

A Case Study and Description of the PDIR Method of Carpet Maintenance

The authors describe an effective and proactive carpet maintenance process and cite a large-scale case study that demonstrates that better maintenance results in a better bottom line.

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by Richard "Bo" Bodo and Mark Meents



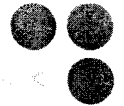
The case study of the effectiveness of a carpet maintenance program that is structured this way comes from Steve Spencer. In 1994, a major insurance company began analyzing the costs associated with the nearly 28 million square feet of carpeting it had in North America. They found they were replacing carpet on average every six years. This meant that every year they replaced nearly five million square feet of carpet, a significant investment.

The company (which has requested that its name not be used) approached Spencer about managing their cleaning program. He analyzed their maintenance process and discussed with them the concept of lifecycle costs. Like many companies, it invested significantly in carpet replacement and tried to save money on maintenance to keep costs down. And, like many companies, it was disappointed when its carpets "uglied out" and had to be replaced prematurely.

The company's average facility was about 100,000 square feet and 90 percent of that was carpet, or about 90,000 square feet. It cost \$350,000 to put carpet into the average facility. Since the carpet lasted six years, the cost of ownership of the carpet was \$58,333 per year. To save money, it invested 15 cents per square foot, or \$13,500 per year, in maintenance. Their total cost of ownership, including purchase and maintenance costs, was \$71,833, or about 79¢ per square foot per year. Their maintenance program consisted of vacuuming, bonnet cleaning when the carpet looked dirty, and extraction when it looked really dirty.

Spencer showed this national insurance company the connection between maintenance and replacement, that they

The purpose of this paper is to examine the effect that a proactive approach to carpet care has on a carpeted floor and ultimately its lifecycle costs. It will demonstrate that by implementing a program with a proper understanding of each element of effective carpet care — preventative, daily, interim and restorative (PIDR) — that the lifecycle for textile floors can be extended and lifecycle costs can be lowered.



should not separate the costs, that they were actually one number. The cost to purchase and to maintain was their real cost. They could not simply separate the numbers because they were under different budgets: a capital budget for the carpet and an operating budget for the cleaning. Once they understood this, it was eye opening.

Spencer told them that in order to extend the life of their carpet and lower the overall lifecycle cost he would need an initial 66 percent increase in the carpet maintenance budget. He promised that the increase would be more than offset by lower replacement costs.

He was right. As figure 1 illustrates, 20 years later the company has seen the results and now invests double their cleaning budget from 1994, 30¢ per square foot. The payback is that they have also seen the life of their carpet double from six years to 12 years, lowering the annual cost of purchase from \$58,333 to \$29,167. Their cleaning budget has doubled to \$27,000, but if you combine the costs, their overall cost of ownership is now \$56,167 per year or 62 cents per square foot. This represents a 22 percent decrease in their overall cost of ownership.

Today, this national insurance company's maintenance program consists of the following elements:

- Forty to 60 feet of walk-off matting tiles at entrances.
- Scheduled vacuuming in all areas, with high soil-load areas being vacuumed on a more frequent basis to control the spread of soil into the facility.
- Scheduled interim maintenance that varies by location.
- Scheduled hot water extraction.

This program contains all the elements of the PDIR Method and demonstrates that when followed this type of program will yield positive results from the perspective of cleaner facilities, finance and waste stream.

Why Maintenance Matters

In 2002, the Carpet America Recovery Effort (CARE) estimated that in the United States 4.7 billion pounds of carpet

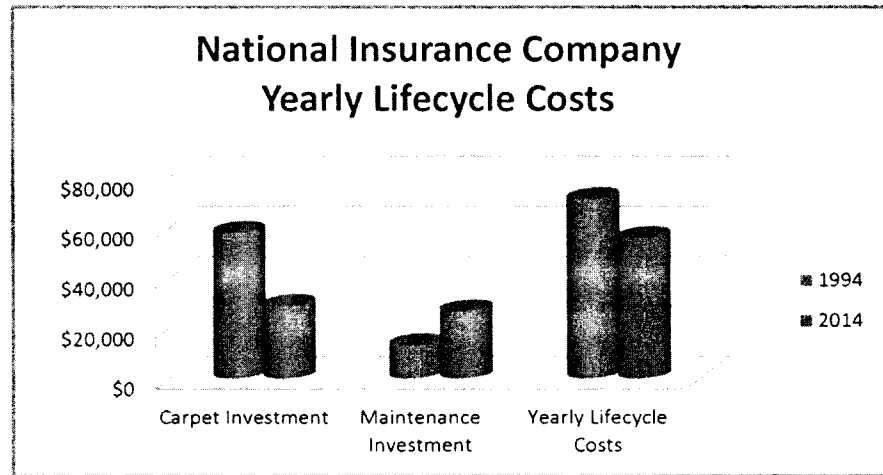


FIGURE 1

| Soil Type | Composition | Source | Soil % |
|--------------------------------------|---|---|-------------|
| Insoluble particles or fibers | sand, quartz, dolomite, clay, feldspar, limestone | tracked from exterior | 45% |
| | protein fiber and dander | people, pets, fabrics | 12% |
| | cellulose matter and fiber | tracked from exterior (e.g., grass, leaf fragments); shed from newspapers, magazines, paper; cellulosic clothing; interior plants | 12% |
| | | Undetermined | 5% |
| Insoluble soil subtotal | | | 79% |
| Water soluble | sugar, starch, salts, fluidic residues | foodstuffs, body fluids | 10% |
| Dry solvent soluble | fats, tars, asphalt; animal, vegetable oils | tracking; cooking vapors, body oil (e.g., human, animal) | 8% |
| Moisture | humidity | outside air; inside activities | 3% |
| Total | | | 100% |

were disposed of with 95 percent of it going into landfills. Today, through CARE, manufacturers have begun to recycle carpet for other uses, but still an estimated 87 percent of carpet ends up in landfills. This becomes an area of concern since the majority of carpet is synthetic and it is estimated that it will take 1,000 years for synthetic carpet to degrade naturally in a landfill. One way that carpet maintenance matters is by extending the lifecycle and conserving landfill space.

It is important to understand how damage occurs to carpet that shortens its life before you develop and implement a

program to extend it. As people enter a building they bring with them soils from the outside which track in on shoes. According to the *IICRC S100 Standard and Reference Guide for Professional Cleaning of Textile Floor Coverings*, on average 80 to 94 percent of the soil in a building is brought in by foot traffic. Many types of soil are brought into a building with foot traffic, including oils and hydrocarbons from automobiles in a parking lot, ice melt in colder climates in the winter, and sand and dry soils.

A study conducted by CW Studer (figure 2) showed that 45 percent of the

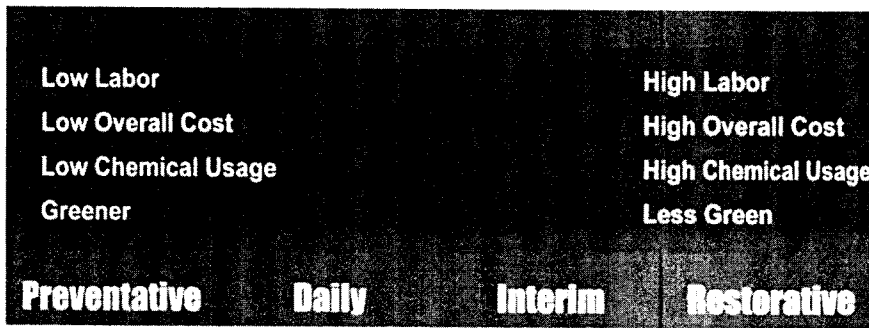


FIGURE 3

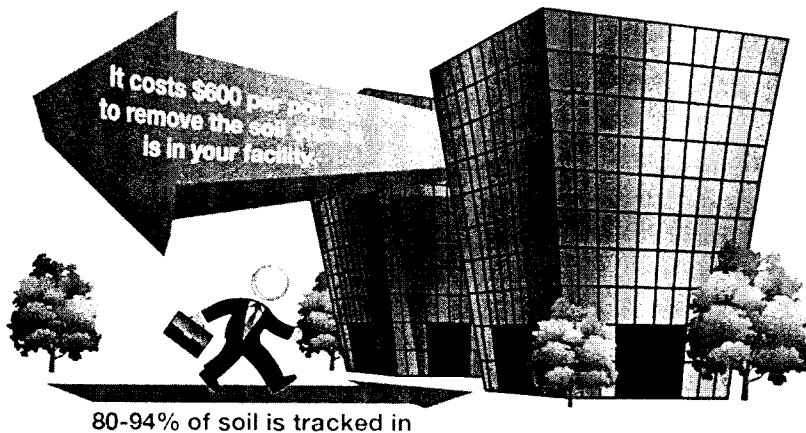


FIGURE 4

soil in any facility is dry particulate soil, composed of sand, quartz, dolomite, clay, feldspar and limestone. When these soils come in contact with the fibers in the textile flooring, they scratch and abrade them. This leads to a dull appearance, as the carpet no longer reflects light evenly to the human eye. This is referred to as a traffic lane or pattern.

The Components of the PDIR Method

In order to maximize the lifecycle of carpet, a four-phase program has been shown to be useful. The “P” phase, preventative maintenance, focuses on preventing soil from entering the facility. The “D” phase, daily maintenance, focuses on removing soil from the facility on a daily basis to minimize the amount of damaging soil buildup. The “I” phase, interim maintenance, focuses on maintaining a consistently clean appearance while using less chemical, water, labor, and lowering dry times so the textile floor can be put back into use more quickly. The “R” phase, re-

storative maintenance, uses systems requiring rinsing and extraction of accumulated soils and cleaning residues at a higher intensity to maximize removal of embedded soils. The frequency of restorative cleaning depends on the effectiveness of the PDI components, location of carpet, traffic intensity and type of use. From this point forward, this approach will be referred to as the PDIR Method.

As figure 3 demonstrates, looking at the PDIR Method on a continuum, you move from preventative to daily to interim to restorative. You move from methods that are:

- Less labor intensive to more labor intensive.
- Less overall cost to more overall cost.
- Use the least chemical to the most chemical.
- More green to less green
- Use the least water to the most water.
- Require the least amount of time to go back into service to the longest time to go back into service.

The theory behind the PDIR Method is that if you allocate your resources with an emphasis on the left side of the continuum, focusing on preventative, daily, and interim, with longer intervals between restorative cleanings, the life of the carpet can be extended and the lifecycle costs can be lowered.

Preventative Maintenance

The first step in the PDIR Method is preventative maintenance: preventing soil from entering the building envelope. A study for the International Sanitary Supply Association (ISSA) concluded that 1,000 people per day entering a building over 20 days will track in an average of 24 pounds of soil. Another ISSA study estimated that once soil is in the building envelope, the average cost to locate, identify, contain, remove and properly dispose of that soil is \$600 per pound. Based on these figures, every time someone enters the building envelop it costs 72¢ to remove the soil they tracked in:

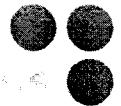
- 24 pounds of soil x \$600 = \$14,400
- \$14,400 ÷ 20 days = \$720 per day
- \$720 per day ÷ 1000 people = 72¢ per person

Numbers like these illustrate why preventative maintenance is so important. Stopping soils, especially dry particulate soils, from entering the building envelope affects the frequency and intensity of the other maintenance procedures.

The first component of preventative maintenance is proper and effective matting. It has been found that the use of two types of matting at all entrances has been especially effective:

- Ridged “scraper” matting on the exterior that scrapes large particulate from the shoe and allows it to fall away into ridges.
- Carpet-type “wiper” matting inside the door to wipe and dry the shoes and remove finer particulate.

The size and type of matting found at the entrances of commercial facilities is often not sufficient. A three-by-five foot mat will offer minimal protection from soils entering the



building envelope. Professionals generally agree that you should have enough matting for at least four to five normal strides on a mat, which for the average person would be at least a 12-foot mat. Studies conducted by the American Institute of Architects have shown that:

- Five feet of matting captures 33 percent of debris walked into a facility.
- 10 feet of matting captures 52 percent of debris walked into a facility.
- 20 feet of matting captures 86 percent of debris walked into a facility.
- 25 feet of matting captures up to 100 percent of debris walked into a facility.

Virtually every building has 25 feet of matting of some sort. If not designed matting, other textile surfaces such as installed carpet serve the purpose. Hard surfaces in the building envelope do not hold soil like textile surfaces since the textured surface of a textile allows it to trap and hold soils that are tracked in.

A second component of preventative maintenance is sweeping. Since 80 to 94 percent of the soil is coming into the building with foot traffic, keeping parking lots, sidewalks and walkways swept and free of debris will help to stop dry particulate soil from entering the facility and help augment a matting program. In a study conducted by Windsor (figure 5), it was found that with no matting in place, sweeping alone reduced by 66 percent the amount of soil entering a facility.

The final component of preventative maintenance is pressure washing parking lots to remove oily soils on a regular basis so that they are not tracked into the building envelope.

Daily Maintenance

The second step in the PDIR Method is daily maintenance. The objective of daily maintenance is to remove soils so as to reduce the damage they cause to the fibers. As certain particulate soils are tracked onto carpet pile, they abrade and scratch the fibers. This causes irreversible damage because these soils are

Case Study Sheraton 4 Points Hotel

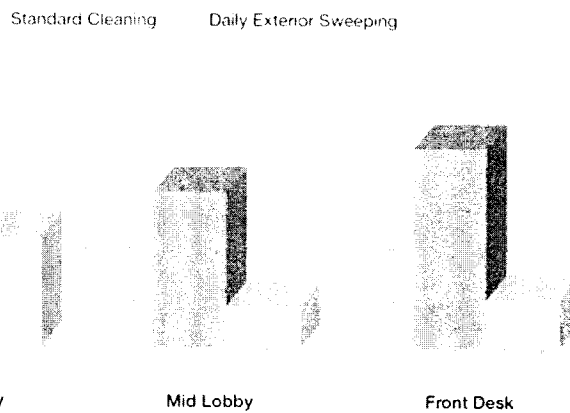


FIGURE 5

inherently abrasive and act like sand paper under foot traffic. Removing these soils before they can cause significant damage is key to extending the lifecycle of carpet.

Dry soils should be removed using an appropriate high-performance vacuum. High soil-load areas, those areas within approximately 40 feet of hard surfaces, should be vacuumed with vacuums that utilize a maximum combination of airflow, water lift and agitation for effective soil removal. Additional time spent vacuuming in these areas is essential to contain the spread of soil into the facility. Examples of these areas are entrances, lobbies and areas where hard surfaces transition to carpeted surfaces.

If matting, a textile surface designed to remove soils, takes 25-plus feet to remove nearly all the soil, it stands to reason that under normal circumstances one should allow up to 40 feet for soils accumulated walking on hard surfaces to be walked off onto normal carpet. Beyond 40 feet, we are not dealing with a significant amount of embedded soils, but rather lighter soils and particulates such as dust, dander, hair, paper dust and VOCs. In these areas, vacuums that offer high production rates but may not offer the same combination of agitation and airflow/water lift would be appropriate. Examples of these types of vacuums are:

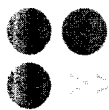
- Back pack vacuums.
- Canister vacuums.
- Wide-area vacuums.
- Stand-on vacuums.
- Riding vacuums.

Carpet that is extremely matted should be vacuumed with a pile lifter to effectively lift and open the pile for cleaning. Carpet that is left in a matted state will be difficult to clean effectively. Under normal circumstances, this will only need to be performed in traffic lanes and not on the overall carpet.

A second component of daily maintenance on a textile surface is spot removal. A thorough examination of spotting is beyond the scope of this paper, but a couple points are in order.

First, spotting should be performed on a regular basis to maintain a clean, consistent appearance. Ideally spills are reported and cleaned up immediately; however, this is seldom the case. Generally speaking, spots are discovered during other cleaning procedures or during routine building inspections.

Second, there is a significant difference between a spot and a stain and this must be taken into account when spotting. A spot occurs when a substance is added to the carpet. A stain occurs when a color is added to the carpet. Generally speaking, spots can be removed more easily than stains. When dealing with a stain, complete removal may not be possible. Additionally, dam-



age to the carpet may occur from some spot removers or from aggressive agitation of the carpet.

In order to not cause additional damage, be sure to tamp the spotter in and do not rub. Be patient and understand that the best outcome may be to simply lighten the spot. Cleaning technicians should read all labels and test products in an inconspicuous space before use for color damage. Finally, when using any product that may damage the carpet, get customer approval in writing or approval from your supervisor.

Interim Maintenance

The third step in the PDIR Method is interim maintenance. Interim maintenance is the process of maintaining a

- **Absorbent compound-** With this method the detergents are controlled in an absorbent medium, either a synthetic powder or a cellulosic material. The detergent-infused absorbent compound is applied to the carpet and agitated into the pile. Once the medium is completely dry, it is removed with a thorough vacuuming. The area being cleaned can generally remain in service during the cleaning.
- **Bonnet-** With this method a pad and/or the carpet being cleaned is sprayed with a cleaning solution and the bonnet is rotated on the carpet with a low RPM rotary machine. As the bonnet pad contacts soil, it is absorbed into the pad. The bonnet pad should be checked for soil absorption

Restorative Cleaning

The final step in the PDIR Method is restorative cleaning. This is the process of returning the carpet as close as possible to a "like new" condition through a high-intensity cleaning. In order for a successful restorative cleaning process to occur, the five principles of cleaning must be followed:

1. **Dry soil removal-** According to the SW Studer study (figure 2), 79 percent of the soil in a carpet is insoluble dry particulate. As we learned early in life, when you add water to dirt you create mud. That elementary law of physics does not cease to exist in your carpet during cleaning. If you do not thoroughly remove dry soil before adding moisture to the carpet you are creating "mud" in the

"Restorative cleaning ... is the process of returning the carpet as close as possible to a 'like new' condition through a high-intensity cleaning."

clean, consistent appearance of the carpet with less water, chemical, labor and dry time. Implemented correctly, these procedures will allow the cleaner to extend time between restorative cleanings.

Interim maintenance can be done with multiple cleaning methods and is generally a lower-intensity cleaning. Here are the most common options:

- **Encapsulation-** With this method a chemical that encapsulates soils is applied to the carpet and agitated into the pile. After drying, it is extracted by a thorough vacuuming. This can be performed as soon as the product has thoroughly dried or the next time daily vacuuming is performed. This method uses less chemical and far less water than extraction and returns the carpet to service in a short amount of time.

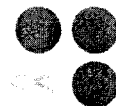
frequently (every 100 to 150 square feet as a rule of thumb) and when the pad begins to soil it should be replaced. Note: Before using the bonnet method, consult the manufacturer's cleaning recommendations and warranty information. Most manufacturers strongly recommend that this method not be used and may void the warranty if it is.

By utilizing interim maintenance procedures in lieu of restorative maintenance, the waste stream of the building is reduced and environmental impact is lessened. Less chemical and water is needed to maintain the clean and consistent appearance of the carpet when compared to restorative cleaning. Interim maintenance can be performed three to five times between restorative cleaning.

carpet. Wet extraction equipment is not designed to effectively remove dry soil in a wet state from carpet. The most effective way to remove dry soil from carpet is in a dry state with a thorough vacuuming.

2. **Soil suspension-** In this step, using a presoak or prespray process, the sticky, oily soils are broken loose from the fibers and held in suspension for extraction. If this step is neglected, and the chemical is only applied during the spray-and-extract step, the chemical may have a mere fraction of a second of dwell time before it is agitated and extracted.

The soil suspension process is similar to that commonly used to clean a lasagna pan: fill with hot



water, add some dish detergent, and allow it to soak. In the morning a small amount of scrubbing and a through rinsing will yield a clean pan with minimal effort.

The soil suspension process for carpet uses similar elements to those used in cleaning the lasagna pan:

- *Time*- Allowing the pan to soak overnight allows the detergent time to separate the oily, sticky soils from the pan. In the same way with carpet, apply a good prespray and allow it to dwell for 10 to 15 minutes. This will loosen the soil and suspend it from the fibers.
- *Agitation*- Agitating the prespray into the carpet provides thorough distribution of the chemicals into the pile.
- *Chemical Action*- Using a chemical designed for the soils you are attempting to remove is important, otherwise it will not be effective.
- *Temperature*- In most cases, applying the prespray at elevated temperature is beneficial. The higher molecular activity or energy value of hot water enables it to be more effective at removing greases, fats and oils than cold water. Furthermore, hot water dries faster.

3. **Extraction**- Extraction is the crucial step where the suspended soils are removed. It is important to use water only or an acid rinsing agent instead of extraction detergent in your extractor. There are two primary benefits of using acid rinses: First, an acid rinse will help neutralize the pH of alkaline presprays used in the soil-suspension step. Second, it removes more residues and leaves the carpet in a state where it is less prone to soiling. Some rinses and extraction solutions today are being offered with a small amount of encapsulant in the chemistry. This addition allows for residual soils that wick to the surface in the drying process to be encapsulated and more easily removed through vacuuming.
4. **Grooming**- Grooming is only performed on cut-pile carpet. Its purpose is to open the pile which speeds-up drying times and improves the appearance.
5. **Drying**- Before cleaning, consider environmental factors such as humidity and air movement in a facility. The cleaning plan should consider drying equipment already in a facility such as HVAC systems, fans, and windows that can be

opened if it is appropriate. Be sure outside conditions are conducive to aiding the drying process and that permission has been given before opening windows. Drying equipment such as air movers should be used to enhance airflow and speed the drying process. HVAC systems should also be operated for 24 hours after cleaning to assist in the drying process.

If all five principles are not implemented, the results will be less than optimal. Many times when cleaners complain about their cleaning not turning out well, it is because they did not follow these five steps.

As the national insurance company's results after 20 years and millions of square feet of carpet purchased and maintained show, implementing a program with an understanding of how soil enters a facility and how to minimize its impact is key to lowering lifecycle costs. A program that minimizes the amount of soil that enters the building envelope, removes soil that enters on a daily basis, uses interim maintenance methods to maintain a consistent appearance, and incorporates restorative cleaning to maintain a clean, healthful facility, will reduce overall costs and improve performance. ☺

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