



The University of Sydney

Faculties of Health Sciences and Architecture

**The Home Modification:
Information Clearinghouse Project**

Industry Factsheet:

Selecting Coatings for Tiled Floors

Purpose

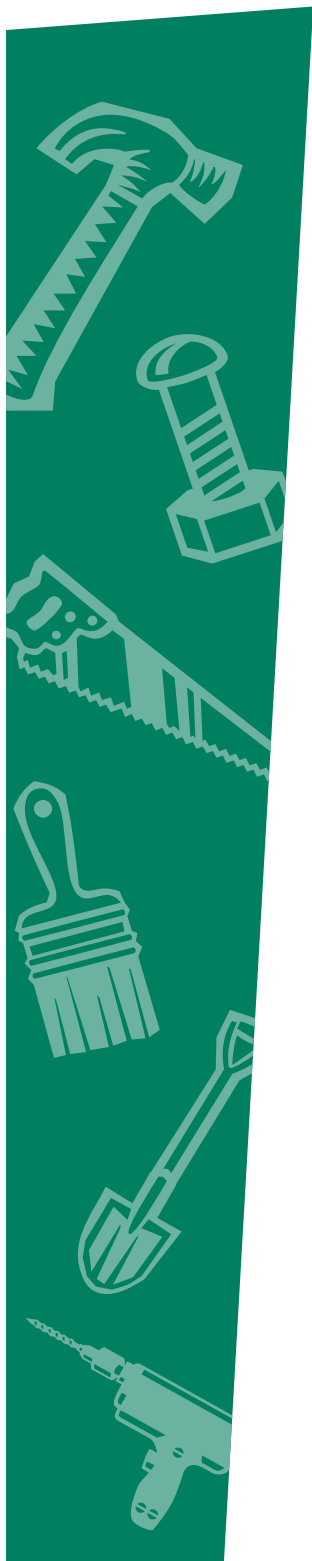
The purpose of this factsheet is to assist service providers and trades people in the selection of slip resistant tile coatings. It summarises available information regarding the effectiveness of tile coatings to improve the slip resistance of surfaces and, to the extent possible, provides information specific to the use of tile coatings in the home of a person with a mobility impairment. The information summarised is from laws and standards, quasi-experimental studies, expert opinion, and anecdotal evidence. A complete list of references used to develop this factsheet accompanies HMinfo Clearinghouse document “Coatings: Evidence Based Research: Selecting Coatings for Tiled Floors”.

This factsheet supplements the HMinfo Clearinghouse document “Coatings: Industry checklist: Selecting Coatings for Tiled Floors.” This factsheet highlights critical information about each item on the checklist. This factsheet is only a starting point, however, and does not provide exhaustive detail. An understanding of basic construction principles, building codes and regulations is assumed.

Achieving satisfactory outcomes, as determined by the consumer, service provider, and trades person, is more likely when the safety and dignity of consumers is considered at all stages of the project from conceptualization through post occupancy.

Background

Personal injuries at home, including falls, cost billions of dollars each year. People with mobility impairment are at an increased risk of slipping and falling. Slip resistance is the resistance that the floor surface offers the shoe, sole, prosthetic or walking aid tip when it makes contact with the floor surface. Improving the floor’s slip resistance can reduce the likelihood of falls and related injuries.



Background - continued

Although there are no specific slip resistance requirements applicable to the interior of private homes, the Australian Standards highlight the importance of slip resistance. AS 4226, Guidelines for Safe Housing Design, recommends that stair treads throughout a dwelling and floors in kitchens, bathrooms, toilets, laundry rooms be slip resistant. AS 3661.2 describes ways to improve the slip resistance of existing surfaces and lists important pre-construction considerations. AS 4586 and AS 4663 describe methods to measure slip resistance and to classify new (AS 4586) and existing (AS 4663) surface materials according to their slip resistance. Other laws require slip resistant access paths (Disability Discrimination Act and AS 1428), ramps, and stairways (Building Code of Australia) but do not contain specific requirements for private home interiors.

This factsheet provides general information about slip resistant floors inside private dwellings. Its primary focus, however, is on the use of coatings to improve the slip resistance of tiled floors. While surface blasting and surface etching also may improve the slip resistance of a tile floor, those process can damage the tile and compromise its water resistance.

The following recommendations are based on our review of the Australian Standards, the Australian Building Code, the Disability Discrimination Act, the Americans with Disabilities Act Accessibility Guidelines, and various published reports concerning slip resistant tile coatings including quasi experimental studies, expert opinion and anecdotal evidence. Because applicable law changes over time, it is recommended that applicable regulations be checked prior to the selection of any building materials or procedures. Similarly, the recommendations in this factsheet are based on information currently available; continued research and new products may

affect the continued reliability of the recommendations.

Slip Resistance Basics

Slip resistance is often expressed as a coefficient of friction (COF). A surface with a COF of 0.0 is slippery; a surface with a COF of 1.0 is not slippery. Although there is not a minimum COF presently required for private homes in Australia, AS 4663 states that a COF of 0.4 has a moderate to low contribution to the risk of slipping. A COF of 0.5 is often recommended for safe walking on level surfaces for people without mobility impairment.

People with mobility impairment require a higher COF. For example, on level surfaces people with mobility impairment require a minimum COF of at least 0.6 to 0.64. A COF of 0.8 is recommended for ramps used by people with mobility impairment. Other circumstances, such as degree of slope, gait, nature of mobility impairment, and shoe or walking tip surface affect the COF necessary for an individual to safely move across a surface.

The lack of a single universally-accepted method to measure slip resistance makes product comparison difficult. One method of measuring slip resistance on a dry surface is the Dry Floor Friction method, described in detail in AS 4663. Slip resistance of wet floors may be measured by the Wet Pendulum method described in AS 4663. According to AS 4663, a Wet Pendulum test result of >44 to >54 (depending on the equipment used) presents a very low risk of slipping when water wet; a result of less than 25 presents a very high risk of slipping when water wet. In addition, AS 4586 describes several methods to test and classify the slip resistance of new floor surface materials (wet pendulum test method, dry floor friction test method, wet/barefoot ramp test method, oil-wet ramp test method, displacement volume test method). In order to evaluate product claims of slip resistance, it is important to know the method used, whether protocol



was followed, the condition of the floor and any other conditions that could affect the accuracy of the results.

Other methods of treating tiled floors include: etching, blasting, and coating. Surface blasting and surface etching, however, can damage the tile and compromise its water resistance. Adequate water resistance is important to maintain stable and hygienic under-flooring. If the under-flooring is timber, water can cause the timber to rot and lead to the build up of mould and bacteria. This factsheet, therefore, focuses on slip resistant tile coatings.

Preconstruction considerations regarding slip and fall prevention

In selecting flooring or other surfacing material, consider the following:

- What is the amount and type of traffic expected?
- Is there adequate drainage in areas where spills can reasonably be anticipated?
- Is the flooring or other surfacing material resistant to chemicals and other contaminants?
- Is the flooring or other surfacing material compatible with cleaning materials and able to meet hygiene requirements?
- Are stairs equipped with handrails and slip resistant tread?
- Do ramps comply with applicable building codes?
- Has special attention been paid to ensure slip resistance in areas that are normally wet (e.g., bath tubs, showers, pools and surrounds) or likely to become wet or contaminated (e.g., entry ways, bathrooms, toilets, laundry rooms, kitchens)?
- Slip resistant mats or tape are recommended for bath and shower floors. They should be replaced if they show any signs of wear.

- Strong fastenings and appropriate selection for hand and grab rails for older people or people with mobility impairment also are helpful in bath and shower areas.
- Is hot water available on every floor of the dwelling so the consumer does not have to carry heavy buckets of water up and down the stairs?

Considerations during installation and finishing of floor surfaces

Slip and fall hazards can be created during the installation of flooring in many ways, for example:

- Base preparation creating a wet or dusty, primed, and smooth surface
- Adhesive residue
- Factory finish on flooring
- Waters and solvents used for clean up during installation
- Loose pieces of material or dust
- Untidy or incomplete work creating uneven surface
- Inadequate lighting
- Inadequate initial cleaning before handover

Choosing tile

Tile type. As a general rule, unglazed tiles have a higher COF than glazed tiles. An effective slip resistant coating, however, can eliminate any significant difference between the two. The coating manufacturer should specify the type of tile(s) for which the particular coating is best suited. In selecting a tile, keep in mind that that surfaces that are too rough can cause a person with a mobility impairment or a shuffling gait to stumble and fall.

There can be significant differences in slip resistance across a given range of tiles manufactured by the same manufacturer. These differences can be due to warpage in



the individual tiles, which affects where colour is deposited. Warpage also could affect the distribution of slip resistant coatings.

Tile size. There is no conclusive evidence regarding the most effective tile size for slip resistance.

Choosing a Tile Coating

Comparing information regarding effectiveness. Slip resistant coatings vary in effectiveness. There is evidence that some slip resistant coatings can significantly increase the slip resistance of tile floors under wet and dry conditions. In comparing products based on reported COFs, it is important to know which test was used. Different test methods may yield different results. In addition, it is important to know the conditions under which the product was tested (for example, whether the claimed COF is attainable under wet or dry conditions). Coatings that significantly improve slip resistance under dry conditions may not work as well to improve slip resistance under wet conditions.

Aesthetics. Coatings can dull the appearance of a surface. Glazed tiles often are chosen because they are shiny. Testing various products on tile samples or on floor sections can allow the consumer to choose one that meets his or her needs.

Type of coating. Chemical treatments had the most information supporting their effectiveness followed by some abrasive coatings. Chemical coatings contain a base (such as epoxy, resin, acrylic or urethane) and a chemical that provides traction by creating a honeycomb-like structure that sits on the tile surface. Abrasive coatings contain granular particles that provide friction.

Effectiveness of Active Ingredient

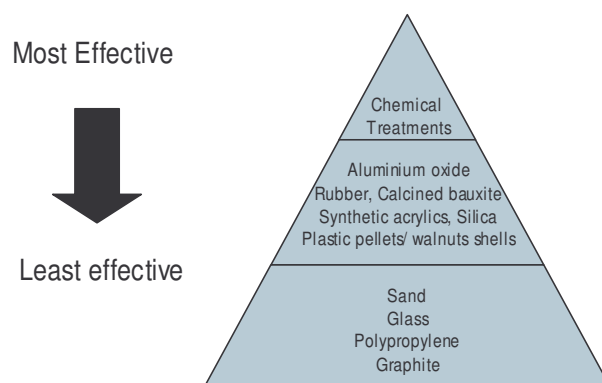


Figure 1: The effectiveness of different active ingredients found in surface coatings

Type of abrasive. Hard, angular particles that are light enough to remain suspended in the coating are reported to be the most effective. Round particles are the least effective shape because they are easily dislodged and crushed. Coatings containing aluminium oxide were generally considered best because of its superior hardness. There are different grades of aluminium oxide for industrial and domestic application, and it is important to choose a grade suitable for the intended use. Other particles, such as rubber, calcined bauxite, synthetic acrylics, silica, and plastic pellets, also are suitable for domestic use, but lack the hardness of aluminium oxide. Coatings containing sand, polypropylene and graphite were the least frequently recommended. These ineffective abrasives were generally heavy and difficult to suspend and could easily become dislodged or crushed.

Particle size. Abrasive particles should be no smaller than 0.2 mm (so they are not submerged in the coating) and generally no larger than 2-3 mm (so they are not easily dislodged from the coating). Generally, smaller particles should be used for barefoot areas, while larger particles may be used in industrial areas. Particles should not exceed 2 mm for domestic use. In selecting



a particle size, note that there is evidence that surfaces that are too rough can cause a person with mobility impairment or a shuffling gait to stumble and fall.

Particle spacing. AS 3661.2 recommends that particles be spaced 1-2 mm apart for maximum effectiveness. There is some evidence that uniform distribution of particles increases slip resistance.

Application. When an abrasive coating is applied to the tile surface, 30-50% of a particle should be submerged in the coating. If more is submerged, the product will be less effective because it is the particle that provides friction. If less is submerged, the particles may be more easily dislodged, which will eventually reduce the slip resistance of the surface.

Given the importance of particle distribution to effectiveness, it is not surprising that preformulated coatings were reported to be more effective than coatings that consumers had to mix before application and coatings that required particles to be broadcast onto them while wet. It can be difficult to maintain the suspension of the particles in the coating if the coating has not been preformulated.

Maintenance

Cleaning and maintenance instructions and precautions should be obtained from the flooring and coating manufacturers, cleaning contractor, or flooring and coating suppliers. Owners should be advised to keep a complete file of cleaning and maintenance instructions.

Cleaning. There are some claims that highly textured surfaces are harder to clean than smooth surfaces. Others argue that if a surface treatment is properly engineered and the correct shape and size particle is chosen, then cleanability will not be reduced excessively.

Regardless of a treatment's effect on cleanability, correct cleaning methods and products are necessary to maintain slip resistance. If a product claims a particular COF, keep in mind that this COF likely is based on tests in laboratory conditions without contamination.

The correct cleaning product depends on the tile, the coating and the contaminant. Some cleaners may damage flooring material or tile coatings (for example, alkaline detergents will damage rubber-based coatings or tiles). The tile and coating manufacturers' specifications should include cleaning and maintenance recommendations. When selecting a coating with a particular consumer, consider the consumer's ability to comply with recommended maintenance instructions. The correct cleaning process also is important. For example, rinsing may be necessary because solvent or detergent residue can decrease the slip resistance of a floor. If professional cleaning or special equipment is required to maintain a coating's slip resistance, that will be an important consideration in coating selection. If, for example, a floor polishing machine is necessary for proper maintenance, the consumer must be able to move the machine from one floor to another.

Frequency of cleaning is important and may be underestimated by consumers. Even a thin film of dust can decrease slip resistance. If an abrasive coating is used, the type of abrasive also may affect cleaning and maintenance needs. For example, sand is easily dislodged and easily crushed. If it remains on the floor, the dislodged or crushed sand particles will further wear the surface, reducing its slip resistance.

Some areas, such as food preparation areas, require special attention to hygiene. The coating selected should tolerate cleaning products and processes necessary to maintain a healthy environment.



Reapplication. Coatings will degrade with use, and it will be necessary to reapply a coating from time to time. If a product claims a particular COF, keep in mind that this COF is likely based on tests in laboratory conditions without regard to wear and tear.

The average life of a coating in a domestic setting is about 3 years; however, that varies with nature and frequency of use. Mobility aids may decrease the life expectancy of a coating. The manufacturer's warranty and/or specifications may indicate the expected life of the coating under particular use patterns.

Budget considerations

Coating prices vary. When comparing prices, consider the suitability of the coating for the particular floor, the effectiveness of the coating, special cleaning products or processes, and the frequency with which the coating must be reapplied.

Choosing tiles and coatings

- ▶ Warped tiles may have decreased slip resistance
- ▶ Choose a chemical coating or an abrasive coating that contains hard, angular particles
- ▶ Make sure the particle size suits the intended use
- ▶ Make sure the particles are evenly distributed in the coating

Cleaning and maintenance

- ▶ Find out the recommended cleaning methods and educate the consumer
- ▶ Find out the recommended reapplication frequency and educate the consumer
- ▶ Educate the consumer about the importance of proper cleaning and maintenance to sustain slip resistance

SUMMARY

Preconstruction

- ▶ Choose flooring that will minimise the risk of slips and falls
- ▶ Choose flooring that is compatible with the type and amount of expected traffic
- ▶ Choose flooring that the consumer can clean and maintain

During construction

- ▶ Keep floor areas free of contaminants
- ▶ Keep floor areas free of debris

