



# Grip Potential Ltd

Comprehensive on-site slip risk assessment

## Kedel Limited

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Report Reference: 1102IPLA180510

Purchase Order: n/a

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### Summary

#### Sample Slip Risk Comments

Low Test results indicate a low risk of slip in both dry and water-wet conditions.

Plastic Decking

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### Theory

The pendulum skid test forms the basis of the coefficient of dynamic friction measurement of a floor. A calibrated 'foot' swings from a horizontal point of release, strikes the flooring surface for a known distance, then reads the "pendulum test value" on its overswing. The rubber slider that contacts the floor is constructed of '4S' rubber (Standard Simulated Shoe Sole) and is designed to replicate the most common slipping motion experienced by pedestrians wearing shoes. A softer, more malleable, rubber (TRL rubber) may be used to simulate a barefoot or casual shoe slip. Pendulum testing is one of the few methods that models the formation of a hydrodynamic squeeze film between the floor and shoe sole, a major factor in a wet slip.

Research carried out by the Health and Safety Laboratory, in conjunction with the UK Slip Resistance Group (UKSRG), has shown that it is possible to assess the characteristics of floor surface materials needed for satisfactory slip resistance. The Health and Safety Laboratory has developed a "reliable and robust" test method that forms the basis of Grip Potential's assessment procedure.

A surface roughness meter is used to measure the ability of the floor's surface to puncture the hydrodynamic squeeze film. The film forms a barrier between sole and floor and significantly reduces grip, in the same way that a car tyre aquaplanes. The minimum recommended valley to peak height for a water wet surface is 20µm. A thicker contaminant, such as motor oil, will require a much greater surface roughness in order to facilitate a sole-floor contact. For this reason it is important to take into account expected contaminants when specifying a floor surface.

A site assessment is an important component in determining the slip risk of any given floor. The HSE's pedestrian slip potential model highlights important environmental factors in a slip. Contaminating substances, frequency and methods of cleaning, types of footwear and likely pedestrian behaviour all affect the potential for a slip incident and are given due consideration.

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### Method

**BS 7976-2:2002 - Pendulum Testers, Method of Operation**

**PTV**



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<25  
25-35  
>35

Table 1. Slip Potential classifications from Pendulum Test Values

High

## Slip Potential

Coefficient of dynamic friction measurement is carried out in accordance with BS 7976 and the UKSRG Guidelines 2005. These industry standard methods of testing are essentially the same but with a slight difference between the two methods of preparation of the rubber sliders. Testing has been carried out in accordance with the UKSRG Guidelines 2005 as both the HSE and UKSRG agree that this is best practice.

A prepared standard rubber slider attached to a weighted 'shoe' is allowed to swing from a horizontal point of release. The slider is mounted on a spring loaded bracket and makes contact with the floor for a known distance. The height to which the shoe travels after contacting the floor gives a reading of the Pendulum Test Value (PTV, formally known as SRV Slip Resistance Value). The dynamic coefficient of friction of a test surface has a direct and measurable effect on the PTV reading obtained.

Test surfaces are subject to eight measurements of the PTV with the first three being discounted from calculations of the mean. Tests are carried out in the principal direction, at 45° to the principal direction and at 90° to the principal direction. Each direction is tested under both wet and dry conditions, totalling 48 measurements. A mean value is generated for wet and dry tests based on the performance in different directions. A slip potential classification can then be applied using the following table from the UKSRG Guidelines.

Moderate

Low

## Surface Roughness Measurement (Rz)

### Rz (µm)

<10  
10-20  
>20

Table 2. Slip Potential classifications from surface roughness (Rz) values

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High

Low

Surface roughness can be used to give a general indication of the slip risk potential of a floor, though it is by no means a comprehensive test. Grip Potential use surface roughness measurements married to pendulum results to enable accurate ongoing monitoring of the surface. The UKSRG published the data shown in the table below to use in conjunction with pendulum testing.

Moderate

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## Slip Potential

Surface roughness, in particular the Rz value, describes the ability of a floor to puncture the hydrodynamic squeeze film. It is also a valuable tool to assess the wear level as over time traffic will smooth a floor surface, changing its slip risk potential.

Grip Potential use a Surtronic Duo surface roughness meter for assessment. The meter moves a stylus along the test surface, measuring the floor profile's average vertical peak to valley distance in microns. A test site will be measured ten times using this method, with tests carried out in random directions in an area local to the pendulum test. This is in line with UKSRG guidelines.

## Site Assessment

A Grip Potential site assessment aims to provide the client with all necessary information of the factors contributing to slip risk of the tested areas. Drawing assessment criteria from a wide range of expert sources ensures that a complete and thorough report of slip risk is produced. Knowledge of factors adversely affecting slip risk allows intelligent decision making in ongoing health and safety procedures.

A site assessment is designed to highlight factors that have an impact on slip risk potential. The Grip Potential site assessment follows the pedestrian slip risk potential model as developed by the HSE alongside guidance published by the UKSRG and CIRIA and our own expert knowledge and experience.

Information required to complete the site assessment is gathered primarily at the time and



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location of the test based on observations made by the test operator. Less obvious information, such as cleaning regimes or shoe control measures, is supplied by the person responsible for the site, or a representative of that person. Where information is uncertain, or an assumption is made, it is made clear that this is the case.

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## Test Equipment

### Munro Portable Skid Tester

Notes:

Serial No: 0852

Calibrated by: BSI Product Services

Calibration date: 19/03/10

Certificate No: 3859

Calibration due: 19/03/11

### Surface Roughness (Rz) Meter Calibration Plate

Notes:

Serial No: 112-2916

Calibrated by: GB Quality Assurance Ltd

Calibration date: 27/04/09

Certificate No: 55283

Calibration due: 27/04/14

### 4S Rubber Sliders (Slider #96)

Notes:

Batch No: 15306

Calibrated by: Munro Stanley London

Calibration date: 27/01/10

Certificate No: 63540

Disposal date: 27/01/11

### TRRL Rubber Sliders (Slider #55)

Notes:

Batch No: 15377

Calibrated by: Munro Stanley London

Calibration checks are carried out 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.

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.

The Surtronic Duo surface roughness meter comes equipped with a calibration plate of known roughness.

Prior to testing on site, check testing is carried out on the calibrated plate.

Sliders are prepared in line with guidance by the UKSRG.

Check testing is conducted both on lapping film

Calibration date: 06/04/10

Certificate No: 63645

Disposal date: 30/03/11

### Digital Level

Notes:

Serial No: 6029

Calibrated by: MD Calibration Services

Calibration date: 08/04/10

Certificate No: 121087

Calibration due: 08/04/11

### Daily Check Test Values

#### Mean Expected

Lapping film: 64 64 64 63 63 64 63 ±1

Float glass: 8 8 8 8 7 8 5 to 10

Surface Roughness tested value: 21.5 µm

Surface roughness expected value: 21.5 µm



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## PTV

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. The digital level is used to determine the gradient of the test surface. The UKSRG give guidance on the effect a slope has on the recommended minimum PTV.

**Please note that all calibration certificates are available on request.**

## Test Results Plastic Decking

Test carried out by: Ben Powers Date of test: 21/05/10

Site location: Grip Potential Ltd Flooring type: Plastic

Substrate: n/a Application: Decking

Image 1. Test surface Image 2. Test surface

### Pendulum Test Results Slider #96 (4S)

#### Direction Condition Mean

Principal 41 40 41 41 41 41

45° 43 43 42 42 42 42

90° 64 67 65 64 63 65

#### 49

Principal 36 35 35 36 35 35

45° 37 37 37 37 37 37

90° 49 50 48 51 50 50

#### 41

#### PTV

Dry

#### Mean wet PTV:

#### Mean dry PTV:

Wet

Pendulum test values indicate that slip risk potential in the dry is

Pendulum test values indicate that slip risk potential in the wet is

### Surface Roughness (Rz) Results

Sample Rz ( $\mu\text{m}$ ) Wet PTV: 35 Rz Value: 41.0

1 16.9

2 65.7

3 46.0

4 46.7

5 52.5

6 21.9

7 35.1

8 70.4

9 16.5  $\geq$  42

10 38.1  $<$  42

Mean **41.0**  $<$  29

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### Rz Value ( $\mu\text{m}$ ) Indicative Slip Risk

Moderate

High

Assuming linear relationship between surface roughness in microns and pendulum test values, the following can be used **as a guide** when monitoring surface roughness of the test surface.

#### Low

#### Low

The above results have been classified in accordance with the UKSRG Guidelines Issue 3, November 2005.

Low

Surface roughness taken in the principal direction as this is the most slippery.

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## Conclusion

Table 1. Results from various assessment measures employed



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In the opinion of Grip Potential Ltd, the plastic decking sample under test demonstrated a low risk of slip in dry conditions and a low risk of slip in water wet conditions.

The decking produced an average wet PTV over 3 directions in excess of 36, in accordance with UKSRG guidelines this is classified as a "low slip risk". It should be noted that tests conducted along the 'grain' produced a PTV of 35, which would be classified as a "moderate slip risk". There is unlikely to be a significant difference in the number of falls a 35PTV surface facilitates over a 36PTV surface. Surfaces exposed to water based contamination should provide a low risk of slip in these conditions. The decking sample traversed parallel to the 'grain' does not provide a low risk of slip.

Assuming an identical material composition, results suggest that the curvature of previously tested samples was in fact providing favourable pendulum test results. The trough shape may have been sufficiently great to provide an excess of pressure applied at the edges of the slider. The same effect would not have been seen in a real slip with a rounded heel. The flat samples tested above better represent the slip resistance that can be expected by end users.

The common macro-profile decking design features deep grooves cut along the length of the decking planks, as in the tested sample. This profile provides excellent grip at right angles to the grain, with the profile effectively cutting through the fluid film lubricating a

Current risk management strategies n/a

Pendulum (BS 7976) in water wet conditions Low Slip Risk

Current Rz reading 41.0

Low Slip Risk

Estimated Rz threshold for low slip risk 42

## **Plastic Decking: Test Method Result**

Pendulum (BS 7976) in dry conditions

Signed:

Ben Powers 24/05/10

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slip. The slip resistance along the grain is compromised however, as the contact area is reduced and there are no features cutting through the fluid film. In addition, the sample under test featured a micro-profile similar to that of wood, running along the grain. A directional micro-profile offers similar properties to a directional macro-profile. The ability of the micro-profile to cut through the fluid film is significantly reduced along the 'grain'.

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The above assessment was carried out by Grip Potential adhering to the UKSRG, HSE and CIRIA guidelines on pedestrian slip risk assessment. The results given are accurate representations of data acquired on site and through the client. The results have been interpreted to give slip risk classifications based on parameters recommended by the UKSRG and HSE