UV Exposure Testing vs Other Market Competitors

Objective

Evaluate the UV resistance of the **PRECIDIUM™ Rail Floor System** side by side with other standard products from the rail flooring industry.

Sample Preparation

PRECIDIUM™ Rail Floor

- Free films of the base membrane was sprayed on puckboard using a Graco EXP2 proportioner and Fusion gun with an AR4242 mix module.
- **PRECIDIUM™ Rail Floor** samples were given a colored basecoat
- Color accents were applied
- A topcoat with NS-100 was applied for appearance and traction

Samples were prepared in all of the standard color schemes, which are summarized in the table below:

PRECIDIUM™ Rail Floor	Sandstone 1	Sandstone	Mirage Tan	Desert Beige
	Adobe 1	Adobe	Red Earth	Dijon
	Garnet 1	Garnet Red	Black	Garnet Gold
	Granite 1	Granite Grey	Black	Cream
	Slate 1	Slate Grey	Black	Falcon Grey
	Safety Yellow	Safety Yellow	N/A	N/A

Competitor Flooring

- Samples from several companies were obtained for testing, which are summarized below

Product	Type of Material
TransitFlor® LGF Vero	Rubber
TransitFlor® LGF Torma	Rubber
TransitFlor® LGF Vega	Rubber
TransitFlor® PGF Granite-Flor 452	Rubber
TransitFlor® PGF Primary Line 621	Rubber
TransitFlor® PGF Primary Line 625	Rubber
Gerfloor® NT	Vinyl
Altro Transflor Chroma™	Vinyl
Baultar	Quartz Aggregate

An approximately 3”x11” rectangle of each of the samples was cut and labeled for exposure in the QUV accelerated weathering cabinet.

Test Procedure

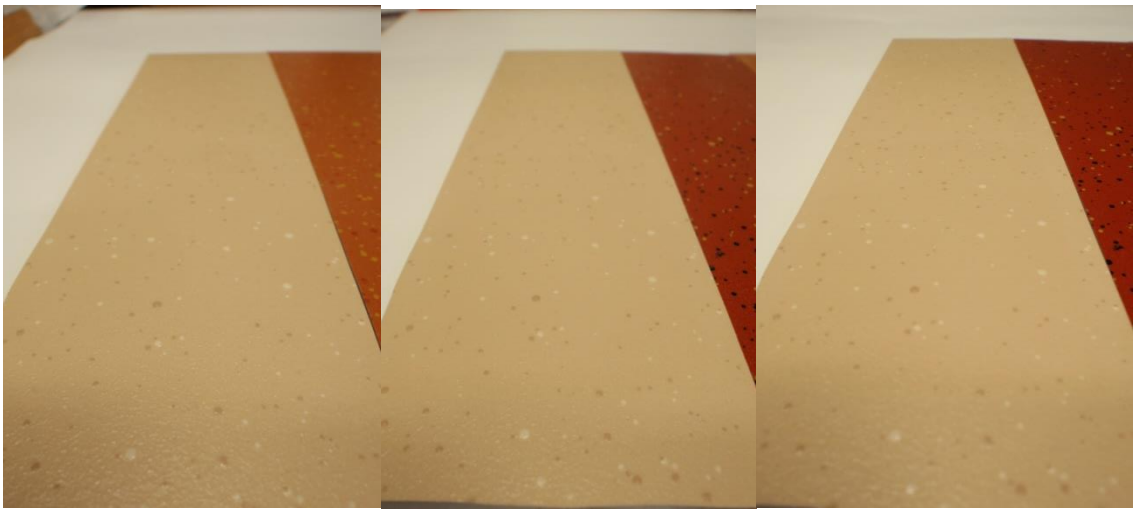
The accelerated aging study was performed in accordance with **ASTM G154.** Samples were placed in QUV sample holders and secured with a back plate and locking clips. The sample holders have two 2 ½" x 4 ¾" windows, which allow for a clear boundary between exposed and unexposed sections when examining the samples.

The panels were then exposed to UV light for a period of 1000 hours using a Q-U-V Accelerated Weathering Tester equipped with UVB-313 lamps. Panel temperature during the test was 50°C. Panels were removed for visual inspection and pictures at 24, 48 and 100 hours, and at every 100 hour interval thereafter. After every inspection the panels were placed back into the QUV in a randomized pattern.

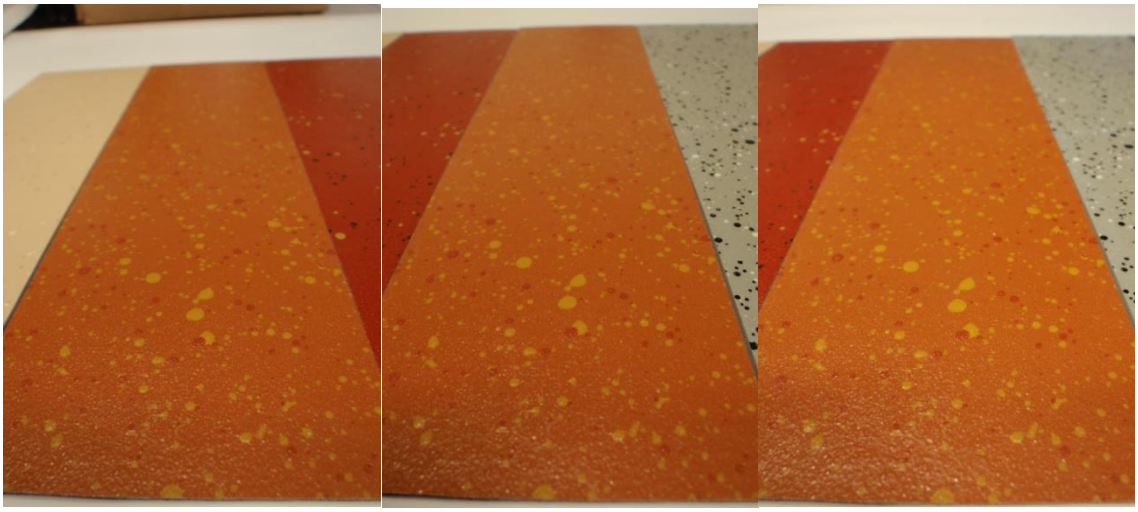
To assess the color fastness of the samples at the end of the 1000 hours the Gloss was checked as per **ASTM D523** and the change in color was checked as per **ASTM D308.** A 20, 60, and 85 degree gloss was recorded using an MG268-FE Tri-Gloss Meter. Color coordinates were measured using a Konica Minolta CM-600D Spectrophotometer.

Results

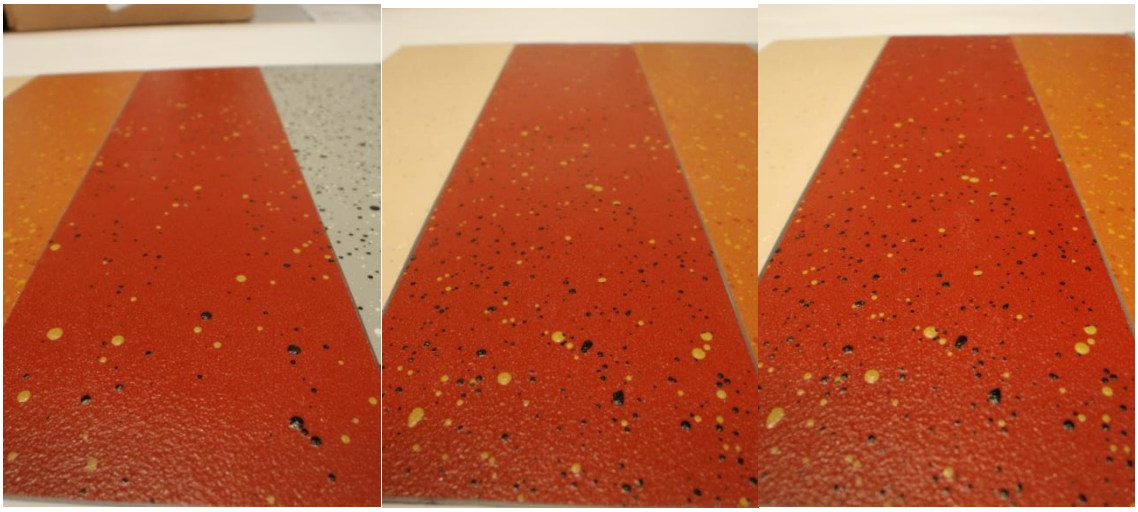
The following pages depict the samples at 24, 500 and 1000 hours of exposure to show the visual changes observed over the course of the testing.



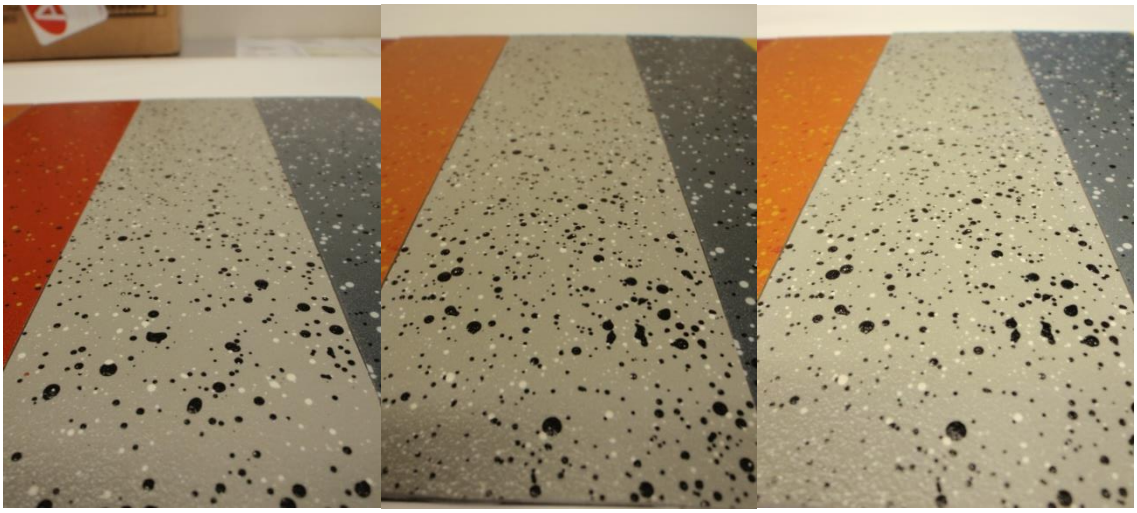
Above: **PRECIDIUM™ Rail Floor** – Sandstone 1



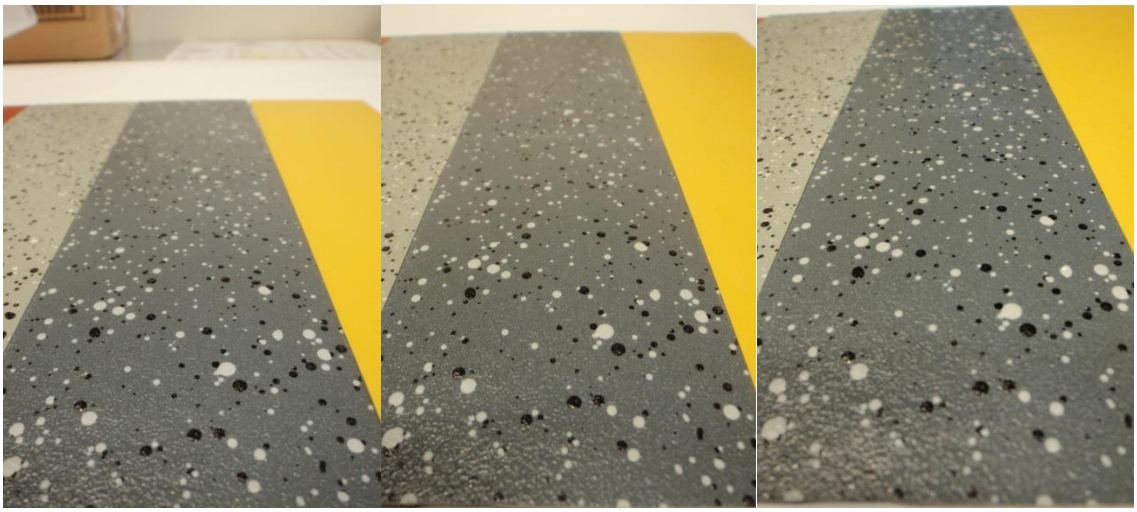
Above: **PRECIDIUM™ Rail Floor** – Adobe 1



Above: **PRECIDIUM™ Rail Floor** – Garnet 1



Above: **PRECIDIUM™ Rail Floor** – Granite 1



Above: **PRECIDIUM™ Rail Floor** – Slate 1

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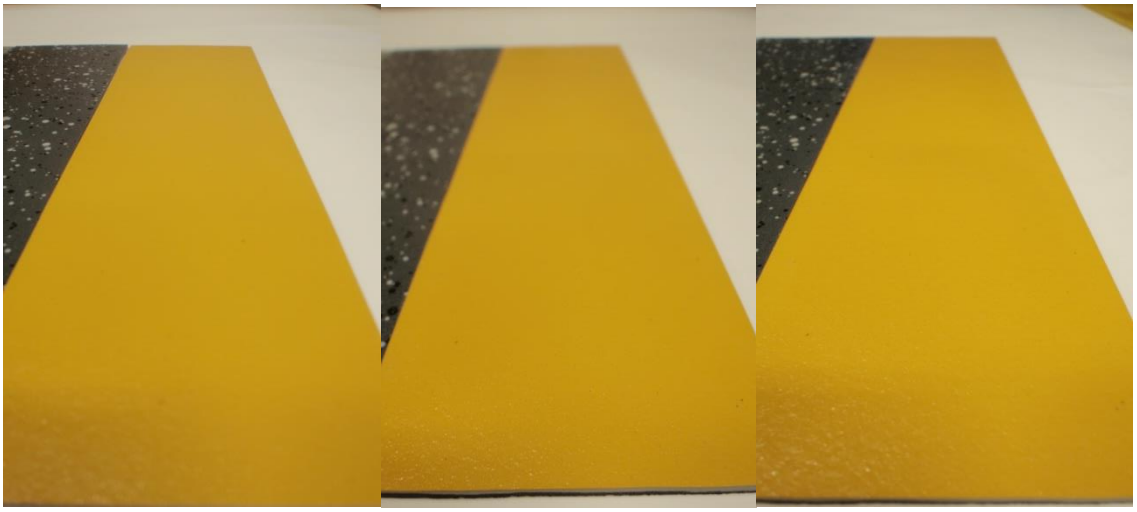
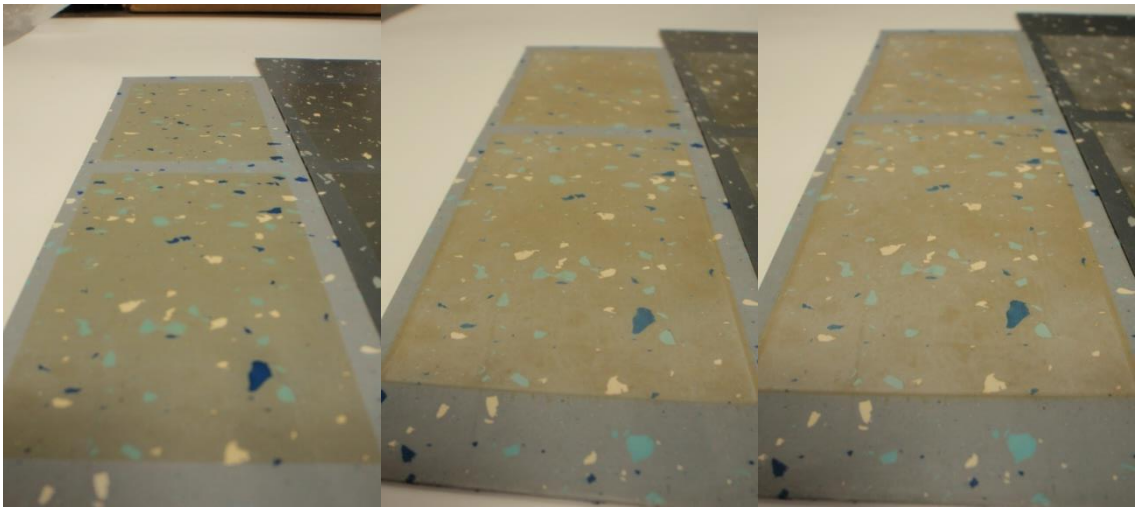
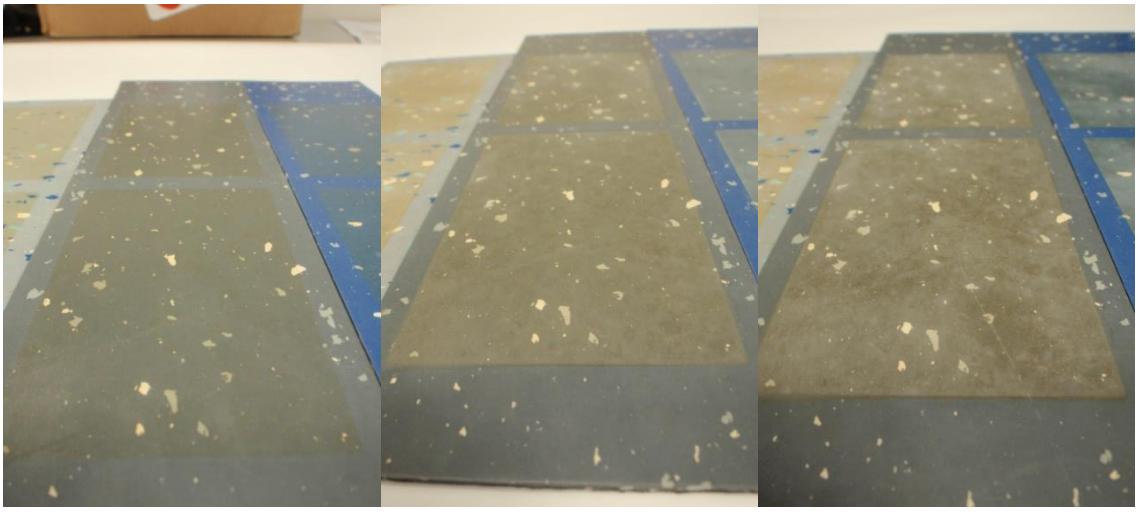


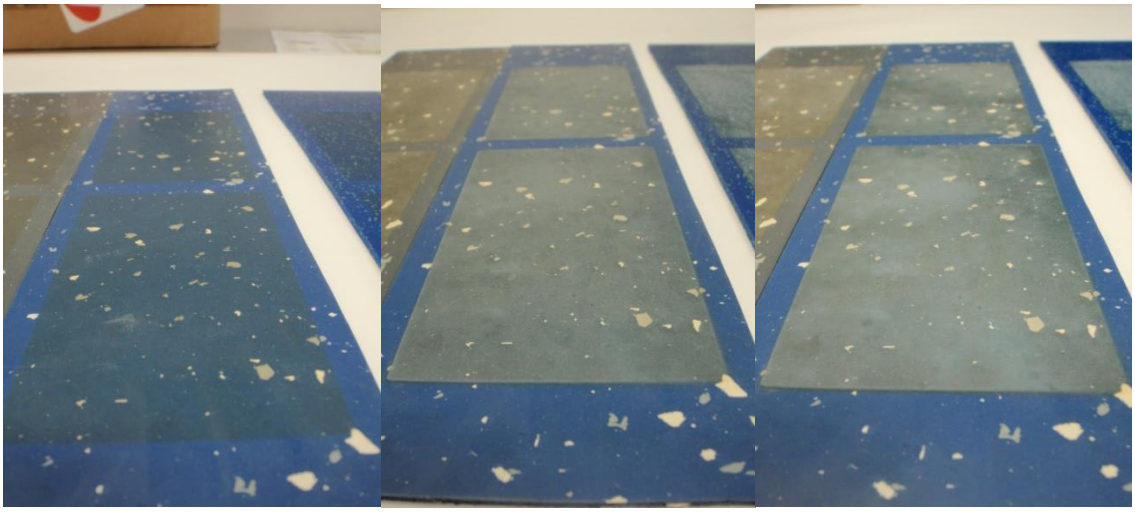
Above: **PRECIDIUM™ Rail Floor** – Safety Yellow



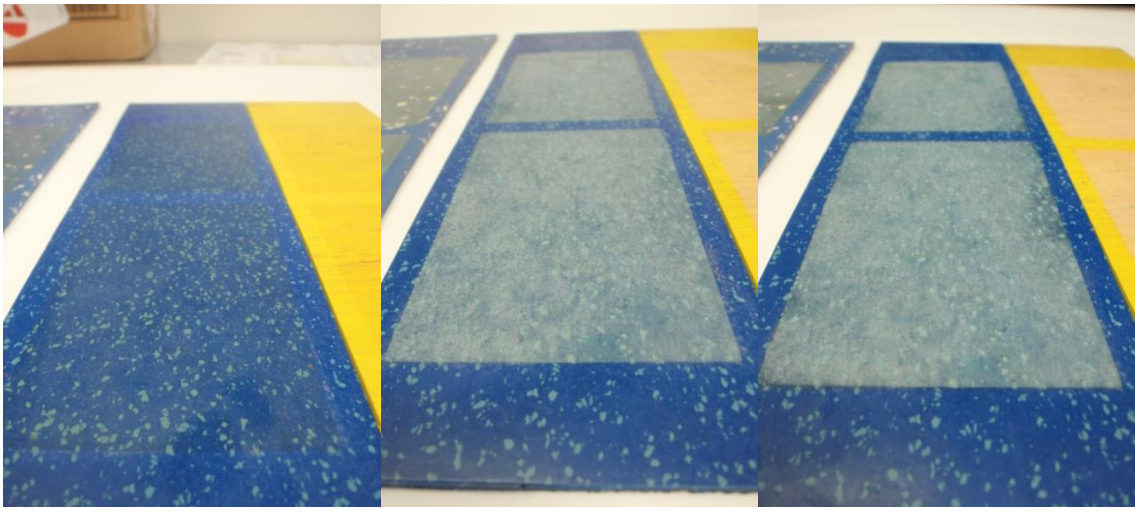
Above: TransitFlor® LGF Vero



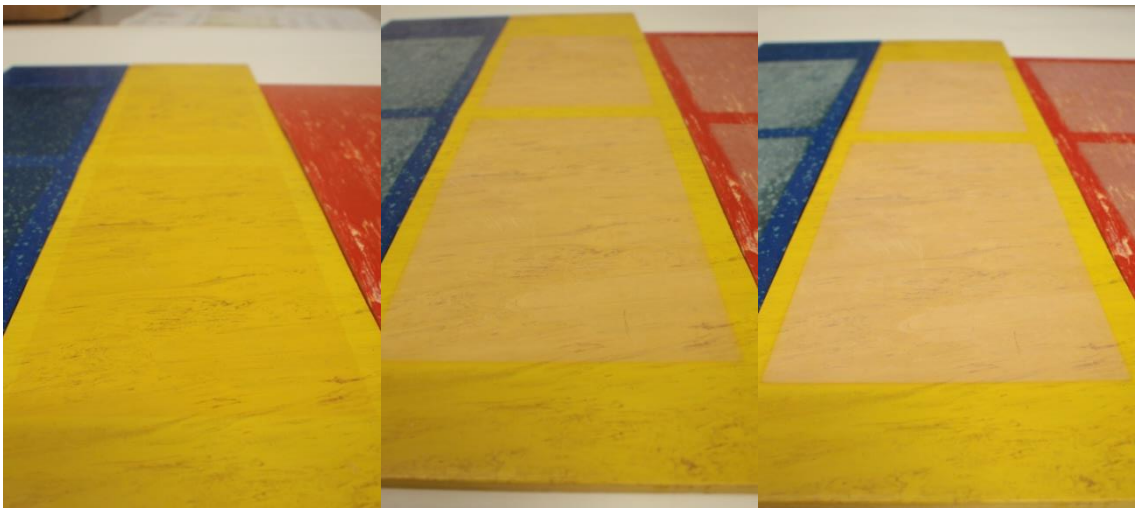
Above: TransitFlor® LGF Torma



Above: TransitFlor® LGF Vega



Above: TransitFlor® PGF Granite-Flor 452



Above: TransitFlor® PGF Primary Line 621

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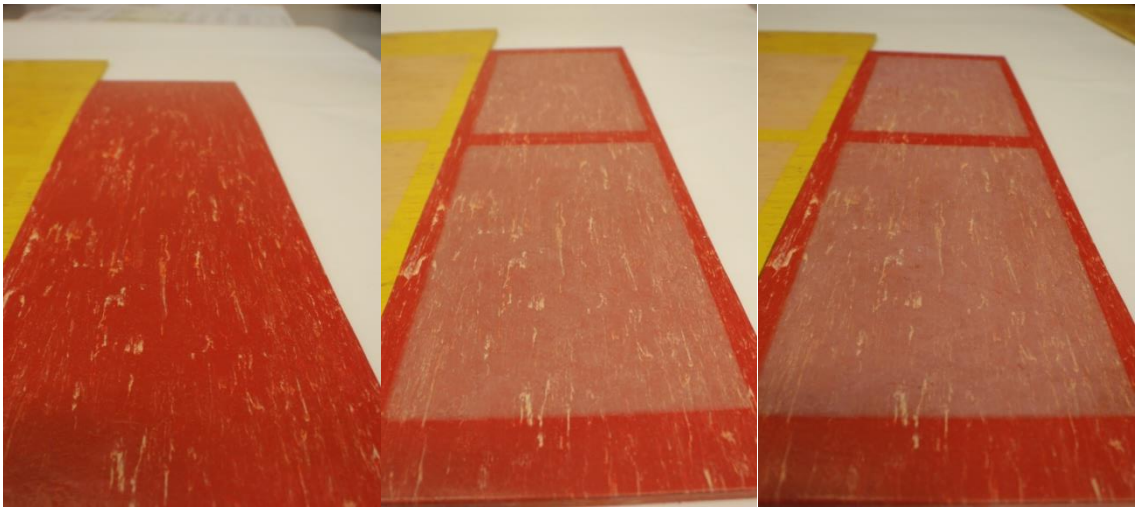
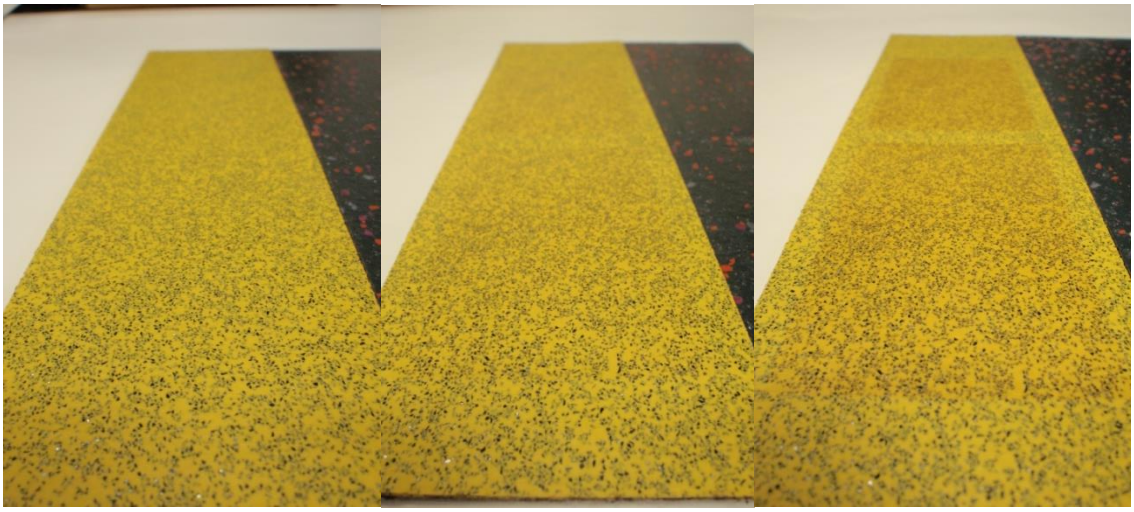


Above: TransitFlor® PGF Primary Line 625



Above: Gerfloor® NT

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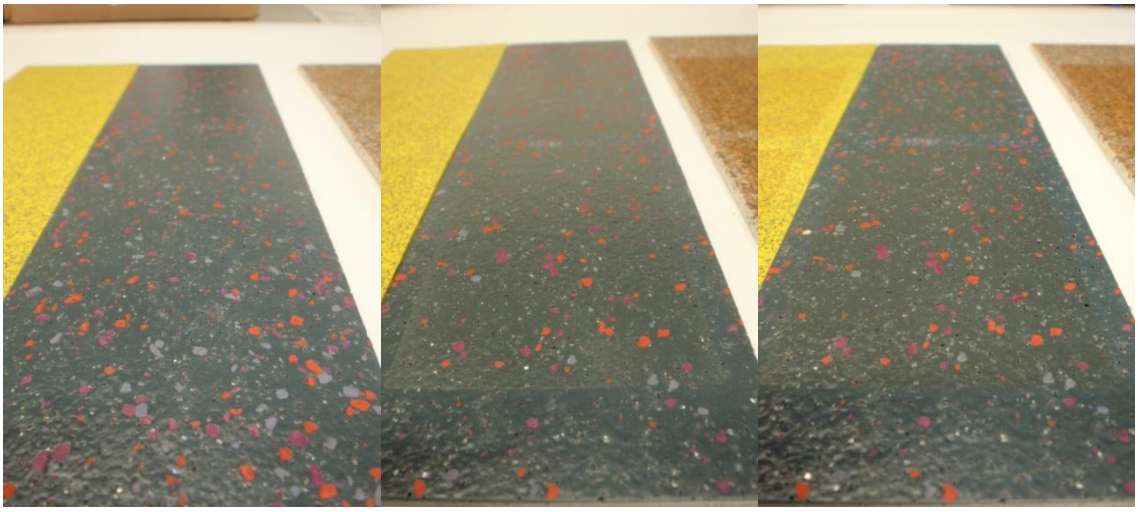
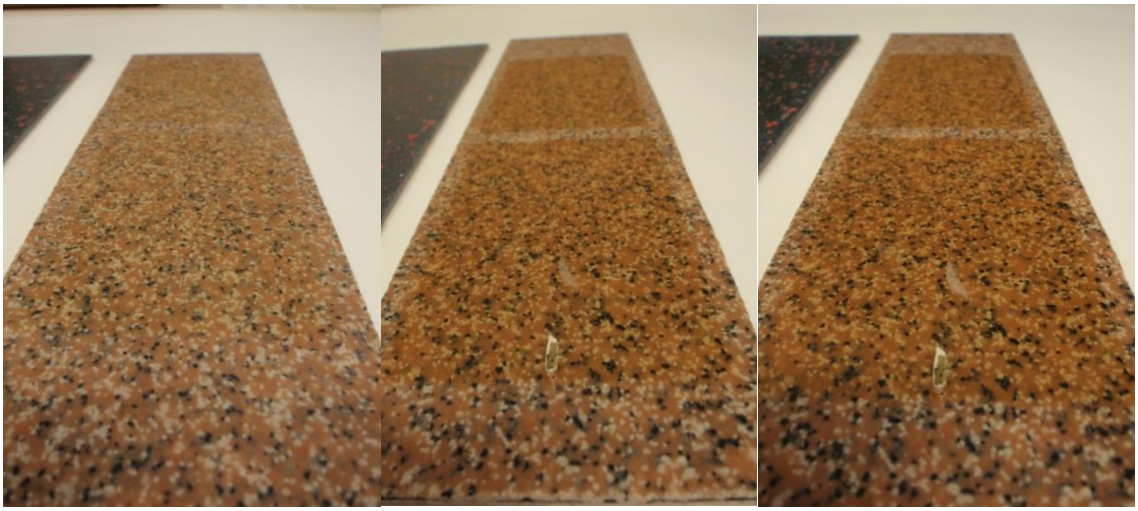


Above: Altro Transflor Chroma™



Above: Baultar

As shown in the pictures on the previous pages, the visual changes observed in the different samples can be striking, but in an effort to make quantitative results, gloss and color change were tested.

Gloss Change

Each sample was tested for 20°, 60° and 85° gloss on both the exposed and unexposed areas. An average of four readings is displayed in the chart below.

Floor Sample	Gloss								
	Unexposed			1000 Hours QUV			Change in Gloss		
	20°	60°	85°	20°	60°	85°	20°	60°	85°
PRECIDIUM™ Floor Sandstone 1	2.0	12.4	6.8	1.9	11.9	7.6	-0.1	-0.5	0.8
PRECIDIUM™ Floor Adobe 1	1.4	11.6	8.6	2.3	13.4	11.1	0.9	1.8	2.5
PRECIDIUM™ Floor Garnet 1	1.1	9.4	5.3	1.6	12.3	8.0	0.5	2.9	2.7
PRECIDIUM™ Floor Granite 1	1.2	9.7	6.4	1.5	11.7	8.3	0.3	2.0	1.9
PRECIDIUM™ Floor Slate 1	1.5	12.0	8.9	1.6	12.2	9.4	0.1	0.2	0.5
PRECIDIUM™ Floor Safety Yellow	3.6	18.1	13.5	2.7	16.6	13.1	-0.9	-1.5	-0.4
TransitFlor® LGF Vero	1.6	16.2	58.1	0.4	3.3	5.0	-1.2	-12.9	-53.1
TransitFlor® LGF Torma	4.9	28.7	62.6	0.7	7.0	6.3	-4.2	-21.7	-56.3
TransitFlor® LGF Vega	3.3	24.8	63.7	0.8	8.5	11.2	-2.5	-16.3	-52.5
Granite-Flor PGF 452	0.8	10.6	32.0	0.5	5.9	11.5	-0.3	-4.7	-20.5
TransitFlor® PGF 621	7.4	34.9	66.2	1.7	15.0	20.4	-5.7	-19.9	-45.8
TransitFlor® PGF 625	1.8	17.5	40.9	2.1	18.2	30.6	0.3	0.7	-10.3
Gerfloor® NT	0.8	5.5	5.2	1.6	9.3	7.0	0.8	3.8	1.8
Altro Transflor Chroma™	0.9	9.0	12.2	1.0	10.4	12.0	0.1	1.4	-0.2
Baultar	0.3	1.7	1.7	0.3	2.1	1.8	0.0	0.4	0.1

NOTE: While the readings for the **PRECIDIUM™ Floor** samples are not very high, it is important to note that the samples were not low gloss. On the contrary, the samples are quite high gloss, but the non-skid surface is very textured, which correlates to a lower number when taking a reading. The change in gloss is still a valid number as the samples were averaged and taken with the same procedure.

Color Change

This aspect was difficult to measure as all of the samples except for the **PRECIDIUM™ Rail Floor** Safety Yellow were not solid colors. That being said, many samples obviously exhibited a color change, so three ΔE readings were taken with every effort to check representable spots. These readings, along with the average, is displayed in the chart below.

Floor Sample	Color			
	ΔE			
	1	2	3	Average
PRECIDIUM™ Sandstone 1	1.92	1.96	2.02	1.97
PRECIDIUM™ Adobe 1	3.08	0.76	1.29	1.71
PRECIDIUM™ Garnet 1	0.50	0.75	0.96	0.74
PRECIDIUM™ Granite 1	5.44	3.41	7.90	5.58
PRECIDIUM™ Slate 1	0.91	1.04	0.84	0.93
PRECIDIUM™ Safety Yellow	0.51	0.47	0.66	0.55
TransitFlor® LGF Vero	14.38	11.15	13.49	13.01
TransitFlor® LGF Torma	9.39	8.50	9.25	9.05
TransitFlor® LGF Vega	21.90	21.83	22.53	22.09
Granite-Flor PGF 452	25.79	24.92	23.64	24.78
TransitFlor® PGF 621	47.09	47.12	45.07	46.43
TransitFlor® PGF 625	11.43	14.55	11.21	12.40
Gerfloor® NT	4.74	12.34	3.85	6.98
Altro Transflor Chroma™	3.46	2.92	3.36	3.25
Baultar	12.04	13.64	11.91	12.53

Conclusions

The following table is a summary of the results based on the type of sample:

	Change in Gloss			Color Change
	20°	60°	85°	ΔE
PRECIDIUM™ Floor	0.1	0.8	1.3	1.9
LGF Rubber	-2.6	-17.0	-54.0	14.7
PGF Rubber	-1.9	-8.0	-25.5	27.9
Vinyl	0.5	2.6	0.8	5.1
Baultar	0.0	0.4	0.1	12.5

From the data and observations made during this testing the following generalizations can be made for each of the sample groups. They are ordered in overall performance, from best to worst.

PRECIDIUM™ Rail Floor

- Gloss retention was excellent, with no noticeable change and even a slight increase in gloss by measurement.
- Color change was by far the best of any samples tested. The Safety Yellow, which was a solid color, had a ΔE of only 0.55, likely due to no accent colors interfering with taking readings.

Vinyl

- Gloss retention was excellent, performing as well as the **PRECIDIUM™ Rail Floor** samples. Both samples had metallic flakes, which may have increased the results as they increase the reflectivity.
- The Altro TransFlor sample also exhibited another degradation of the sample during testing. After only 200 hours the exposed area became tacky. This may have been caused by the UV exposure or the temperature, or both, but in either case it would be a cause for concern, as wear and dirt pickup would increase and cleanability would decrease.

Baultar

- Gloss retention was excellent numerically, but it was also very low gloss to start with, so there was really no gloss to lose from exposure.
- The resin used to bind the quartz aggregate yellowed and darkened considerably with exposure to UV, resulting in poor color retention.

LGF Rubber

- Gloss retention was very poor; samples chalked and took on a dull finish within the first few hundred hours of exposure.
- The color changed very quickly, and was evident after only 24 hours. By the end of the test the samples were very faded and did not resemble the original colors.

PGF Rubber

- Gloss retention was poor, but performance was better than the LGF.
- Color change was double that of the LGF samples, but the change occurred slower. During the first 100 hours they performed quite well, but from there on deteriorated at an increasing rate.