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A SERIES OF FLOORCOVERING BULLETINS

COMING UNGLUED

BOND FAILURE SYMPTOMS AND SOLUTIONS

Despite the carpet industry's efforts to improve the quality of installation workmanship, bond failure in commercial carpet installations remains a leading cause of complaints, lawsuits and premature replacement. Annual losses from such failures run into the millions of dollars, and ripples and open seams caused by bond failure create a high-liability safety hazard. This bulletin discusses the most common types of failure, their causes and methods of prevention. The highlighted boxes are selected quotes from applicable sections of the Carpet and Rug Institute's CRI 104 *Standard for Installation of Commercial Textile Floorcovering Materials*.

CAUSES OF BOND FAILURE

The #1 Cause: Incorrect Trowel Size

By far the leading cause of bond failure in both direct-glue and double-glue installations is application of too little adhesive, usually resulting from use of a trowel that is the wrong size (Figures 1 and 2, following page) and/or too worn (Figures 3, 4 and 5) to provide 100% transfer of adhesive to the carpet.

8.3.1 Select the appropriate adhesive and trowel notching recommended by the carpet manufacturer and/or adhesive supplier, or refer to the list shown in Table IV as a minimum. A 100% transfer of the floor adhesive into the carpet backing while maintaining full coverage of the floor must be obtained

WARNING - Lack of adhesion is most often caused by either incorrect trowel notch size, improper adhesive selection, or incorrect open time. A 100% transfer of floor adhesive into the carpet backing, including the recesses of the carpet back, while maintaining full coverage of the floor must be attained.

CRI 104, TABLE IV - TROWEL SIZE MINIMUM GUIDELINES

CARPET BACKING:

- **jute, rubber (foam & sponge), urethane cushion, jute/vinyl, vinyl-foam, vinyl-slab, vinyl coated:** 3/32 wide x 3/32 deep x 3/32 space V-notch, or 1/8 wide x 1/8 deep x 1/8 space U-notch
- **polypropylene secondary (e.g., Action Bac):** 1/8 wide x 1/8 deep x 1/16 space V-notch, or 1/8 wide x 1/8 deep x 1/8 space U-notch
- **unitary (latex) or woven:** 1/8 wide x 1/8 deep x 1/16 space V-notch, or 1/8 wide x 3/16 deep x 1/8 space U-notch
- **hot melt:** 1/8 wide x 1/8 deep x 1/8 space U-notch

BETWEEN FLOOR AND CUSHION: 1/16 wide x 1/16 deep x 1/16 space square notch

BETWEEN CUSHION AND CARPET:

- **smooth back carpet:** 1/8 wide x 1/8 deep x 1/16 space U-notch
- **rough back carpet:** 1/8 wide x 3/16 deep x 1/8 space U-notch

Notes: The above guidelines should only be used when specific recommendations are not available from the carpet manufacturer and/or the adhesive supplier. Rough, porous concrete surfaces and heavily textured carpet backs may require a trowel with deeper notches than listed above. A 100% transfer of floor adhesive into the carpet backing while maintaining full coverage of the floor must be obtained.

1/16 wide x 1/16 deep x 1/16 space



3/32 wide x 3/32 deep x 3/32 space



1/8 wide x 1/8 deep x 1/16 space



1/8 wide x 1/8 deep x 1/8 space

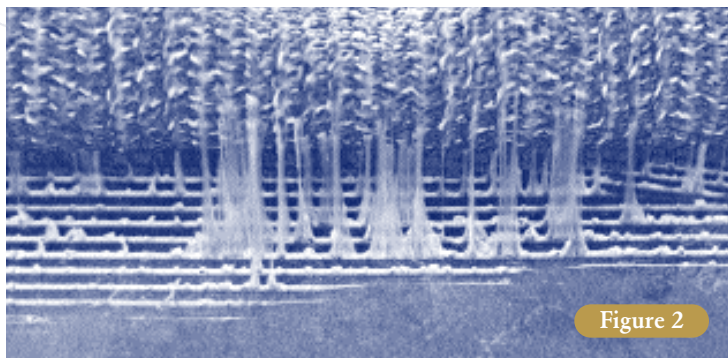
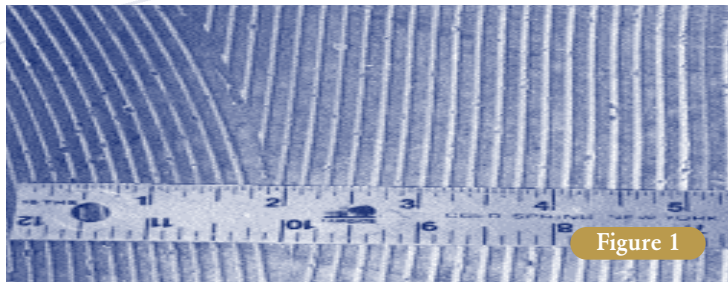


1/8 wide x 1/8 deep x 1/16 space

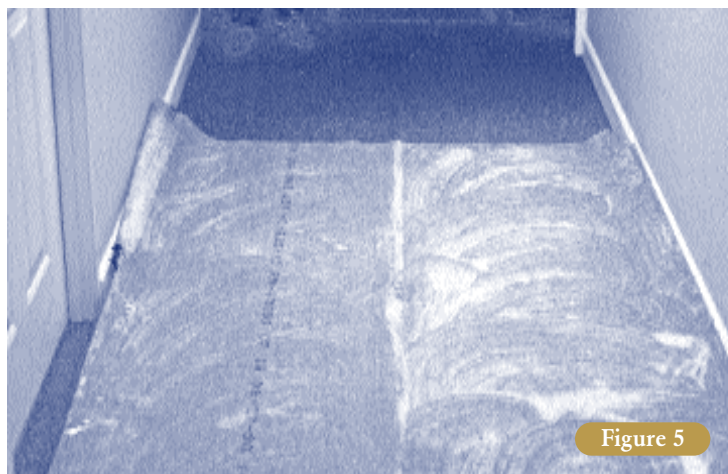
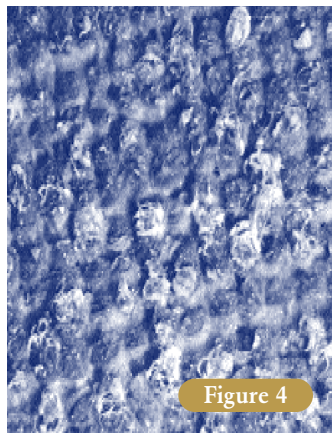
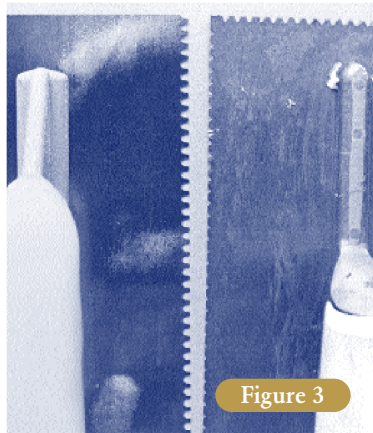


1/8 wide x 3/16 deep x 1/8 space





TROWEL PROBLEMS: Trowel notches that are too small (Figure 1) result in poor adhesive transfer. (Figure 2) Trowels that are too badly worn (Figure 3) also apply too little adhesive seen in (Figure 4). (Figure 5) shows progressive trowel wear. Note the difference in adhesive transfer: The right half of the corridor was spread with a trowel that was slightly worn; by the time the left half was spread, the trowel was severely worn.



INCORRECT OPEN TIME

Open time is the time allowed after spreading adhesive before carpet is laid into it. This time allows the adhesive to release some of its moisture and develop tack. Proper open time is critical, since too little open time may result in too much adhesive being absorbed into the back of the carpet, leaving too little between the carpet and floor or cushion. Allowing the adhesive to stand too long reduces its ability to bond to the back of the carpet.

8.3.3/9.2.1 The correct open time for adhesive is required. The applied adhesive must develop “legs” or tack prior to laying the carpet into the adhesive. Open time will vary dependent upon environmental conditions.

MOISTURE AND ALKALI

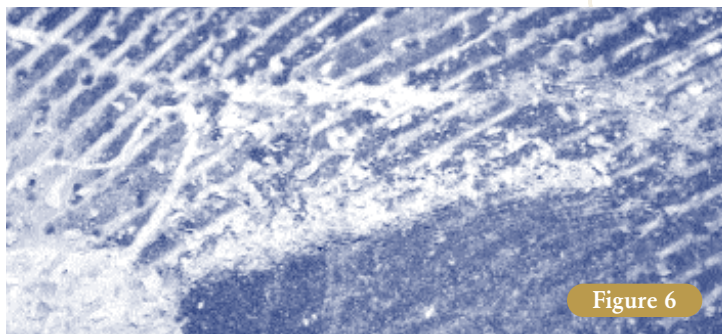
Prolonged exposure to moisture and/or high alkalinity is detrimental to most adhesives. (Figures 6 and 7). Unfortunately the pH of moisture released by concrete often is as high as 12 to 12.5, more than 1,000 times higher than most adhesives can withstand. Alkali from within concrete is carried to the surface by migration of water from under or within the slab toward warmer, drier air at the surface. Depending on the porosity of the carpet, moisture emissions generally should be below 3-5 pounds per 1000 square feet per 24 hours as measured by the quantitative calcium chloride test.

In addition to concrete, cleaning, if done improperly (allowing the carpet’s back to become saturated) or using excessively alkaline chemicals, can cause the adhesive to gradually deteriorate.

6.2 Moisture and Alkalinity in Concrete Subfloors - To prevent glue-down installation failures due to moisture and alkalinity, the owner or general contractor shall be responsible for providing written moisture and alkali test results pertaining to the concrete slab prior to installation.

As a general guideline, an emission rate of 3 lbs. or less is acceptable for most carpet. In the range from 3 to 5 lbs., carpet with backings of porous construction can usually be installed successfully. An emission rate above 5 lbs. is considered unacceptable.

6.2.2 Alkalinity - A pH range of 5-9 is satisfactory; however, a reading above 9 requires corrective measures. Consult the adhesive manufacturer for recommended corrective procedures.



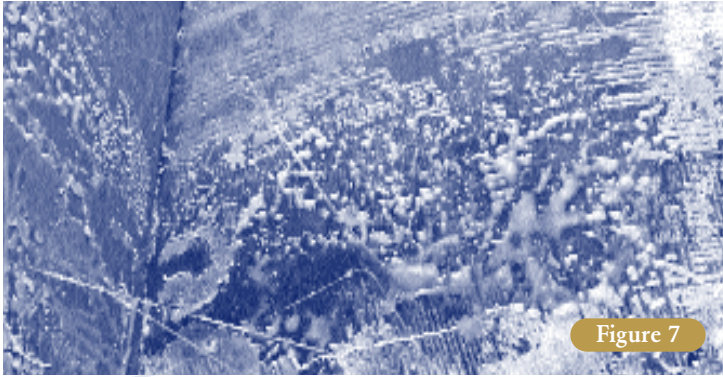


Figure 7

OTHER CONCRETE PROBLEMS

If the surface of a concrete slab is dirty, oily, dusty or contaminated with curing or parting agents, a secure bond cannot be established. Even the best workmanship can not prevent failure caused by poor floor preparation.

INADEQUATE CONDITIONING

All installation materials must be thoroughly acclimated before installation. Ideally the temperature and humidity at which the materials are conditioned should be similar to that under which they will be used. Though this often seems impractical due to construction schedules and site conditions, it is a very real factor in the success or failure of the installation.

5.3 Conditions - The carpet and adhesive shall be contained on site in a heated, dry space at a minimum temperature of 65°F (18°C) and a relative humidity between 10% and 65% for at least 48 hours before installation. These conditions shall be maintained night and day during installation and for at least 72 hours after completion.

PREMATURE TRAFFIC

Adhesive takes time to set up enough to withstand traffic. Premature traffic forces adhesive out from between the carpet and floor (or carpet and cushion) up into the carpet's back, where it cannot provide bond strength.

15.2 Curing of Adhesive - Traffic over adhesive installations should be restricted for a minimum of 24-48 hours to allow proper adhesive cure. Premature traffic can cause installation failure. Exposure to water from cleaning and other sources should be restricted for a minimum of 30 days.

MATERIAL INCOMPATIBILITY

If an adhesive is chemically incompatible with a carpet backing or cushion, adhesive deterioration and/or failure are almost inevitable. Though not a common cause of failure, it does occur, usually due to the wrong adhesive being used.

CUSHION PROBLEMS

Double-glue installation failures may occur when the surface of a cushion will not allow the adhesive to bond securely. In some cases, the cushion actually fractured within, leaving half glued to the carpet and half glued to the floor. This is particularly probable if the cushion used is unsuitable for the type and/or volume of traffic of the application.

IMPROPER ROLLING

If carpet is not properly pressed into the adhesive, it is unlikely that 100% transfer will be achieved. But if the carpet is rolled too much, or with a roller that is too heavy, the adhesive will be forced up into the recesses of the carpet's back, resulting in a weak bond.

8.6 Rolling [direct glue] - Rolling shall be performed with the lightest roller that will achieve 100% transfer of the floor adhesive into the carpet back. Refer to manufacturer's recommendations for roller weight. Normally, do not exceed 75 pounds (34 kg).

8.6.1 Jute or Synthetic Secondary Backing - Tufted carpet with jute or synthetic secondary backing should be pressed down into the adhesive bed using a section of carpet core or a roller. Roll in both directions, but do not over roll.

8.6.2 Unitary and Woven - Unitary carpet and woven carpet must be rolled a second time about 3-12 hours after initial rolling to make sure a strong bond is established.

9.6.1 Secondary Backed Tufted Carpet and Woven Carpet [double glue] - Tufted carpet with secondary backing, as well as woven carpet, should be pressed into the adhesive bed with a two-foot section of carpet roll core, a stiff broom, or by using a roller weighing 35-50 pounds (16-23 kg). Roll in both directions, but do not over roll.

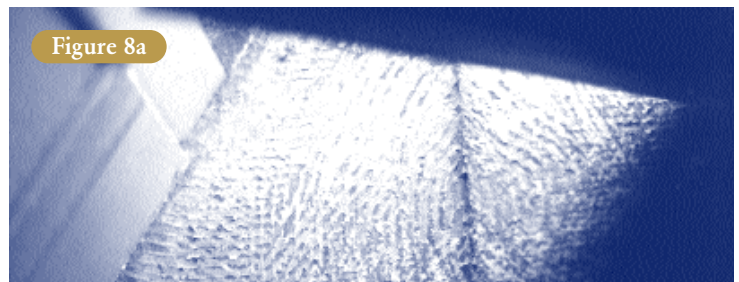


Figure 8a

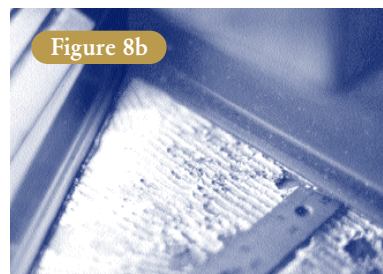


Figure 8b

INVESTIGATION:
A clear picture of the job's installation and repair history. Ultraviolet light often reveals features of adhesive application and transfer that cannot be seen under visible light.

INVESTIGATING BOND FAILURES

Because numerous variables are involved, correctly diagnosing the cause of bond failure can be complex. In the illustrations below, pre-installation bond tests (Figures 9a and 9b) were conducted to assess the suitability of the slab to receive carpet. Fortunately, the tests identified a bonding problem before installation began. (Figure 10) Additional tests confirmed that an extremely strong bond could be achieved with additional floor preparation. (Figure 11)

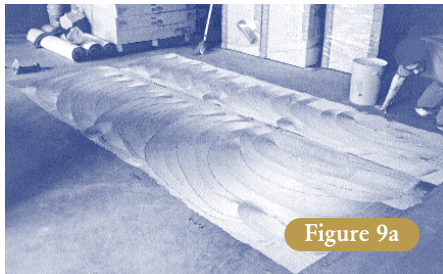


Figure 9a

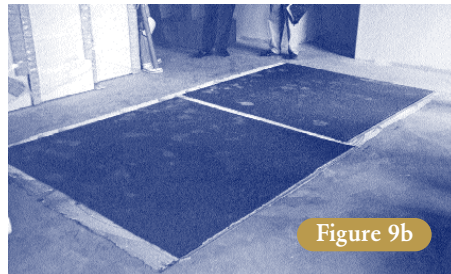


Figure 9b

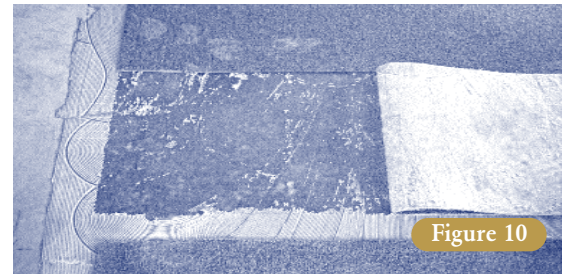


Figure 10

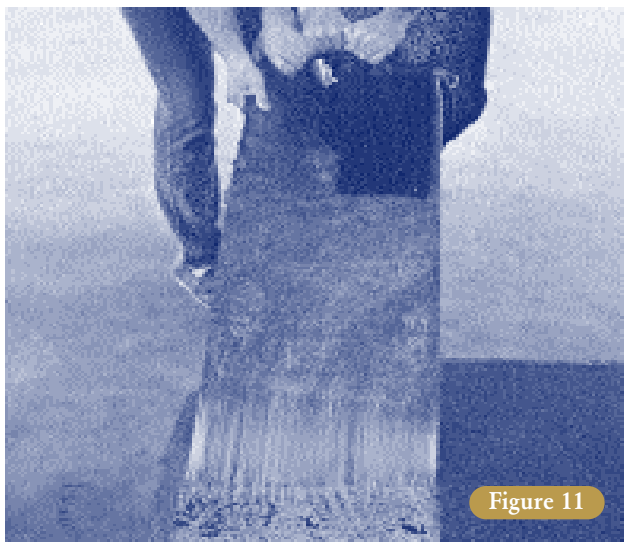


Figure 11

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