




This presentation was created by Dr. Mike Minett from Polyflor. Polyflor is the leading manufacturer of resilient vinyl floor coverings in the UK and is part of the James Halstead Group which in 2015 celebrated it's 100th anniversary. Polyflor has been manufacturing safety floor coverings in the UK since 1983 and has been successful in growing the business and developing new products for a wide range of end use of applications which require slip resistant floorings.


## Specification of Safety Vinyl Floorcoverings

### Don't slip up !

#### Summary

- Introduction to Polyflor
- Definition of a safety floor
- Comparison of safety floors
- Requirements for safety floors
- Safety floor specification and sustainable slip resistance
- Common misconceptions with safety floorings
- Types of safety floorings
- Future of safety floorings





Safety floor coverings are well established in the UK and are extensively used in schools, hospitals and other buildings throughout the UK.

Despite this there still remain significant misunderstandings with regard to the specification and requirements for safety floors as well as misconceptions with regard to their use.

This presentation clarifies the definition of a safety floor covering with sustainable slip resistance , explains how to correctly specify a safety flooring , correct some common misconceptions and gives some further information on types and future development.

## Background to James Halstead / Polyflor

- Founded in 1915
- Manchester textile manufacturer
- 1950s - pioneered homogeneous vinyl floor coverings
- 1983 – first safety flooring launched containing aggregate particles
- Manufacturing for 100 + years - a major manufacturer and employer in Manchester



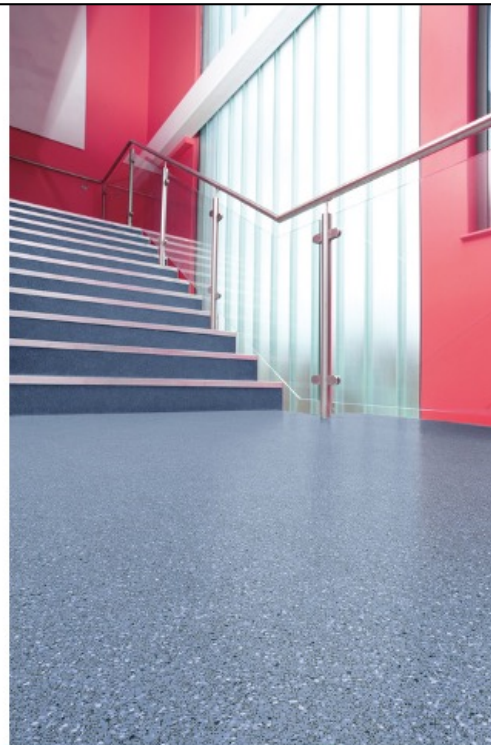
**POLYFLOR**  
COVERING THE WORLD

Polyflor is the leading manufacturer of resilient vinyl floor coverings in the UK and in 2015 celebrated its 100<sup>th</sup> anniversary.

Polyflor has been manufacturing safety floor coverings for more than 30 years and has been successful in growing the business and developing new products.

## What is a Safety Floor?

- Many different resilient floor coverings are available with a wide range of performance characteristics and slip claims.
- It is essential to choose a product which has a performance matched to its end use areas.
- Manufacturers claims for slip performance can often be misleading or misunderstood. Although there is no 'official' definition of a safety floor, it is generally accepted in the UK that a 'True' safety floor product must be particle based and meet the requirements of EN13845.



**POLYFLOR™**  
COVERING THE WORLD

Although there is no official definition of a PVC safety flooring, the requirements are commonly understood and referenced in the Contractor Flooring Association guide as below: PVC floorcoverings with particle enhanced slip resistance (safety flooring) must comply with BS EN13845. Enhanced slip resistance for these products is achieved through the addition of particles such as quartz, carborundum or cork in body (Homogeneous) or wear layer (heterogeneous) of the product. These particles ensure that the slip resistant properties of the floorcovering will be retained for the useful life of the product.

Products which provide slip resistance through surface coatings, surface embossing or a combination of these are also available but at present there is no British or European Standard to which these products must conform with regard to slip resistance.

EN 13845 - This is a European standard specifically relating to particle based safety flooring. Meeting this Standard is imperative if a flooring is classified as a true safety floor. Products can be classified as ESf (Enhanced Slip for use with footwear) or ESb (Enhanced Slip for barefoot use) to this standard. This standard now include reference to the pendulum test.

True safety flooring products offer slip resistance that is sustainable for the guaranteed life of the product due to the particles being incorporated through the performance layer and will reduce the risk of slipping on a floor for this period, should it become contaminated.

## Safety Floor Specification

Characteristic	Test Method	Product 1	Product 2
<b>Description</b>		Safety Flooring	Safety Flooring
<b>Slip Resistance Pendulum</b>	BS7976-2 / UKSRG	> 36	>36
<b>Surface Roughness</b>	R <sub>z</sub> (microns)	>20	>20
<b>Slip Resistance Ramp</b>	DIN 51130	R10	R10
<b>CE Slip Classification</b>	EN14041	DS	DS
<b>Use Area Classification (Durability)</b>	EN ISO 10874	34/43 (Public and commercial areas with intense use)	34/43 (Public and commercial areas with intense use)

Both products claim good slip performance and are recommended for public and commercial areas. However, tests described in this table are 'ex factory tests only.



There are a multitude of products available which describe themselves as safety floor coverings based on ex factory slip tests, however, it is important to understand which of these products give true sustainable slip resistance

The above Table summarises some ex factory slip claims for 2 different flooring products both of which are marketed as safety floors.

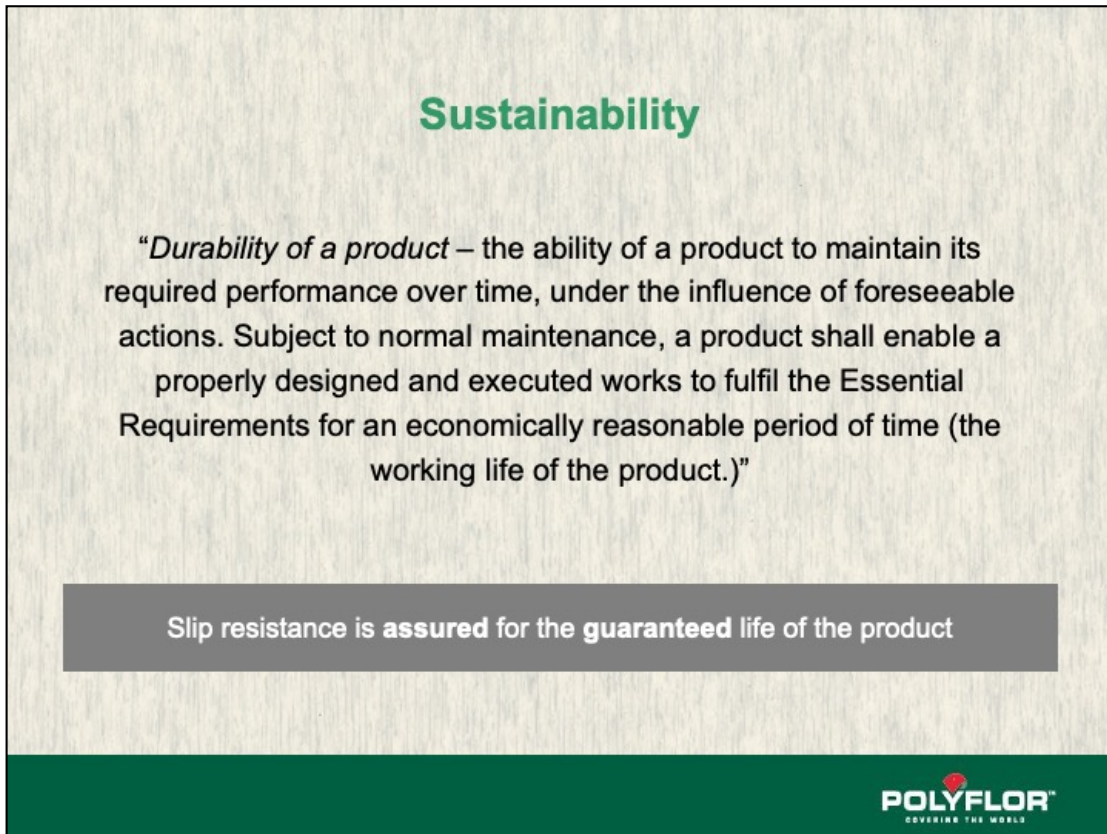
At first glance both of these products appear to give satisfactory slip performance tests , however, as following slides explain there are significant differences in performance between them.

## Factors affecting Slip Performance

- Wear
- Maintenance
- Traffic



The previous slide outlined ex factory slip performance test results. However, when a floor covering is installed it will be affected by the way it is used in surface, i.e. walking , cleaning regimes, dirt build up and other uses in the area. These can lead to wear of the surface which can in turn affect the slip performance.



## Sustainability

*“Durability of a product – the ability of a product to maintain its required performance over time, under the influence of foreseeable actions. Subject to normal maintenance, a product shall enable a properly designed and executed works to fulfil the Essential Requirements for an economically reasonable period of time (the working life of the product.)”*

Slip resistance is assured for the guaranteed life of the product

**POLYFLOR™**  
COVERING THE WORLD

If wear of a product under normal use conditions results in reduction of slip resistance, then it is evident that ex factory results will not necessarily provide a reliable indication of the slip performance throughout the products life.

It is generally accepted that a product marketed as a slip resistant floor should be able to demonstrate slip performance and meet slip resistance claim throughout its guaranteed life.

The following slide describes some techniques used to measure sustainability of slip.

## Sustainable Slip Testing

### EN13845 Annex D Abrasion

The test measures the loss of particles in the surface after a 50,000 test cycles. Wear is generated by the abrasive action of a simulated shoe sole and abrasive particles.



### SATRA Pedatron Test Machine

In order to achieve a realistic wear assessment, the Pedatron has been developed to closely replicate the action of walking, with parameters determined from biomechanical studies of walking gaits



**POLYFLOR**  
COVERING THE WORLD

All sustainable slip resistant floors currently on the market contain hard aggregates which are embedded into the surface and are effective in imparting slip resistant properties, these products conform to the European standard EN13845 “Resilient floor coverings – Polyvinyl chloride floor coverings with particle based enhanced slip resistance – specification”. In order to ensure that slip is durable it is important to ensure that these hard particles are retained in the floor covering throughout the life of the product. A test has been developed as part of EN13845 which simulates abrasion of the floor covering surface, for heavy use commercial areas the requirement is that the particle loss should be <10% after 50,000 cycles.

To more accurately replicate end use walking conditions the SATRA pedatron machine is often used. This machine replicates the action of walking and thus can be used to study the effect of walking on the durability of slip resistance. This is not a standard test but is often used for development purposes to assess the sustainability of slip on new floor covering surfaces.



## Comparison of 'slip resistant' floor in sustainable slip tests

	Product 1	Product 2
<b>Particle Count after 50,000 Cycles</b>	100% loss after 1,000 cycles Not classifiable against EN13845	2% loss. Meets requirements of EN13845. Class 34/43
<b>Surface roughness – Initial (microns)</b>	20.4	30.6
<b>Surface Roughness At End Of Test (microns)</b>	7.5	37.8
<b>SATRA Pedatron – Initial Pendulum Slip</b>	42	41
<b>SATRA Pedatron Slip Durability</b>	<36 after 300,000 footsteps	47 after 1,000,000 footsteps

Only product 2 is sustainable, sustainable slip cannot be substantiated by ex factory slip tests alone.



This Table illustrates the performance of the 2 floor coverings described earlier where ex factory tests appear to demonstrate satisfactory slip resistance.

The results show that although the ex factory results for slip are similar the response to the durability tests is completely different.


Product 1 is a floor covering which has a textured coating for improved slip resistance but contains no slip resistant particles in the wear layer. The texture of this product is worn through after only 1,000 cycles as evidenced by the sharp reduction in surface roughness values. The product also becomes an increased slip risk with slip resistance dropping to the medium risk category after only 300,000 cycles. It is evident that the ex factory slip resistant claims for this product are not sustainable.

Product 2 is a floor covering containing embedded particles to impart slip resistance, which are present throughout the wear layer of the product.

This product loses only 2% of particles when subjected to abrasive wear tests, becomes slightly rougher when worn and shows an increased slip resistant with wear and is classified as low slip risk according to UKSRG guidelines after 1,000,000 footsteps on the SATRA pedatron test.

### Safety Floor Specification

Characteristic	Test Method	Product 1	Product 2
<b>Description</b>		Safety Flooring	Safety Flooring
<b>Slip Resistance Pendulum</b>	BS7976-2 / UKSRG	> 36	>36
<b>Surface Roughness</b>	R <sub>z</sub> (microns)	>20	>20
<b>Slip Resistance Ramp</b>	DIN 51130	R10	R10
<b>CE Slip Classification</b>	EN14041	DS	DS
<b>Use Area Classification (Durability)</b>	EN ISO 10874	34/43 (Public and commercial areas with intense use)	34/43 (Public and commercial areas with intense use)
<b>EN13845 (PVC Floor Coverings With particle Based Enhanced Slip Resistance)</b>		Does not comply	Complies
<b>EN13845 Annex D Abrasion test</b>	>50,000 cycles for 34/43 classification	< 1,000 cycles (unsuitable for classification as a safety floor against EN13845 in any area , >20,000 cycles required for general domestic use)	>50,000 cycles
<b>Sustainability of slip</b>	Manufacturers guarantee	No guarantee	Lifetime of the product (typically > 10 years)



This table summarises the full test results for both products previously described. The table makes it evident that it is not possible to specify a slip resistant floor covering based on ex factory results alone as they give no clear indication of slip sustainability.

If sustainable slip resistance of a floor covering is required then there must be some evidence of slip sustainability , this is usually supported by a manufacturers guarantee.

## Key requirements for Safety Flooring

- Sustainable slip resistance for guaranteed life is crucial
- Particles through performance layer for long term performance
- Must meet EN 13845 & 50,000 cycles abrasion test
- Should meet 36+ on the HSE recommended Pendulum in wet conditions – low slip potential



**POLYFLOR**  
COVERING THE WORLD

The only floor coverings which give truly sustainable slip resistance should meet the following requirements:

- Contain hard particles throughout the wear layer thickness and show compliance with EN13845.
- For very heavy use commercial areas such as schools and hospitals , the products must meet the EN13845 abrasion test requirements of <10% particle loss after 50,000 cycles.
- Should meet pendulum test requirement of 36 minimum throughout guaranteed life, this claim should be supported by a manufacturers guarantee.

## Common Misconceptions in Specification of Safety Floorings

- Safety floors can be specified based on ramp test results
- Safety floors can be specified by ex factory pendulum testing
- Floors CE marked for slip are safe to use
- Safety floors are difficult to clean
- Safety floors are unhygienic



The image shows two young children sitting at a white table with orange chairs, eating a meal. The floor is made of light-colored wood. The children are wearing red and green clothing. There are plates of food and a glass on the table.

**POLYFLOR**  
COVERING THE WORLD

There are several misconceptions with regard to safety floor coverings these will be addressed in turn on the next series of slides.

### Can safety floors can be specified based on ramp test results?

- R9-R13
- Ex-Factory, in-situ testing not possible
- Oil contaminant not relevant to most situations
- No account of wear or maintenance regime





Slip resistance is often specified based on the ramp test. However, this test can only be performed on ex factory products , the earlier part of this presentation has already demonstrated that ex factory results are not a reliable guide to in-use performance. The test also uses oil as a contaminant , since most slip resistance issues are with water as a contaminant this test has limited relevance to most real life end use conditions.

Another issue with this test is that the R values are often misunderstood as the lowest end of the scale starts at R9 which can be misconstrued as being a result which suggests high slip resistance.

## Slip Sustainability in Ramp Test

- Study completed to assess sustainability of slip resistance claims
- Samples tested for ramp slip and pendulum slip, installed in school corridor for 2 years, uplifted and then retested

Product	Before Installation		After Installation	
	Platform	Class	Platform	Class
	Angle (°)		Angle(°)	
<b>EN13845 Safety</b>	17.4	R10	14.5	R10
<b>PVC Smooth R10 -1</b>	14.9	R10	10.2	R10
<b>PVC Smooth R10 -2</b>	7.8	R9	3.6	<u>uncl.</u>
<b>PVC Smooth R10 -3</b>	11.2	R10	3.5	<u>uncl.</u>
<b>PVC Smooth R10 -4</b>	14.3	R10	7.6	R9
<b>PVC Smooth R10 -5</b>	12.7	R10	4.8	<u>uncl.</u>
<b>Linoleum R10</b>	11.5	R10	5.0	<u>uncl.</u>



These results summarise a study undertaken by Cleaning Research International on behalf of Polyflor. Samples of various floor coverings were installed into a busy corridor for 2 years and then uplifted for retest. The test results show that most floor coverings classified as R10 reduce in slip resistance over time. This confirms that ex factory ramp test results are not a reliable guide to actual slip resistance in use

**Can safety floors can be specified based on ex factory pendulum results?**

- **HSE Guidelines**
  - $\geq 36$  RRL Pendulum Wet Test (four-S rubber/Slider 96)
  - Barefoot areas – TRL Rubber/Slider 55
  - Surface roughness  $Rz \geq 20\mu m$



**POLYFLOR**  
COVERING THE WORLD

The pendulum test is recommended by UKSRG and the UK Health and Safety Laboratory as the most suitable 'in-situ' test for measuring slip resistance of floor coverings.

Pendulum test values of 36 or greater in wet conditions indicate a low risk of slip for a floor covering. This test is often used in conjunction with a complementary surface roughness tests which can be used to monitor changes in the surface of the floor covering.

## Slip Sustainability in Pendulum Test

- Study completed to assess sustainability of slip resistance claims
- Samples tested for ramp slip and pendulum slip, installed in school corridor for 2 years, uplifted and then retested

Product	Slip Resistance(°)			
	Original		After Use	
	In direction of	Across direction	In direction of	Across direction
	manufacture	of manufacture	manufacture	of manufacture
<b>EN13845 Safety – R10</b>	43	45	45	42
<b>PVC Smooth R10 -1</b>	28	29	25	27
<b>PVC Smooth R10 -2</b>	24	25	24	21
<b>PVC Smooth R10 -3</b>	34	34	20	22
<b>PVC Smooth R10 -4</b>	38	39	18	18
<b>PVC Smooth R10 -5</b>	23	25	21	19
<b>Linoleum R10</b>	36	34	20	21



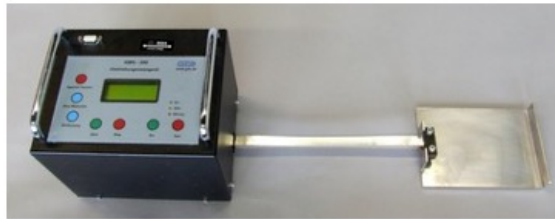
When floor coverings installed in a the school corridor were measured with the pendulum test it was found that the slip resistance of all smooth floor coverings decreased over time and after 2 years none were in the low risk slip category. On the other hand the EN13845 floor covering maintained it’s slip resistance value and continues to be classified as low slip risk.

This test illustrates again that ex factory pendulum slip test results can not be used to specify safety floor coverings.



## Are floor coverings CE marked for slip safe to use?

- Tribometer test (EN 13893) used for CE marking is a dry test only and does not define slip performance in wet conditions.
- There is also no substantive test data available to confirm this test method is suitable for in-situ testing of contaminated products
- Under development as a wet test in harmonised slip standard CEN/TS 16165
- Test is widely used in Germany , however, there is limited data available on application of this test to floor coverings in the UK



**POLYFLOR**  
COVERING THE WORLD

A tribometer test known as the GMG test is used to measure dry slip as part of CE marking floors to EN14041 standard. Floors that meet the required threshold are classified as DS within the CE mark. It is sometimes misunderstood that the DS classification means that the floor covering is slip resistant, however, it should be made clear that this classification applies to dry slip only and has no relevance to wet slip.

A modified version of this test is under development for application to wet slip as part of the CEN/TS16165 standard. This test is quite new and the current position of UK manufacturers is that there is as yet insufficient experience or test data available to be able to recommend this as an alternative test to the pendulum.

In conclusion floor coverings CE marked for slip can only be considered safe for use in dry areas, for wet areas where slip risks are higher floor coverings which meet the requirements of EN13845 are recommended.

## Are safety floors difficult to clean?

- New safety floors much easier to clean (PUR coatings)
- Clean floor is a safe floor
- Appropriate maintenance regime must be in place
- Impact of poor maintenance
- No polish





There is a common misconception that due to their increased roughness safety floors are more difficult to clean.

However, most safety floors are treated with PUR coatings in the same way as other smooth floor coverings. Although cleaning regimes for standard smooth resilient and safety floor coverings differ they can be easily kept clean if a maintenance regime according to manufacturers recommendations is applied.

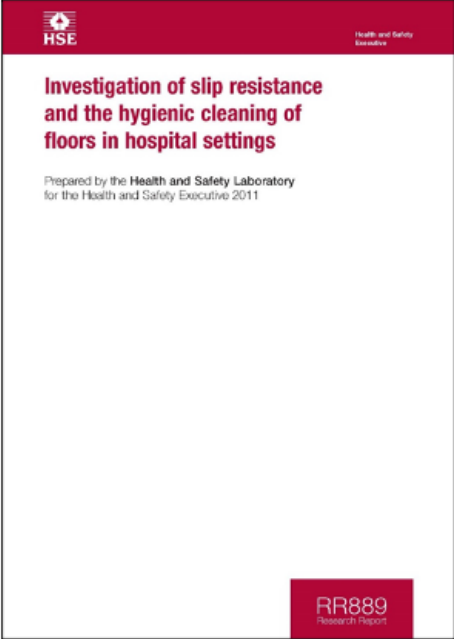
It should also be noted that if safety floorings are not cleaned and maintained correctly build up of dirt and cleaning chemicals can adversely affect slip resistance. The application of post treatment finishes and polishes can also be detrimental to slip and if this is required manufacturers should be consulted for advice.

The many millions of square meters of safety floorings that are installed every year in the UK are testament to the fact that there are no significant maintenance issues as long as manufacturers guidelines are followed.

## Are safety floors unhygienic?

### HSE Report

- Compared flooring in live hospital environments with respect to slip resistance & hygienic cleaning of floors
- Ability to clean typical hospital floors to hygienic standard using typical cleaning regimes NOT influenced by slip resistance of flooring
- Safety floors cleaned as effectively as smooth flooring and bacteria levels not dependent on product type
- Level of contamination after cleaning was variable & not dependent on type of flooring used – down to cleaning technique & tools used



<http://www.hse.gov.uk/research/rrhtm/rr889.htm>

**POLYFLOR**  
COVERING THE WORLD


In conjunction with incorrect perceptions of maintenance there is often a view expressed that safety floors can be unhygienic as a result of higher levels of dirt build up in comparison with smooth floor coverings.

An independent study to look into this issue was commissioned by HSL which concluded that the main issue of hygiene of floor coverings was associated with the effectiveness of the cleaning regime rather than the type of floor covering.

It can be concluded that there are no issues with regard to the hygiene performance of safety floor coverings as long as manufacturers recommendations for cleaning and maintenance are followed.

## Types of Safety Flooring

- Traditional
- Decorative
- Easy to maintain
- Extra heavy duty
- Extra rough surface for high viscosity contaminants
- Embossed for barefoot/continually wet areas
- Foam backed layer for dual acoustic & safety performance
- Traditional performance layer construction with carrier
- Clear wear layer construction with aggregates throughout and printed layer underneath



**POLYFLOR™**  
COVERING THE WORLD

Traditionally safety floors are regarded as unattractive functional products , however , there have been several new developments over the past years and now safety floors are manufactured with printed and decorative layers where the hard particles are disguised within the decoration, as a result of this safety floors are now available in attractive designs equally attractive as those of standard decorative and printed ‘smooth’ products.

There are also many specialist safety floors available tailored to meet the requirements of specific end use requirements such as greasy kitchens and barefoot shower areas.

## Future of Safety Floors

- Increasing use
- Improved appearance of safety products
  - Design for dementia
  - Easier to maintain



Despite the large number of improvements and enhancements in EN13845 safety floorings in recent years, new innovations and developments continue to be produced. Examples are improved appearance, enhanced cleaning and also floor coverings specifically designed to meet the needs of dementia patients.

## Check list for specification of safety floors

- Sustainable slip resistance is guaranteed for life lifetime of the product by the manufacturer
- Must meet EN 13845 & 50,000 cycles abrasion test (Particles through performance layer for long term performance)
- Should meet 36+ on the HSE recommended Pendulum in wet conditions – low slip potential
- Should not be specified with ex factory test methods such as the ramp which can not be measured 'in-situ'.

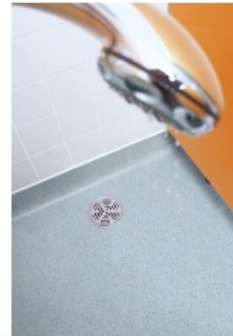


If you are intending to specify a safety floor covering for a heavy use commercial area , it is essential that you consider the following points;

1. The safety flooring should not be specified on ex factory test results – look for a manufacturer who will guarantee sustainable slip resistance for the lifetime of the product.
2. The safety flooring should be compliant with EN 14845 standard , meeting abrasion test requirements of <10% particle loss after 50,000 cycles – look for a manufacturer who can provide independent testing evidence of compliance with this requirement.
3. To ensure a low slip risk hazard the floor covering should be guaranteed as 36+ for the lifetime of the product – look for a manufacturer who will give a lifetime guarantee on pendulum slip rather than just an ex factory result.
4. Remember that ex factory test methods such as the ramp test can not be assessed in use and are therefore not suitable tests for guaranteeing sustainable slip resistance – Avoid manufacturers who only specify slip based on the ramp test.

**DON'T SLIP UP !**  
Make sure that slip resistance is **assured** for the **guaranteed** life of the product

**Acknowledgements:**  
Co-workers at Polyflor / James Halstead  
Colleagues in UKSRG/UKRFA



**POLYFLOR**  
COVERING THE WORLD

Follow the recommendations in this presentation and you will not 'SLIP UP' when specifying safety floorings.