PendulumTest(s) carried out in accordance with:

BS EN 13036-4:2011
BS 7976-2:2002+A1:2013
UKSRG Guidelines-4:2011
EN124:1994
HA104\09

On behalf of:

Fibrelite Limited.

Prepared by:

Phil Nolan
GET-A-GRIP! (UK) Limited
30th January 2015

Report Number:

0130-15/2

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1. INTRODUCTION:

On site slip and skid resistance testing of an FL90 access cover was requested by Mr David Holmes of Fibrelite Ltd. It is our understanding that the FL90 access cover had been manufactured using standard Fibrelite processes and incorporated their standard anti-slip/skid particle. An independent assessment of the cover was required to determine the pedestrian slip resistant characteristics and the unpolished skid resistance value (USRV) of the surface. The cover was tested on the factory floor at Fibrelite Ltd. in Skipton. The pendulum testing took place on Friday, 30th January 2015 and was carried out by Mr Philip Nolan of GET-A-GRIP! (UK) Ltd. Various members of staff from Fibrelite Ltd. were also present during all or some of the testing.

2. EXPLANATION OF TESTS COMPLETED:

Pendulum tests were undertaken using standard UK HSE techniques in accordance with the following test methods and standards, where appropriate:

- EN 13036-4:2011, *The method for measurement of slip/skid resistance of a road and airfield surface.*
- BS 7976-2:2002+A1:2013, *The method of operation for the pendulum tester*.
- UK Slip Resistance Guidelines – Issue 4:2011.
- BS EN 124:2004, *Gully tops and manhole covers for vehicular and pedestrian services*.
- HA104\09, *Design Manual for Roads and Bridges:2009.*

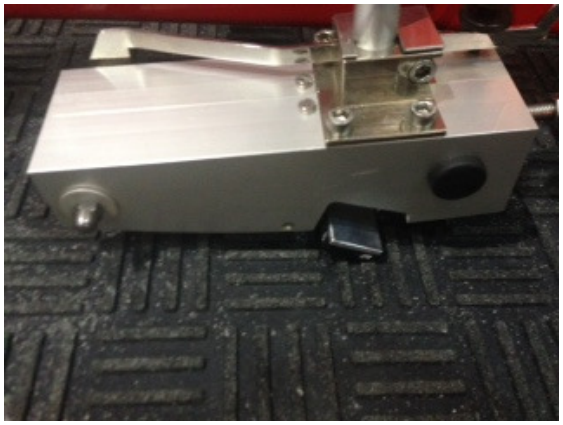
All tests were carried out using a calibrated Wessex Pendulum Tester and correctly prepared rubber sliders. The apparatus and test methods are strongly recommended by the UK Health and Safety Executive and such tests would be carried out by them in the event of a vehicular skid or pedestrian slipping accident.

Testing was conducted “as found” in both the dry and water wet conditions. The dry tests may not be of any interest to the client however, the wet pendulum test value (PTV) might have been reduced slightly if the dry testing was not undertaken as the slider is known to be conditioned by the test surface in the course of the dry tests. Our understanding of the “as found” condition is simply a measure of the state of the surface at the time of the test and may not be representative of the state of the surface at the time of an accident. Also, an unpolished test value (USRV) will not necessarily indicate the in-service skid resistance of a cover and as such may give rise to safety concerns.

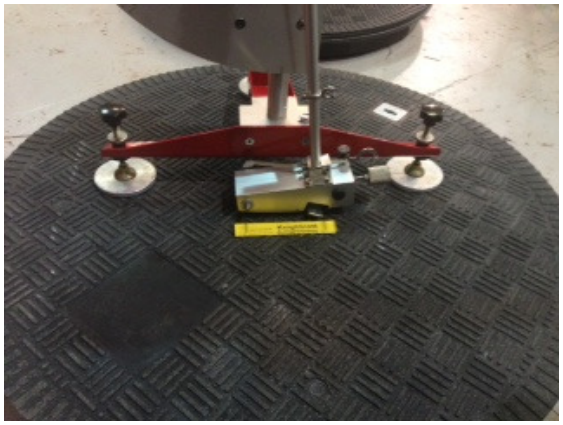
The FL90 access cover was defined as follows:

Cover #1: FL90 access cover (UK Version)

Due to the profiled surface of the FL90 cover testing was completed using both Slider 55 and Slider 96 which, on the basis that profiles have been shown to give a wide range of pedestrian slip resistance values with different footwear. Using the two verified sliders gives the client an indication of the range of behaviour that may be experienced by users.



Pendulum tests at 0° and 90° to key housing.



Pendulum test at 45° to key housing.

As the FL90 covers had a raised geometric pattern pendulum measurements were recorded in various directions to determine the minimum pendulum test value (PTV).

3. GUIDANCE FOR INTERPRETING SKID RESISTANCE TEST RESULTS

The pendulum skid tester was widely adopted for the testing of road and runway surfaces shortly after its conception. Road note 27 describes the method of testing and classification of results, the first edition being published in 1960. Whilst there are now a wide range of methods to measure the skid resistance of roads and runways, BS EN 13036 remains a useful addition.

Guidance on suggested minimum skid resistance values, when measured using the portable pendulum tester are recommended in the table below:

Category	Type of Site	Minimum Wet Skid Resistance
A	Difficult sites such as: (i) Roundabouts (ii) Bends with radius less than 150m on unrestricted roads (iii) Gradients, 1 in 20 or steeper, lengths greater than 100m (iv) Approaches to traffic lights on unrestricted roads	65
B	Motorways, trunk and class 1 roads and heavily trafficked roads in urban areas (carrying more than 2000 vehicles per day)	55
C	All other sites.	45

Note 1: For category A and B sites where speed of traffic is high (in excess of 95km/h) and additional requirement is a minimum "texture depth" of 0.65mm.

4. GUIDANCE FOR INTERPRETING PEDESTRIAN SLIP RESISTANCE TEST RESULTS

The UK HSE recommends that the minimum slip resistance value that is deemed to be safe for pedestrians is **36 PTV** in the worst foreseeable contaminated condition.

The following table contains guidelines recommended by the UK HSE and the UK Slip Resistance Group – Issue 3:2005.

Pendulum Test Value (PTV)	Slip Potential
0 – 24	High
25 – 35	Moderate
36 +	Low

Predictions of friction requirements for pedestrians for level walking made by Building Research Establishment (BRE) - P.W Pye & H.W Harrison 2003:

Risk	Minimum PTV	Slip Potential
1 : 2	19	High
1 : 20	24	High
1 : 200	27	Moderate
1 : 10,000	29	Moderate
1 : 100,000	34	Moderate
1 : 1,000,000	36	Low

The information presented above is intended as a guide only. Other factors, such as level and type of pedestrian activity and user demographic (such as age and physical ability) should also be considered. A risk assessment should be carried out in all situations. *See notes below.*

Note 1: The Building Research Establishment (BRE) and the former Greater London Council (GLC) suggested that for reasonably active pedestrians aged between 18 and 60 a PTV of 36 or above represented an acceptably low risk of slipping when walking in a straight line on a level surface.

Note 2: Wherever possible, all floor/pedestrian surfaces should be such that they fall within the parametres of "Low Slip Potential" and ideally on a level floor a minimum Pendulum Test Value (PTV) of 40.

Note 3: Where assisted access is required, for example a person aiding a wheel chair user then a higher PTV is required. In such instances due consideration should therefore be given to increase further the traction slip resistance of the walkways.

Note 4: Where slopes and gradients are involved the PTV requirements need to be increased.

5. PENDULUM TEST RESULTS

TABLE 1- COVER #1: *FL90 ACCESS COVER (UK VERSION)*

Slider Type	Test Direction	Contaminant	Pendulum Test Value (PTV)						Slip Potential
			1	2	3	4	5	AVG	
55	Parallel to key housing	Dry	98	102	98	95	102	99	98 PTV Low
	90° to same		100	103	104	104	104	103	
	45° to same		93	93	93	93	93	93	
	Parallel to key housing	Wet (water)	93	95	93	93	93	93	89 PTV Low
	90° to same		90	90	93	93	93	92	
	45° to same		83	79	82	80	82	82	
96	Parallel to key housing	Dry	85	86	92	92	92	89	82 PTV Low
	90° to same		92	92	92	92	92	92	
	45° to same		65	65	65	65	65	65	
	Parallel to key housing	Wet (water)	80	76	73	78	73	76	59 PTV Low
	90° to same		76	78	73	73	73	75	
	45° to same		59	59	58	59	59	59	

6. CONCLUSIONS

Pendulum testing revealed that the raised geometric tread design on the FL90 access cover provides higher pendulum test values (PTV) at 0° and 90° but lower readings when tested at 45°.

The interaction of the Pendulum slider with a profiled surface is greatly exaggerated compared with the interaction of the foot with the same profiled surface. The Pendulum gives the correct thickness of lubricating squeeze film between the slider and the surface but the Pendulum foot does not have the same momentum as a person foot. Furthermore, it is assumed that users will transit at different angles across the in-situ FL90 access cover; their heel strike angle may even vary when walking in a single direction. It is therefore suggested that the reading obtained in the direction that gives the lowest readings using the Pendulum is likely to indicate the lowest slip resistance that a pedestrian user would experience and so should be considered when assessing the pedestrian slip potential.

Pendulum Test Values of FL90 access cover in water-wet conditions, using Slider 96 (see table 1 above):

Test Sample	Lowest Test Direction	Pendulum Test Value (PTV)						Slip Potential
		1	2	3	4	5	**AVG**	
FL90 access cover	45° to key housing	59	59	59	59	59	**59**	Low

The FL90 access cover tested was found to have a “low-slip” potential for pedestrian users when tested in water-wet conditions.

According to BS EN 124:2004 the mean of the last three of the five pendulum readings shall be determined for each test direction. This shall be declared as the unpolished skid resistance value (USRV) for each direction. The mean of the two lowest USRV values shall be declared as the overall unpolished skid resistance value (USRV).

Pendulum Test Values of FL90 access cover in water-wet conditions, using Slider 55 (see table 1 above):

Test Sample	Lowest Test Direction	Unpolished Skid Resistance Value (USRV)						USRV
		1	2	3	4	5	**AVG**	
FL90 access cover	90° to key housing	90	90	93	93	93	**93**	87
	45° to same	83	79	82	80	82	**81**	

An unpolished test value (USRV) will not necessarily indicate the in-service skid resistance of a cover. The client may wish to carry out additional testing to determine the Polished Skid Resistance Value (PSRV) in accordance with BS 9124. Alternatively, direct measurements made on similar covers in similar conditions of use can be used as an indication of expected levels of in-service performance.

The above assessment was carried out by GET-A-GRIP! adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip and vehicular skid risk assessment, where appropriate. The results given are accurate representations of data acquired on-site and through the client. The results presented only relate to the sample areas measured at the time of the testing. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE.

The results given in this report apply only to the samples that have been tested.

Report authorised for and on behalf of GET-A-GRIP! (UK) Ltd by:

Phil Nolan
Floor Safety Adviser

END OF REPORT

APPENDIX 1 TEST EQUIPMENT

Wessex Pendulum Skid Tester

The Pendulum has been chosen by the HSE and UK Slip Resistance Group for two main reasons. Firstly, unlike most other available instruments, it reproduces the same hydrodynamic uplift characteristics that occur when a person slips in liquid-contaminated conditions. Secondly, good correlation between the readings given by the instrument and the incidence of pedestrian slipping accidents has been observed since the 1940's.

For many years the Pendulum has been the only instrument for the purpose of floor surface slip resistance measurement described in British Standards.

Serial No.:	SK1586
Calibrated by:	Knightcott
Calibration Date:	30th October 2014
Certificate No.:	CN 218
Calibration Due:	29th October 2015

Notes:
Calibration checks are regularly by way of check testing on lapping film previously tested by a UKAS accredited laboratory. Further to this, check testing is conducted on-site using lapping film and float glass of a known value.

Slider #96 (4S Rubber Slider)

Slider 96 rubber, formely known as Four S rubber, should be used for assessing pedestrian slip potential in all areas used by shod pedestrians. Slider 96 is a standard test rubber that simulates a shoe heel of moderate slip resistance.

Batch No.:	#56
Calibrated by:	Knightcott
Calibration Date:	30th October 2014
Certificate No.:	102/14
Disposal Date:	29th October 2015

Notes:
Sliders are prepared in line with guidance by the UKSRG. Check testing is conducted both on lapping film previously tested by a UKAS accredited laboratory and float glass. This procedure is conducted prior to a site visit and is in addition to the site check testing.

Slider #55 (TRRL Rubber Slider)

Slider 55 rubber, formerly known as TRRL rubber, should be used for assessing pedestrian slip potential in areas used by barefoot pedestrians. Slider 55 is also useful in understanding the range of behaviour that may be experienced with different footwear on a profiled or macro anti-slip surface.

Batch No.:	#82
Calibrated by:	Knighcott
Calibration Date:	30th October 2014
Certificate No.:	68/14
Disposal Date:	29th October 2015

Notes:
Sliders are prepared in line with guidance by the UKSRG. Check testing is conducted both on lapping film previously tested by a UKAS accredited laboratory and float glass. This procedure is conducted prior to a site visit and is in addition to the site check testing.

All calibration certificates are available on request.