

Topshield 2.0;
Protection against soils

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CHAPTER 1 INTRODUCTION

Forbo Flooring BV has developed a durable protective top layer for their Marmoleum floorings: Topshield. According to Forbo Flooring BV, Topshield provides a highly protective shield against soiling. In this independent research the protection against some specific soils is assessed and compared to other floor systems.

For this purpose eight floors were selected by Forbo Flooring BV (table 1.1). On each floor, the effects of four soils on each floor will be determined (table 1.2). These soils are all relevant and common in institutional environments.

Table 1.1 Floorings

Code	Brand and type
A	Topshield
B	Topshield 2
C	Linoleum 1
D	Linoleum 2
E	Heterogeneous vinyl 1
F	Heterogeneous vinyl 2
G	Homogeneous vinyl 1
H	Rubber 1

Table 1.2 Soils

Soil	Brand and batchcode
Acetone	VWR 20165.298
Betadine (100mg/ml povidonjood)	Meda 111540 12/2013
Ink	Parker Quink black 57ml
Hand disinfection lotion	Sterillium BODE 311993 01.2015

CHAPTER 2 RESEARCH METHOD

In this research the protection of the floors against several specific soils will be determined. Each soil is applied on the floor and left there for some time. Then the floor is cleaned. Before and afterwards the gloss condition of the floor surface is measured and possible effects are assessed.

The test is performed in duplicate.

Before soiling

All floors are pre-conditioned, i.e. cleaned with a normal household cleaner and left to dry at room temperature.

The gloss of the area that will be soiled (i.e. the measurement spot) is measured with a Minolta gloss meter (Multi Gloss 268) at an angle of 60°. According to the specification of the gloss meter, the size of the measurement spot at this angle is 9 x 15 mm and the range is from 0,0 ~ 180 GU (Gloss Units).

Soiling

0,5 ml of the soil is applied on the measurement spot. After two hours the floor is rinsed with tap water.

Cleaning

The floor is cleaned with a cleaning robot ("Hubert"; Indramat system BTV04 200). This robot can clean surfaces under reproducible test conditions such as: the cleaning pressure, cleaning speed, the length of the sweep, the direction of the sweep and the sweep frequency.

In this test the following settings are used:

Pressure: 1000 g
Speed: 400 mm/sec (i.e. normal cleaning)
Length: 200 mm
Direction: vertical
Frequency: 20 sweeps

Cleaning until the stain is removed is not possible in this test; some effects are irreversible.

Therefore the cleaning is stopped after a fixed number of sweeps for all soils.

For the cleaning a damp sponge cloth without additional detergent is used. After cleaning, the floor is dried with a tissue.

Evaluation

The cleaning result is visually assessed on a 3-point scale by one researcher:

1. No visible effects: the floor shows no corrosion, damaging or discoloration.
2. A slightly visible effect: some corrosion, damaging or discoloration is visible.
3. A clearly visible effect: corrosion, damaging or discoloration is evident.

In addition, the gloss of the measurement spot is measured again and the difference of the gloss before and after soiling is calculated as follows:

$$\Delta \text{ gloss GU} = \text{GU before} - \text{GU after}$$

A difference of about 5 GU on a matte surface would be visible for the human eye and could therefore be perceived as significantly different (www.gloss-meters.com).

CHAPTER 3 RESULTS

In each paragraph the results of the different soils are reported. The separate gloss measurements are shown in appendix A.

3.1 ACETONE

After two hours all the acetone was evaporated. The rinsing and cleaning with the cleaning robot did not have an extra effect on the remaining stain.

The visual assessment showed that acetone had a damaging effect on some floors (table 3.1). This is supported by the average gloss measurements (table 3.2).

Table 3.1 Visual assessment: acetone

Floor	run 1	run 2	Average
Topshield	3	3	3
Topshield 2	1	1	1
Linoleum 1	3	3	3
Linoleum 2	1	1	1
Heterogeneous vinyl 1	1	1	1
Heterogeneous vinyl 2	2	2	2
Homogeneous vinyl 1	1	1	1
Rubber 1	1	1	1

Table 3.2 Gloss differences (in GU): acetone

Floor	run 1 Δ gloss	run 2 Δ gloss	Average Δ gloss
Topshield	9,3	16,8	13,0
Topshield 2	-0,3	3,3	1,5
Linoleum 1	19,3	16,8	18,0
Linoleum 2	-2,3	-1,8	-2,0
Heterogeneous vinyl 1	-4,8	-3,8	-4,3
Heterogeneous vinyl 2	18,3	4,3	11,3
Homogeneous vinyl 1	3,3	11,0	7,1
Rubber 1	-0,3	-5,8	-3,0

3.2 BETADINE

After rinsing with tap water the edges of the stains were more or less visible on all floors except on the Rubber 1 floor. During the first five sweeps with the cleaning robot, these edges disappeared and the colour of the remaining stain faded. The visual assessment showed that betadine has a discolouring effect on most floors (table 3.3). The gloss of the floors is not influenced by the betadine. No differences were found in the average gloss measurements (table 3.4).

Table 3.3 Visual assessment: betadine

Floor	run 1	run 2	Average
Topshield	2	2	2
Topshield 2	1	1	1
Linoleum 1	3	3	3
Linoleum 2	3	3	3
Heterogeneous vinyl 1	2	2	2
Heterogeneous vinyl 2	1	1	1
Homogeneous vinyl 1	1	1	1
Rubber 1	3	3	3

Table 3.4 Gloss differences (in GU): betadine

Floor	run 1 Δ gloss	run 2 Δ gloss	Average Δ gloss
Topshield	1,8	0,8	1,3
Topshield 2	1,0	3,5	2,3
Linoleum 1	-0,5	2,0	0,8
Linoleum 2	-5,3	-2,3	-3,8
Heterogeneous vinyl 1	-0,5	0,5	0,0
Heterogeneous vinyl 2	-0,3	-2,0	-1,1
Homogeneous vinyl 1	-1,8	-2,8	-2,3
Rubber 1	1,8	1,5	1,6



In time the colour of the betadine fades but it is still visible in time. The left side of this picture shows a stain after 1 hour and at the right sight after 1 day after applying.

3.3 INK

The ink doesn't spread on all floors. On Topshield 2, Homogeneous vinyl 1 and Heterogeneous vinyl 1 and 2 it remains more or less a drop.

After two hours the ink is easily removed with the tap water. The cleaning robot had a little fading effect on some of the remaining stains.

The visual assessments showed that ink has a discolouring effect on some floors (table 3.5). On the gloss measurements (table 3.6) only on Linoleum 2 a difference is found although the standard deviation is rather large.

Table 3.5 Visual assessment: ink

Floor	run 1	run 2	Average
Topshield	3	2	2,5
Topshield 2	1	1	1
Linoleum 1	1	1	1
Linoleum 2	3	3	3
Heterogeneous vinyl 1	1	1	1
Heterogeneous vinyl 2	1	1	1
Homogeneous vinyl 1	1	1	1
Rubber 1	3	3	3

Table 3.6 Gloss differences (in GU): ink

Floor	run 1 Δ gloss	run 2 Δ gloss	Average Δ gloss
Topshield	0,0	1,8	0,9
Topshield 2	0,5	2,5	1,5
Linoleum 1	0,5	0,8	0,6
Linoleum 2	-12,8	-4,5	-8,6
Heterogeneous vinyl 1	0,0	-0,5	-0,3
Heterogeneous vinyl 2	-0,3	1,3	0,5
Homogeneous vinyl 1	-1,5	-0,5	-1,0
Rubber 1	-2,0	-1,0	-1,5

3.4 HAND DESINFECTANT LOTION

After two hours the size of the stains was different:

- Linoleum 1 and 2 and Rubber 1 had a small stain and were still wet
- Topshield 2 and Heterogeneous vinyl 2 had a normal size stain and were almost dry
- Topshield, Heterogeneous vinyl 1 and Homogeneous vinyl 1 had a large stain and were dry.

The rinsing and cleaning with the cleaning robot faded the remaining stain.

The visual assessment showed that hand disinfection lotion had a corroding effect on some floors (table 3.7). This is also confirmed by the higher Δ gloss for the Linoleum 1 floor. The gloss of the Topshield floor isn't influenced by de hand disinfection lotion (table 3.8).

Table 3.7 Visual assessment: hand disinfection lotion

Floor	run 1	run 2	Average
Topshield	2	2	2
Topshield 2	1	1	1
Linoleum 1	2	2	2
Linoleum 2	1	1	1
Heterogeneous vinyl 1	1	1	1
Heterogeneous vinyl 2	1	1	1
Homogeneous vinyl 1	1	1	1
Rubber 1	1	1	1

Table 3.8 Gloss differences (in GU): hand disinfection lotion

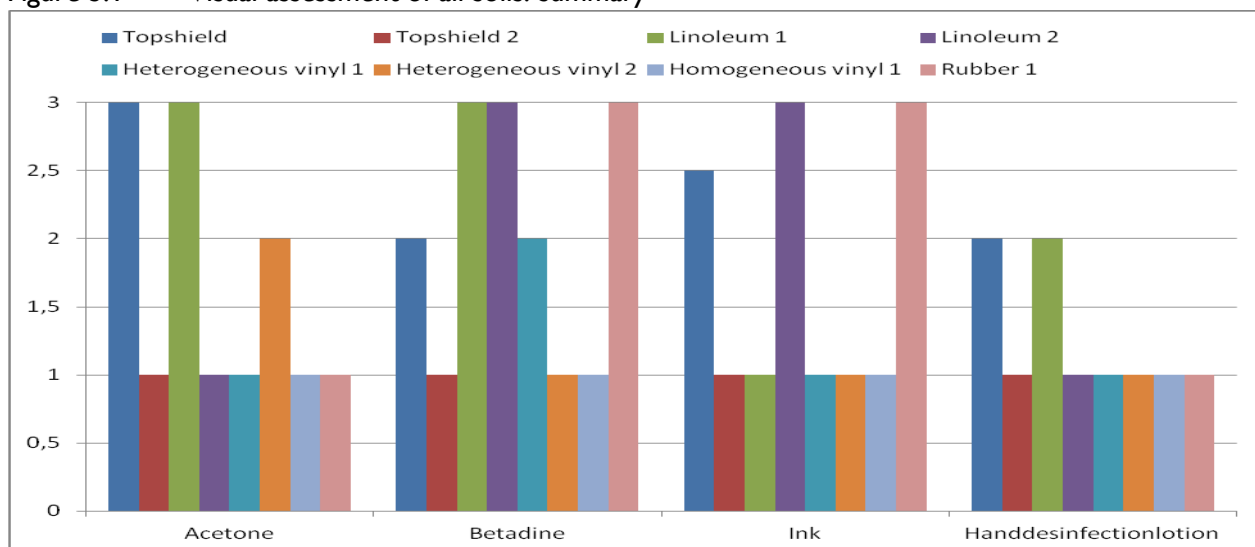
Floor	run 1 Δ gloss	run 2 Δ gloss	Average Δ gloss
Topshield	3,0	4,3	3,6
Topshield 2	4,3	-0,3	2,0
Linoleum 1	10,3	8,0	9,1
Linoleum 2	3,0	-2,0	0,5
Heterogeneous vinyl 1	-1,0	-1,5	-1,3
Heterogeneous vinyl 2	-2,5	-0,3	-1,4
Homogeneous vinyl 1	-3,3	-3,0	-3,1
Rubber 1	1,3	0,0	0,6

3.5 CONCLUSION

The floors react differently on the different soils. Acetone and hand disinfection lotion have a damaging effect on some floors. In general, the floor seemed to be corroded. Betadine and ink changed the colour of some floors.

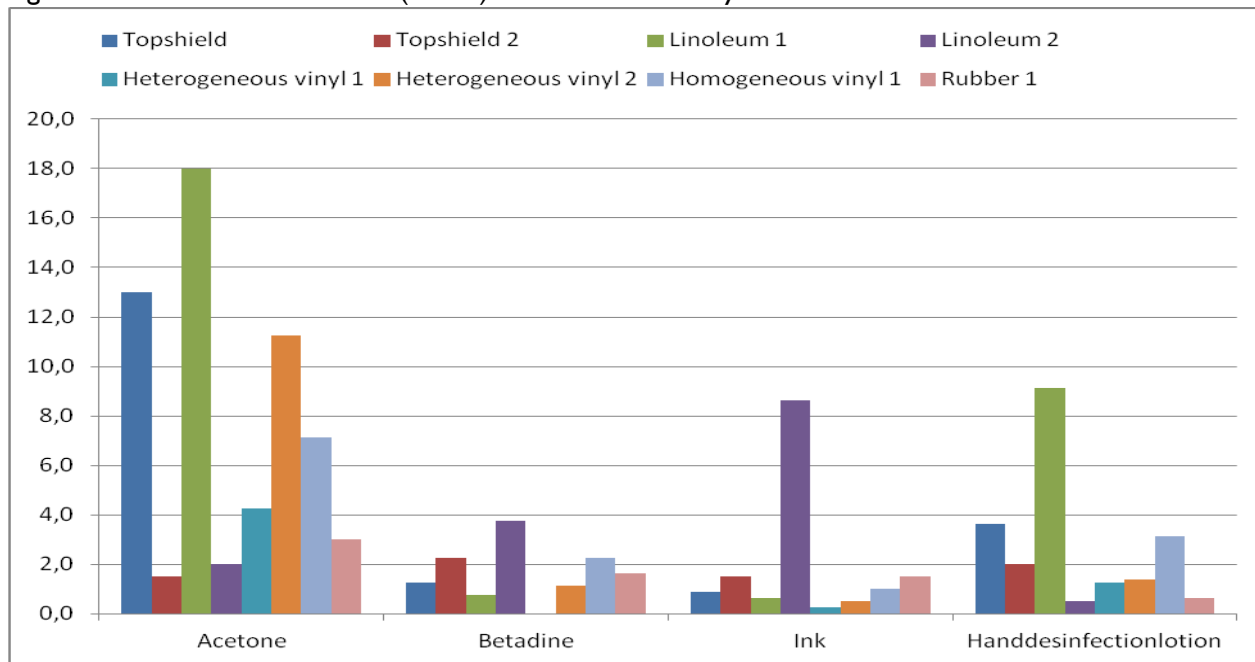
From figure 3.1 it becomes clear that only on Topshield 2 and Homogeneous vinyl I no visible effects have been found. On acetone, as well as on betadine, ink and hand disinfection lotion, no corrosion, damaging or discoloration were visible.

Figure 3.1 Visual assessment of all soils: summary



The absence or presence of visual effects is not always confirmed by the gloss differences. A discoloring effect doesn't need to influence the gloss of the surface. The average gloss differences are summarized in figure 3.2. For the readability the positive value of negative differences is shown. In this research a difference of about 5 GU is considered relevant. In some cases the standard deviation between the average gloss measurements of run 1 and run 2 were rather high. Additional runs should be done to verify the results.

Figure 3.2 Gloss differences (in GU) of all soils: summary



On Topshield 2, Heterogeneous vinyl I and on Rubber I no relevant differences were found for all soils. The gloss isn't influenced by the soils on these floors.

In this research Topshield 2 did not show any visible effects of the acetone, betadine, ink and hand desinfection lotion. Also the gloss of Topshield 2 isn't influenced by the soils. Topshield 2 has therefore the best protection against these soils.

APPENDIX A

Gloss measurements (in GU)

Floor	Run 1		Run 2	
	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
Acetone				
Topshield	38,8	29,5	38,8	22,0
Topshield 2	58,0	58,3	60,8	57,5
Linoleum 1	66,3	47,0	64,3	47,5
Linoleum 2	95,8	98,0	85,8	87,5
Heterogeneous vinyl 1	42,0	46,8	42,0	45,8
Heterogeneous vinyl 2	83,8	65,5	81,8	77,5
Homogeneous vinyl 1	73,5	70,3	76,3	65,3
Rubber 1	64,3	64,5	66,8	72,5
Betadine				
Topshield	37,0	35,3	36,8	36,0
Topshield 2	61,5	60,5	63,8	60,3
Linoleum 1	63,8	64,3	64,8	62,8
Linoleum 2	79,5	84,8	84,3	86,5
Heterogeneous vinyl 1	40,0	40,5	41,0	40,5
Heterogeneous vinyl 2	82,0	82,3	85,3	87,3
Homogeneous vinyl 1	76,8	78,5	71,3	74,0
Rubber 1	68,3	66,5	67,0	65,5
Ink				
Topshield	37,5	37,5	40,0	38,3
Topshield 2	56,8	56,3	55,8	53,3
Linoleum 1	72,0	71,5	61,0	60,3
Linoleum 2	94,8	107,5	95,5	100,0
Heterogeneous vinyl 1	42,0	42,0	42,0	42,5
Heterogeneous vinyl 2	81,5	81,8	84,0	82,8
Homogeneous vinyl 1	73,8	75,3	74,5	75,0
Rubber 1	63,5	65,5	65,0	66,0
Hand disinfection lotion				
Topshield	36,8	33,8	35,5	31,3
Topshield 2	62,5	58,3	63,3	63,5
Linoleum 1	65,8	55,5	54,0	46,0
Linoleum 2	79,8	76,8	84,0	86,0
Heterogeneous vinyl 1	38,5	39,5	41,0	42,5
Heterogeneous vinyl 2	87,3	89,8	82,8	83,0
Homogeneous vinyl 1	73,5	76,8	78,3	81,3
Rubber 1	66,5	65,3	66,5	66,5