White Paper:

STUDENT HEALTH. STUDENT PERFORMANCE. STUDENT SUCCESS.

How flooring supports 21st Century learning in colleges and universities.

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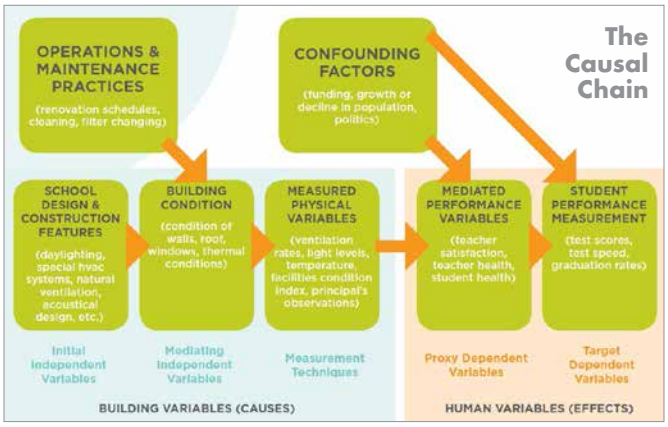
The foundations for successful learning in higher education must include the impact of the built environment on students and faculty. The performance characteristics of building materials can help students achieve their educational goals by keeping them safe, healthy and alert.

One fundamental but often overlooked element of educational spaces is the floor. Resilient flooring decisions can have a far-reaching effect on budget, safety, absenteeism and aesthetics. Flooring is more than a design driver – it is a decision that impacts health, safety and wellness. Creating spaces that promote a safe and healthy learning environment can have a positive impact on academic performance and student, faculty and staff wellness.

Aging infrastructure in higher education

A recent State of Facilities in Higher Education report estimated that colleges and universities account for 1.4 billion gross square feet in over 40,000 buildings that support more than three million students.[1]



Aging colleges and universities are renovating or taking on new construction to improve campus health and safety. Due to infrastructure and budget concerns, many schools have adopted a reactive approach to facility repair, creating maintenance

backlogs with limited staff that are unable to keep up with demand given the rise in new construction. Trying to achieve top performance at the lowest cost can be challenging and may lead to additional infrastructure concerns in the future.

The cause effect issue is one of the largest challenges faced when attempting to define impacts of building design decisions on health.[2] The constraint on resources means more for the renovation and daily upkeep of existing facilities given maintenance staff have not expanded adequately to cover newly constructed space.[3]

Investments in infrastructure are necessary to maintain a competitive edge and attract and retain students given the competitive nature of the higher education market. When capital dollars enable new construction to occur, facilities are faced with additional square footage to maintain. These budgetary challenges force administrators to find innovative ways to manage limited operational resources more efficiently.

Campuses that implement policies and practices in four specific areas have experienced greater success in navigating the relentless trials of facilities management.[4]

1. Lower capital and operational demands.
2. Make the problem "smaller" for decision-makers.
3. Make the most of capital funding.
4. Manage operational resources more effectively.

Evidence-based design for specification

Evidence-based Design (EBD) is "the process of basing decisions about the built environment on credible research to achieve the best possible outcomes."[5] The principles of EBD can apply to a wide range of occupancies, including college and university buildings. According to the Healthy Buildings Teams at Harvard, there are nine foundations of a healthy building. They include ventilation, air quality, thermal health, moisture, dust and pests, safety and security, water quality, noise, lighting and views and ventilation.[6] Any of these can have a direct impact – positive or negative – on academic performance and a student's ability to learn. Those specific to resilient flooring include indoor air quality, moisture in the floor, safety issues and noise mitigation.

Taking this concept further, the built environment can be broken down into specific areas to demonstrate how building features affect health. Physical conditions, such as ventilation rates, temperature and lighting; construction features, including daylighting, natural ventilation and acoustics; and building materials, such as walls, roof, flooring and windows.

The condition and presence (or lack thereof) of any of these features can influence a student's ability to absorb and process information and potentially impact retention of both students and faculty. Applying the EBD process to specification of interior finishes allows designers to focus on the impact of the built environment on its occupants.

Facilities and indoor air quality

Colleges and universities with facilities built prior to 1980 may contain hazardous building materials, including but not limited to asbestos, lead paint and outdated wiring. Older buildings can present dust mites and mold in addition to potentially toxic chemicals found in building materials and interior finishes. The presence of these pollutants can negatively impact indoor air quality (IAQ) and pose health issues to students and faculty. Considering 1:13 adults in the U.S. has asthma, which is a lung disease, having good IAQ is critical to health.[7]

Excellent IAQ can have a positive impact on the health and safety of university students, faculty and staff, resulting in:

- Reduced absenteeism
- Improved speech intelligibility and footfall sound reduction
- Resistance to bacteria and fungi
- Enhanced physical safety
- Less glare and light reflective value (LRV), better visual acuity and cognitive function

U.S. Environmental Protection Agency (EPA) studies indicate that human exposure to indoor air pollutants can be two to five times higher than outdoor levels.[8] Resilient flooring that requires a maintenance protocol of stripping, coating and refinishing in tandem with harsh chemicals can emit harmful volatile organic compounds (VOCs) and can contribute to poor IAQ.

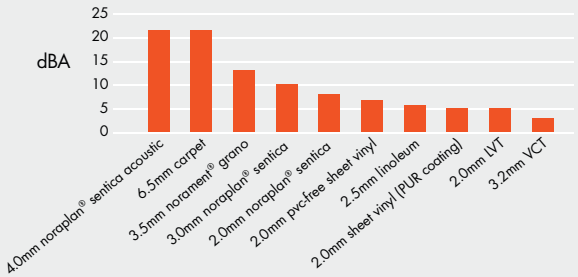
Knowledge expands daily on implications of prolonged exposure to toxic chemicals in building materials as it relates to health and wellness. According to Dr. Greg Norris, Harvard School of Public Health, "The amount of VOCs emitted from a single waxing of a floor is comparable to the amount of VOCs emitted from the flooring itself over its entire lifetime."[9] Premium rubber flooring

cleans with little more than water and never requires coating, stripping or refinishing during its useful life.

Impact of acoustics on learning

The ability to hear and be heard plays an integral role in the learning process. A growing body of research links acoustics to student learning and achievement. The Acoustical Society of America estimates that many classrooms have a speech intelligibility rating of 75 percent or less, although it's recommended students with average hearing have a 95 percent speech recognition level.[10] This poses severe problems for students with hearing difficulties or who lack fluency in English.[11]

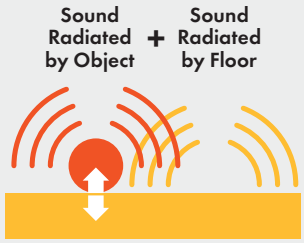
Large lecture halls, such as those found in colleges and universities, can pose auditory challenges for students. Premium rubber flooring reduces in-room impact noise transmission, helping control unwanted ambient noise. Its superior acoustical properties reduce unwanted noise to lessen distractions and provide greater speech intelligibility for both students and faculty. A third-party research study showed that premium rubber is up to four times quieter in dBA than vinyl composite tile (VCT).



Human Reactions to Change in Level	
Change in Level	Reaction
3 dBA	Perceivable sound difference
5 dBA	Clearly perceivable sound difference
10 dBA	Doubling (or halving sound)
20 dBA	Four times louder (or quieter)

A third-party independent acoustics study conducted on "In-room Impact Noise Reduction" shows a significant degree of acoustical separation between floor coverings

- Premium rubber acoustic 4mm (21dBA)
- Carpet 6.5mm (21dBA)
- Premium rubber 3.5mm (13dBA)
- Premium rubber 3mm (10dBA)
- Premium rubber 2mm (8dBA)
- PVC-free sheet vinyl 2mm (7dBA)
- Linoleum 2.5mm (6dBA)
- PVC sheet vinyl 2mm (5dBA)
- LVT 2mm (5dBA)
- VCT 3.2mm (3dBA)



Safety and comfort for all

Resilient flooring can impact both the comfort and safety of students and faculty. Slips, trips and falls are a major concern in maintaining safe spaces. Coefficient of Friction (COF) is often considered the only relevant component of slip resistance, but it's complicated to measure effectively and consistently. Non-coated premium rubber floors have a high COF range of .76 to 1.0 – regardless of whether they're wet or dry. A high COF is important for common areas such as the dining commons where floors are often wet. Gymnasiums also benefit from a high COF since it may help prevent sports-related injuries. It is important to remember that once any resilient floor is coated, the COF changes since you are no longer walking on the floor, rather the coating.

Premium rubber flooring can also reduce musculoskeletal stress on faculty and staff. An independent test method, supervised by a senior clinical research consultant, used an in-shoe transducer measuring pound per square inch (psi) on the metatarsus (the group of bones between the ankle and toes) using both carpet and premium rubber flooring. The peak pressure on carpet showed 3.5 kg/cm^2 while premium rubber maxed at 2.8 kg/cm^2, proving premium rubber can have an ergonomic advantage over carpet.

That resulted in a third-party research study by the University of Pittsburgh Bioengineering Department that measured seven different floor coverings over 50 cycles for force, impact and reaction on musculoskeletal health. It concluded the force of a

person's foot impacting the floor can be defined by walking on the resultant floor covering. For example, a 216-pound person walking on 3mm premium rubber has an impact on the body of 156.84 pounds, while the same person walking on 2.5mm linoleum greatly increases musculoskeletal impact at 240.99 pounds.

Professions that require a great deal of standing during the workday – such as college and university faculty – are often subject to musculoskeletal disorders (MSDs). MSDs are the leading cause of pain, suffering and disability in the workplace, resulting in more than 400,000 injuries every year. The direct cost of MSDs is over $20 billion per year and accounts for one-third of all worker compensation costs.[12] Premium rubber's dense surface offers enhanced ergonomic properties to lessen the strain of those who are standing on their feet for prolonged periods of time.

The importance of life-cycle cost analysis

When specifying interior finishes, such as resilient flooring, specifiers must look beyond first cost and calculate the life-cycle cost (LCC) of a floor. The resultant data from a credible third-party LCCA tool demonstrated that a coated floor can consume 80 to 90 percent of the operational budget in floor maintenance alone due to the stripping, coating and refinishing protocol. A coated floor, either VCT or a factory-applied coated floor that does not sustain for the life cycle of the floor greatly impacts total cost of ownership (TCO). The International Sanitary Supply Association (ISSA) cleaning and maintenance protocol standards coupled with a third-party LCCA tool can evaluate both the real-time and life-cycle cost for both a coated and non-coated resilient floor.

ISSA provides a framework to assess the effectiveness of the cleaning process, which contributes to the quality of the indoor environment for the benefit of students and staff.[13] To support operational optimization, administrators can use the data to reallocate tasks from the maintenance backlog given the reduced hours in floor cleaning and maintenance for a never-coated resilient floor. An LCCA can help administrators and facility and environmental services managers make informed decisions for the specification, purchasing, installation and maintenance of flooring. ISSA states, "Facility decisions makers need to stop thinking of cleaning as a cost and start thinking of it as the profit center it truly is."

Both economic and environmental considerations impact LCCA. Economic factors include:

- Material first cost
- Installation material and labor costs
- Maintenance protocol and labor costs
- Performance characteristics
- Cleanability, repairability

Environmental considerations can include how raw materials were sourced, sustainable manufacturing practices, elements of the product and chemicals used in the cleaning and maintenance process. Premium rubber flooring embraces many of these practices with a cleaning regimen that requires little more than water.

Clean, measure, monitor

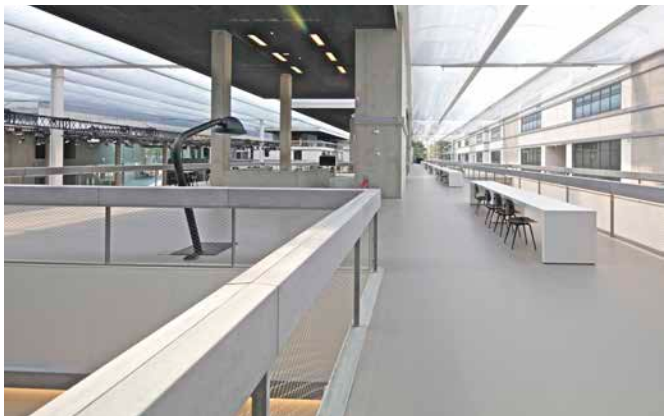
Proper cleaning and maintenance can extend the operational efficiency and useable service life of a resilient flooring product. It's important to consider what level of cleaning and maintenance is required to achieve the desired level of cleanliness.

The ISSA K-12 Clean Standard was developed by a consensus-base process representing all sectors of the industry, including the facility management and school communities selected by the ISSA board, staff and alliance partners to participate in standard development.

The committees worked directly with ISSA and its partner, the Cleaning Industry Research Institute (CIRI), to draft the Standard, which was subject to full peer review prior to official publication. The results assessed and improved cleaning processes and product selection, resulting in a clean, healthy and safe learning environment.

Considering cleaning and maintenance can comprise 80 to 90 percent of the operational budget as it pertains to flooring maintenance, it is imperative to understand the ongoing maintenance regimen, which can have a significant impact on TCO when it comes to resilient floor selection.

Proper cleaning and maintenance can extend the operational efficiency and reference service life (RSL) of a flooring product. The Resilient Floor Covering Institute (RFCI) shares RSL of resilient products in their Environmental Product Declarations (EDPs). Premium rubber flooring has a thirty-five-year RSL according to RFCI. It can be simply cleaned with a mop and water. Its dense surface can withstand heavy foot traffic and the weight of rolling loads. Unlike many resilient floors, premium rubber also has no factory-applied coating and never needs waxing, making it ideal for colleges and universities with limited downtime to the facility.



Durable floors for demanding spaces

Finding a resilient floor that offers low maintenance with high operational efficiency involves looking below the surface. Many resilient floors require a coating, stripping and refinishing process due to the porosity of the surface or factory-applied coating. When a factory-applied coating, i.e., urethane or polyurethane reinforced (PUR), no longer sustains the wear layer and becomes scratched or dull, the floor now has to be coated to maintain its aesthetic appearance. Once coated, IAQ, safety and cost of ownership are compromised.

Premium rubber flooring has no factory-applied coating and never requires waxing. It also resists staining and wear caused by harsh cleaning chemicals, spills, high-traffic footfall, rolling equipment and moving furniture to change room configurations. In addition, premium rubber has an extremely dense, closed surface that is inherently bacteriostatic and fungi resistant.

Premium rubber flooring also has a low VOC rating, contributing to a healthier environment and IAQ. Premium rubber that is GREENGUARD Gold certified tests for an additional 330 chemicals and total volatile organic content (TVOC), making it one of the most stringent and rigorous IAQ certification programs in the world. Green cleaning protocol improves IAQ and can contribute to LEED and U.S. Green Building Council (USGBC) rating system credits.

Flooring with third-party-compliant EPDs and Health Product Declarations (HPDs) provide another level of confidence in the performance and sustainability of the product. Using LCCA during flooring specification helps colleges and universities lower operational expenses while increasing the health and safety of students, faculty and staff.

Higher-ed applications for premium rubber

There are many spaces in colleges and universities that would benefit from premium rubber flooring. To understand why premium rubber is an ideal application, let's look at its performance characteristics.

- Reduces unwanted sound
- Lessens distractions
- Enhances speech intelligibility
- Fosters a safe environment
- Lowers outlay for maintenance
- Promotes healthy IAQ
- Chemical free, no-coating protocol
- Sustainable product
- Comfortable underfoot
- Improves ergonomics
- Reduces cognitive discomfort
- Inhibits bacterial growth

Here are just a few areas in higher-ed facilities that would benefit from premium rubber flooring:

Auditorium/Theater – Can you hear me? Premium rubber flooring's dense, closed surface helps reduce unwanted sound while providing superior acoustics from the front row to the back row.

Classrooms – Classrooms can be filled with distractions, so it's important to have flooring that contributes to a healthy learning environment. Premium rubber flooring helps keep students alert by promoting a healthy IAQ with reduced surface glare that can lessen fatigue and cognitive discomfort.

Common Areas – Gathering spaces such as cafeterias and student centers can pose hazards such as trips and falls from wet floors. The surface density of premium rubber flooring offers a higher COF for additional traction to prevent slipping. The non-coated surface of premium rubber helps to reduce glare and the perception of slipperiness.

Computer Lab – Static-dissipative rubber floor coverings are the ideal solution for university computer room applications, reducing the incidence of electrostatic discharge.

Gymnasium – Premium rubber flooring can withstand the effects of heavy traffic and harsh impacts. Its slip-resistant and soft cushioning make it ideal for athletic competitions. Athletes can play with greater confidence on a floor that delivers less glare than coated surfaces.

Laboratories – Chemicals used in laboratories can stain floors and compromise IAQ. Rubber flooring's inherent stain resistance makes spills easy to clean, which can reduce growth of bacteria and fungi. Its hygienic properties also contribute to a more sterile environment.

Lecture Hall – The ability to hear and be heard can be challenging in large classrooms that hold hundreds of students. The sound absorption properties of premium rubber help reduce unwanted noise and increase speech intelligibility to create an optimal learning environment.

Preserving higher education

As colleges and universities continue to invest in aging infrastructure along with new construction, the use of interior building materials that support health and wellness are increasingly common. This conscious effort to specify sustainable materials to attract students with eco-friendly values supports health and wellness for all who work and learn the built environment. Interior finish specification that supports the principles of evidence-based design can further enhance the health, safety and educational outcomes of students and faculty.

Resilient flooring selection should focus on reducing health and safety risks to students and faculty while providing a sustainable solution that embraces LCCA and lowers TCO. Steps for specifying flooring that creates a foundation for successful learning include:

- Evaluate flooring as a performance driver for students and faculty
- Examine premium rubber flooring's impact on achieving educational goals
- Foster and influence the built environment for 21st-century learning
- Evaluate flooring performance characteristics that address exposure and risk to IAQ; musculoskeletal fatigue; slips, trips and falls; absenteeism; speech intelligibility and surface contamination
- Using LCCA to support product selection and determine the TCO over the lifespan of the resilient flooring product

Health and safety are design drivers in all aspects of the built environment – including flooring. Selection should focus on exposure and risks to students, faculty and staff. Knowing the physical environment has a direct impact on outcomes, including student performance, colleges and universities continue to embrace the principles of human-centered and evidence-based design for product selection in support of a safe and healthy learning environment.

End Notes

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