials according to their frictional characteristics using 4 different test methods. Namely the wet pendulum, dry floor friction test, wet barefoot ramp test and wet oil ramp test.

Test method: AS/NZS 4586:2004 Slip Resistance Classification of New Pedestrian Surfaces
Appendix A "Wet Pendulum Test Method"

Preparation for laboratory testing:	A4 preparation for laboratory testing using 4S Rubber Slider		
Location of test:	Central labs		
Type of test:	Unfixed		
Moisture condition of surface:	Wet	Air temperature:	20 °C
Date tested:	6.5.04	Relative humidity:	59 %

TEST RESULTS

Appendix A: Wet Surfaces

Specimen no.	1	2	3	4	5
Direction of test *(along or across)*	N/A	N/A	N/A	N/A	N/A
British pendulum Number	65	68	65	65	65

Sample Classification **V**

Comments: AS/NZS 4586:2004 provides a classification rating for new surfaces. Handbook 197:1999 An Introductory Guide to the Slip resistance of Pedestrian Surface Materials contains a flooring selection guide that is based on the wet pendulum and ramp methods.

Tested by: S. Potter
Designation: *Senior Laboratory Technician*
Date: 20/3/06

Checked by:
Designation: *Research Scientist*
Date:

PEDESTRIAN SLIP RESISTANCE TEST REPORT 04-527918.83a

Resene Paints Ltd
P.O Box 38242
Wellington Mail Centre
Wellington

Client:	Resene Paints Ltd	
Sampled by:	Client	
Date received:	May 2004	
Material type:	Paving Paint on chip board	
Manufacturer:	Resene Paints Ltd	
Common name:	Non-Skid Deck and Path	
Colour:	Off Piste	
Surface type:	Textured	
Surface Coating:	Nil	
Number of specimens:	Five	
Specimen size	300 x 300	mm

Project no.:	527918.83a
Lab. sample no.:	7/04/31 (1-5)
Client ref. no.:	Order No.A506584

TEST METHOD

AS/NZS 4586:2004 provides means of classifying pedestrian surface materials according to their frictional characteristics using 4 different test methods. Namely the wet pendulum, dry floor friction test, wet barefoot ramp test and wet oil ramp test.

Test method: AS/NZS 4586:2004 Slip Resistance Classification of New Pedestrian Surfaces
Appendix A "Wet Pendulum Test Method"

Preparation for laboratory testing:	A4 preparation for laboratory testing using 4S Rubber Slider		
Location of test:	Central labs		
Type of test:	Unfixed		
Moisture condition of surface:	Wet	Air temperature:	20 °C
Date tested:	6.5.04	Relative humidity:	59 %

TEST RESULTS

Appendix A: Wet Surfaces

Specimen no.	1	2	3	4	5
Direction of test *(along or across)*	N/A	N/A	N/A	N/A	N/A
British pendulum Number	69	69	69	69	65

Sample Classification **V**

Comments: AS/NZS 4586:2004 provides a classification rating for new surfaces. Handbook 197:1999 An Introductory Guide to the Slip resistance of Pedestrian Surface Materials contains a flooring selection guide that is based on the wet pendulum and ramp methods.

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Date: