Research Report: The Impact of Bonded Polyurethane Cushion on Appearance Retention and Durability of Commercial Carpet

Alliance for Flexible Polyurethane Foam

How long can a carpet look good? Carpet's ability to retain its "like new" appearance is called appearance retention and improving appearance retention can have a dramatic impact on lifecycle cost, environmental issues and efficiency. New research has demonstrated an appearance retention improvement of 17% to 50% for commercial carpet installed with commercial bonded polyurethane cushion as compared to the same carpet directly glued to the floor. With the lowest grade of carpet tested, the carpet over cushion retained better appearance even with 1.5 times more traffic than the non-cushioned carpet.

Additionally, separate testing has confirmed field results of outstanding cushion durability. The studies were conducted by Independent Textile Testing in Dalton, Georgia for the Alliance for Flexible Polyurethane Foam (AFPF), using the Hexapod Drum test and the Phillips Chair test.

Success in these two demanding testing protocols provides a strong indicator of the suitability of a properly specified carpet in combination with commercial bonded polyurethane cushion. The carpets and cushions tested were chosen as representative of the commercial carpet market based on their physical characteristics and broad usage.

Proving Durability

Commercial cushion must be able to withstand the rigors of high traffic levels while providing a long service life. One of the most problematic traffic issues is chairs with casters found behind nearly every desk. Fortunately, this action can be simulated in the lab setting by the Phillips Chair test.

In this portion of the study, Carpet B, a 32 oz. nylon commercial loop carpet, was installed in the test device via the double-glue method. Cushion 1 was installed under half of the carpet and Cushion 2 under the other half (see Tables 1 and 2 for product descriptions). The test was run in 10,000 cycle increments to a total of 50,000 cycles. At the end of each increment, the carpet/cushion was checked for signs of installation performance problems such as bubbling, wrinkling, delamination, or any other indicators of product failure. No problems of any kind were noted after 50,000 cycles indicating successful completion of this rigorous test and providing a basis for significant confidence in these 10 lb./cu. ft. density bonded polyurethane carpet cushions.

Carpet Properties
Table 1

Sample Designation	Construction	Face Weight (oz. / sq. yard)	Backing
Carpet A	Nylon loop	26	Conventional latex
Carpet B	Nylon loop	32	Conventional latex

Cushion Properties
Table 2

Sample Designation	Cushion Type	Density (lbs./cubic foot)	Thickness (inches)	Compression Load Deflection (psi)
Cushion 1	Bonded Polyurethane	10.5	.259	22.9
Cushion 2	Bonded Polyurethane	10.2	.252	33.6

A Closer Look at Appearance Testing

Utilizing the method developed and endorsed by the Carpet and Rug Institute, the demanding Hexapod Drum Test was used to simulate very heavy walking traffic followed by a rating of carpet appearance. Two different commercial carpets and two different commercial bonded polyurethane cushions were included in the test. After a conditioning period, all combinations of the two carpets and two cushions were installed in the Hexapod Drum. As shown in Figure 1, the carpet/cushion samples are installed inside a drum. As the drum turns, the weighted ball rolls in the drum causing the rubber "feet" to continually walk on the tested sample. Each revolution of the drum is considered one cycle. The drum was stopped after 2,000, 4,000, 8,000 and 12,000 cycles to allow judgment of the appearance rating of the tested sample (Table 3).

Figure 1 - Hexapod Drum

Installation was by the double-glue method per guidelines published by the AFPF in *Installation Guidelines for Commercial Carpet and Commercial Bonded Polyurethane Carpet Cushion*. As controls, the two carpets were also tested without cushion, installed via the direct-glue method.

Understanding the Results

Consider the trends revealed by Graphs 1 and 2. Graph 1 shows Carpet A evaluated with and without cushion. Graph 2 repeats the evaluation using Carpet B. In Graph 1 we see that both of the samples installed over cushion have better appearance ratings at 12,000 cycles than the direct-glue version at 8,000 cycles (3.0 vs. 2.5). In other words, the carpet over cushion retained better appearance even with 1.5 times more traffic. The difference

becomes even greater when comparing cushioned samples at 12,000 cycles vs. the direct-glue sample at 12,000 cycles, where the cushioned samples demonstrated a 50% improvement in appearance rating over the direct-glue sample (3.0 vs. 2.0).

Appearance Rating Results Following Hexapod Test - Table 3

Carpet	Cushion	Installation Method	Appearance Rating after Hexapod Test*			
			2000 Cycles	4000 Cycles	8000 Cycles	12000 Cycles
Carpet A	None	Direct-glue	4.0	3.5	2.5	2.0
Carpet A	Cushion 1	Double-glue	4.5	4.0	3.5	3.0
Carpet A	Cushion 2	Double-glue	4.0	3.5	3.0	3.0
Carpet B	None	Direct-glue	4.5	4.0	3.5	3.0
Carpet B	Cushion 1	Double-glue	4.5	4.0	3.5	3.5
Carpet B	Cushion 2	Double-glue	4.5	4.0	3.5	3.5

*1=Severe change 2=Considerable change 3=Noticeable change 4=Slight Change 5=Negligible or no change

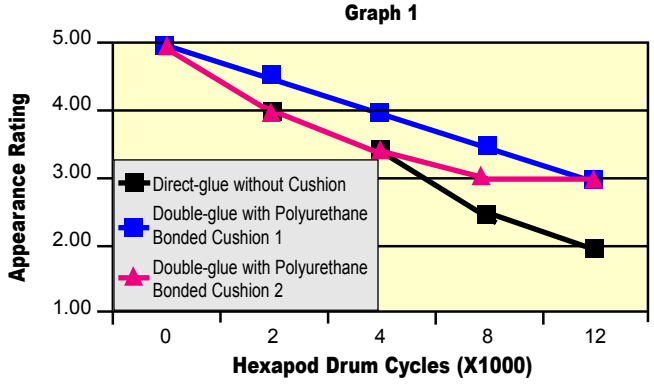
As expected, the higher quality 32 oz. carpet (Carpet B), had similar appearance retention through the early stages of testing in both cushioned and non-cushioned samples. This is likely due to the density of yarn on the face of the carpet, in which the individual tufts are packed together so that each helps support the surrounding tufts. However, as shown in Graph 2, the cushioned samples begin to demonstrate an appearance advantage at the 12,000 cycle mark.

In an actual installation, this is consistent with the concept that the grade of carpet influences when cushion will make a difference in carpet appearance retention, with better quality carpet realizing the benefit later in the life-cycle. The results from both carpet grades in this study support the potential of life-cycle extension with the use of cushion. It is important to note that different results may occur with different carpets or field conditions. However, the trends observed in this study with 10 lb./cu.ft. density bonded polyurethane carpet cushion appear to be consistent with the results of various other studies using other carpets and cushions.

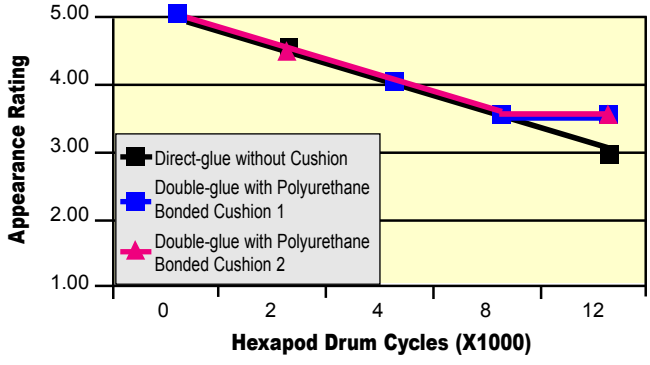
Research Proves Value of Cushion

As is shown by this and other studies conducted by AFPF, bonded polyurethane carpet cushion provides benefits to end-users, facility managers and property owners alike. End-users benefit from an upgraded floor covering system with improved acoustical and ergonomic properties. Facility managers realize the added advantage of easier carpet maintenance and the prospect of reduced energy usage based on the thermal insulating properties of carpet installed over cushion. At the same time, the building owner or management see an economic and environmental advantage through longer use of the carpet between replacements and fewer business disruptions. For further information on commercial bonded polyurethane cushion, visit www.afpf.com or send an email to info@afpf.com.

Improving Carpet Appearance Retention
Carpet A (26 oz) With and Without Cushion
Graph 1



Improving Carpet Appearance Retention
Carpet B (32 oz) With and Without Cushion
Graph 2



BACKGROUND

Benefits of Cushion

When carpet is installed via the direct-glue method (directly to the floor with no cushion), all of the forces from walking or rolling traffic are absorbed by the carpet face. With accumulation of time and traffic, the carpet tufts can begin to lie over or mat. That's why visible traffic lanes may develop in busy corridors, or matted areas appear in jogs and turns or entryways.

When a properly specified carpet and commercial cushion is installed, preferably by the double-glue method, much of the energy from traffic is diverted to the cushion. Exposed to the daily wear and tear of normal use, the cushion acts like a system of tiny shock absorbers supporting the entire carpeted area. This has the desirable effect of protecting and preserving the carpet face, a critical factor in achieving improved appearance retention and extended carpet life.

Carpet that looks better, longer contributes to life-cycle extension, which in turn reduces life-cycle cost. The reduced frequency of carpet replacement also shrinks the environmental footprint of carpet through lessened landfill needs for disposed carpet and lower raw material usage for new carpet. Efficiency is improved by reduced disruption of business operations associated with the carpet removal/carpet installation process.

The right commercial-grade cushion, properly installed, can improve appearance retention and durability. The ergonomic benefits of cushion are intuitive. Additional studies, conducted by AFPF and the Carpet Cushion Council, prove the benefits of carpet cushion in the workplace in improving both sound absorption and maintenance through better soil removal and increased vacuumability.

Installing Cushion

Carpet installation should be performed by professional installers with specific training in commercial carpet installations. Many installers are certified by the International Certified Floorcovering Installers Association (Master or C-11), are members of the Floor Covering Installation Contractors Association (FCICA), or are employed by floor covering contractors certified by the Floor Covering Installation Board (FCIB). Recently published by AFPF, *Installation Guidelines for Commercial Carpet and Commercial Bonded Polyurethane Carpet Cushion* is based on the use of a commercial-grade bonded polyurethane carpet cushion with a thickness of 0.25" maximum and a density of 10 lbs./cu. ft. minimum with woven or non-woven scrim on both sides. These guidelines may be downloaded at www.afpf.com.

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