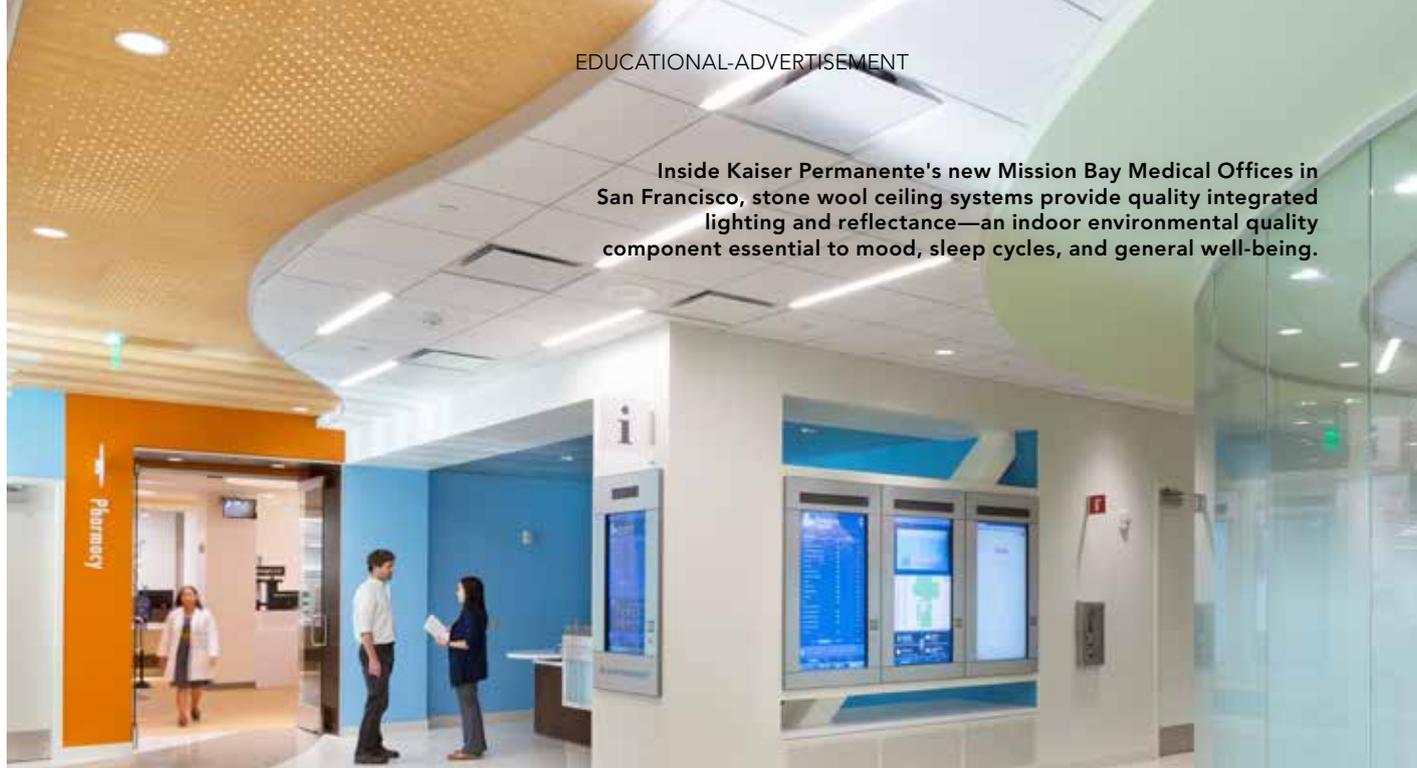


Photo courtesy of Rockfon



Inside Kaiser Permanente's new Mission Bay Medical Offices in San Francisco, stone wool ceiling systems provide quality integrated lighting and reflectance—an indoor environmental quality component essential to mood, sleep cycles, and general well-being.

Stone Wool Ceiling Tiles in Healthcare

High-performance ceilings' role in helping deliver resilient buildings and healthy spaces

Sponsored by Rockfon | *By Erika Fredrickson*

Indoor environmental quality (IEQ) has become a top priority in a time when awareness of health, safety and well-being is higher than ever. Ceiling systems comprise an important element in a broad range of solutions that consider IEQ and sustainability goals. In commercial buildings dedicated to healthcare, the need for flexibility and customized technology has created some challenges and led to opportunities for innovation that are holistic in approach and cutting edge in design.

IEQ refers to the quality of a building's interior environment in relation to the health and wellbeing of those who occupy it. Components of IEQ include IAQ, lighting and daylighting, aesthetics, and acoustics, all of which are vital elements for architects to consider. When IEQ is poor, occupants can suffer long-term and short-term physical and mental effects. According to the U.S. Environmental Protection Agency (EPA), Americans spend, on average, about 90%

of their time indoors. For this reason, IEQ design becomes even more crucial.

Furthermore, the people most susceptible to adverse effects of poor IEQ—the very young, older adults, and people with medical conditions—tend to spend even more time indoors. Within these indoor environments, issues such as too much noise, bad air, and poor lighting can interfere with daily activities. Lack of communication, concentration, and sleep lead to stress responses such as high blood pressure and anxiety. Noise can impact mood and well-being for all those occupying the space.

Over the years, architects have taken a more holistic view of the built environment. The pandemic—in its various phases—has magnified the need for IEQ design. The emphasis on IEQ is now a gold standard for those designing buildings in healthcare. IEQ components not only matter in practical ways for health and safety, but they have also become guiding forces for exciting

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Learning Objectives

After reading this article, you should be able to:

1. Describe how high-performance ceiling tiles with a high Noise Reduction Coefficient (NRC) can positively impact acoustics in the healthcare environment.
2. Explain how stone wool ceiling tiles can help deliver on indoor air quality (IAQ), mold and mildew, and fire resistance.
3. List product performance standards and material ingredient reports that provide transparency for acoustic ceiling tiles.
4. Discuss how high-performance ceiling systems meet building design standards and evidence-based design recommended practices.

To receive AIA credit, you are required to read the entire article and pass the quiz. Visit ce.architecturalrecord.com for the complete text and to take the quiz for free.

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innovations in architectural design.

Good IEQ can enhance the lives of building occupants, increase the resale value of the building, and reduce liability for building owners. Often, a material or product may impact or support several elements of IEQ at once—and ceiling systems are a good example of that.

Few specifications could be as important as those for hospitals and other healthcare facilities. The ceiling system plays an important part in the overall healthiness of the building, as well as the health of the patients and staff. Attention should be given to ceiling systems with excellent acoustic performance to cut down on noise that can make staff irritable and inhibit patient healing. The right ceiling system can save energy on lighting and cooling. It can help prevent mold and mildew growth and can be cleaned and wiped down. It can be made of recycled and recyclable materials. And a full palette of colors can help create a warm and inviting setting appealing to patients, staff, and visitors alike.

One ceiling material that is now being specified and used in healthcare settings is stone wool.

Manufactured stone wool is composed of basalt rock, recycled material from other industries, and held together with a binder. Stone wool ceiling tiles are composed of this stone wool, plus a layer of mineral fleece, and finished with a water-based paint and sometimes a lacquer. The stone wool fibers of the tiles are intertwined in a texture that is similar to cotton candy. The non-directional fiber orientation of stone wool and the open surface make stone wool ceiling tiles and panels highly sound absorptive.

Stone wool acoustic ceiling panels are UL/ULC certified for NRC and AC. They also have other key performances that help deliver on indoor air quality: Certified as UL Greenguard GOLD for low VOC emissions, these panels have also demonstrated resistance to mold and mildew growth when tested to ASTM D3272, are easily cleanable and humidity resistant. In addition, they are rated Class A fire performance and have high light reflectance. Most of these properties contribute to IEQ goals and support the health, safety, and well-being of occupants.

Stone wool ceiling systems can integrate well with quality lighting. Their light reflectance helps enhance natural light. Natural light is vital to human functioning and plays an important role in both psychological and physiological well-being, affecting mood, sleep cycles, and productivity. A 2016 Market



Photo courtesy of Rockfon

Ceiling systems play an important role in healthcare settings. High-performance materials such as stone wool support indoor air quality and save energy on lighting and cooling.

Report published by Dodge Data & Analytics identified access to daylight as a key feature for healthier buildings.

Aesthetics is another IEQ component that stone wool ceiling systems can achieve. Interior finishes can be used to design inspiring and beautiful interior spaces that promote health and well-being. Stone wool panels come in a variety of styles, colors, and shapes; however, the overall aesthetic is decidedly modern. Attributes can be selected to contribute to the design of a space. Biophilic design is an aesthetic type that fits well within the health care industry, has shown to aid in healing, and can be created with ceiling finishes and shapes. The concept is used within the building industry to increase occupant connectivity to the natural environment through direct nature, indirect nature, and space and place conditions.

When it comes to healthcare settings, acoustics are one of the most important design elements that affect IEQ. Optimizing acoustics in the environment requires a combination of highly absorptive ceiling panels (Noise Reduction Coefficient or NRC), robust walls with the right STC rating, as well as other elements such as floor slabs.

According to the World Health Organization, noise can seriously impact human health. Excessive or unwanted noise can cause both short- and long-term health

problems. Most obviously, noise can interfere with a person's daily activities, whether at school, work, home, or a healthcare environment. Noise can disrupt sleep and interfere with concentration; it can also induce a stress response, which comes with several potentially harmful physiological responses such as increased blood pressure. And, as most of us have experienced, unwanted noise can be irritating, thereby affecting our mood and overall well-being.

Healthcare facilities are often noisy places. For instance, many sounds are present in hospital environments, including those from beepers, alarms, machines, rolling carts, HVAC systems, and conversations, among other sources. These can be severely irritating and at times harmful to patients, depending on their current conditions (i.e., age, hearing ability, medication intake, cultural background, and pre-existing fears and anxieties). Acoustics in healthcare environments are complex and require a careful, strategic design. Specific acoustical considerations in healthcare settings include supporting patient well-being and privacy, supporting communication among staff, and meeting standards and regulations (e.g., HIPAA).

In recent years, these issues have received much attention. As evidence, acoustics are a key component of several new healthcare design guidelines; many studies identifying

Photo courtesy of Rockfon



Architects have taken a more holistic view of health care buildings, considering the ways in which acoustics can impact the stress levels and communication abilities of both patients and staff.

design strategies to improve acoustical conditions in healthcare environments have been conducted; and hospitals throughout the United States have taken initiatives to improve their acoustic environments.

Acoustic design requires an approach where absorption, isolation, and background sound performance work together without sacrificing aesthetic design. Three important components of acoustical performance are sound absorption, interior isolation, and mechanical (HVAC) noise control.

Unlike sound blocking, sound absorption is what happens when a material has the ability to absorb and dampen the sound. Softer materials, such as carpets, fabric panels, or perforated ceiling tiles, are most often used for this purpose. In a classroom full of kids, an open office with collaborating employees, or a medical facility where conversations need to be both private and intelligible, sound absorption is key. Sound absorption is calculated in terms of the NRC, which measures the amount of sound absorbed by ceiling panels or other materials. The higher the NRC, the higher the absorption.

Designing intentionally for a comfortable acoustic environment is important in supporting the safety, health, healing, and well-being for patients, staff, and visitors alike in any healthcare setting. An optimized acoustic environment reduces stress not only for the patient but also for doctors, nurses, and support staff. It can reduce errors and aid in good communication, which is essential in settings where accuracy is of the utmost importance.

Acoustics in healthcare settings also need to support speech privacy. Patients and their healthcare providers must be able to talk candidly about the patient's condition, while adhering to confidentiality rules and HIPAA standards. A patient who feels their conversation may be overheard might end up withholding certain vital information or be reluctant to voice all their concerns. Maintaining speech privacy in healthcare settings encourages honest communication among patients, providers, and family members.

High-performance acoustical ceilings can improve patient and resident comfort and

safety, while helping maintain caregiver and employee morale, focus, and productivity.

Several healthcare design guidelines emphasize the importance of acoustics in the design of healthcare environments. Published standards include Sound and Vibration Design Guidelines for Hospital and Healthcare Settings, HIPAA, Facilities Guidelines Institute FGI/ASHE Guidelines for Design and Construction for Health Care Facilities, LEED for Healthcare, and the Green Guide for Health Care.

Although we are focusing on health care environments, it is important to note that IEQ components are also essential to design in schools and offices, where speech intelligibility and productivity affect occupant health, safety, and well-being. In a big-picture view, it is worth thinking about how the indoor environmental quality of spaces in which we live, work, and play can set the stage for our long-term health. IEQ in healthcare spaces is important, but a holistic view of architecture can consider these other environments as spaces where preventative healthcare begins.

BUILDING RESILIENCE AND SAFETY

The Urban Land Institute describes resilience for buildings as “the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events.” Resilient buildings are created with resilient products that prove their ability to take on stressors and still absorb and retain their original state—just like how elastic returns back to form after being stretched.

Photo courtesy of Rockfon



Stone wool ceiling tiles are hydrophobic, which means they do not absorb moisture and will not support mold and mildew growth.

Stone wool acoustical ceilings are durable, which is a quality that supports building resilience. Some of its durable aspects—such as having a resistance to moisture and mold—also support IEQ goals, including indoor air quality. Overall, a durable material can result in a longer life for the building, which can reduce costs over time and can be environmentally beneficial.

Mold and mildew will degrade the quality and performance of the ceiling system over time and affect the overall health of the building. They also create IAQ health concern for occupants and can be especially detrimental in health care spaces, particularly for people with asthma or other respiratory conditions.

Since it is made from stone, the stone wool used in ceiling tiles is hydrophobic. It does not absorb moisture and will not support mold and mildew growth. Stone wool is also unaffected by changes in temperature and humidity. The acoustical tile systems facilitate air flow and resist humidity. One benefit of this resistance to humidity is that opening windows and allowing fresh air to enter the building does not affect the ceiling performance.

As we've discussed, these healthy environments are important in all indoor settings, but vital to spaces where occupants spend long durations, such as schools, offices, and healthcare facilities. In these spaces, air flow and moisture balance contribute to better learning and health and higher productivity and satisfaction.

Stone wool ceiling tiles meet ASTM D3273 mold testing, which is the standard test method for resistance to the growth of mold on the surface of interior coatings in an environmental chamber. In this qualitative test, the test surface is examined via microscope before and after the 28-day incubation period. Test samples are suspended in the environmental chamber with the organism species in soil at the bottom of the chamber. Results are measured on a scale of 0 to 10, and the organism species tested are *Aureobasidium pullulans*, *Aspergillus brasiliensis* (historically known as *Aspergillus niger*), and *Penicillium citrinum*.

Stone wool acoustic tiles also meet ASTM C1338 mold testing, which is the standard test method for determining fungi growth resistance of insulation materials and facings. This is a qualitative test with the same examination process and incubation period. In this test, the organism species is applied directly to the test samples. Organism species tested are



Stone wool ceiling systems have been certified as UL Environment GREENGUARD Gold for low volatile organic compounds (VOCs), which makes them a healthy choice for healthcare settings where more vulnerable populations reside.

Aspergillus brasiliensis, *Penicillium funiculosum*, *Chaetomium globosum*, *Aspergillus flavus*, and *Aspergillus versicolor*.

Although a European based test NF S 90-351 for Clean Rooms and Related Controlled Environments, it is interesting to note that when tested stone wool tiles specifically designed for medical environments achieve a microbiological class M1 fulfilling the requirements of NF S 90-351 in the very high-risk Zone 4.

Tested with MRSA *Candida albicans* and *Aspergillus brasiliensis*, the bactericidal and fungicidal effect of dry steam cleaning stone wool tiles meets the requirements of NF EN 14561 and NF EN 14562, meaning the disinfection is very effective.

Stone wool ceiling tiles and panels have earned UL Environment GREENGUARD Gold Certification for low volatile organic compound (VOC) emissions. This certification process takes into consideration safety factors that may impact those with vulnerable immune systems, including children and the elderly. The stringent UL GREENGUARD Gold certification is recognized by numerous green building and wellness programs, including the Collaborative for High Performance Schools (CHPS), the WELL Building Standard, and LEED.

Stone wool provides several aspects of fire protection that contribute to building resilience as well as occupant safety. High-profile fire incidents have led to increased scrutiny of building safety. More than 3.7 million fires occur in cities worldwide every year, and more than 43,000 lives are lost as

a result. This, combined with the fact that fires today develop more than six times faster than in the 1950s, means there are good reasons for looking at improving fire safety requirements. Non-combustible materials, such as stone wool, play a crucial role in contributing to the fire-resistance of buildings, helping limit the spread of fire and smoke and assist in ensuring a safer environment for all residents. Stone wool ceiling tiles achieve a Class A fire rating when tested to ASTM E-84.

TRANSPARENCY AND SPECIFYING FOR PRODUCT PERFORMANCE

In the healthcare world, there are new evidence-based designs that support reduced treatment times and increased levels of patient comfort. The Center for Health Design categorizes the use of high-performing, sound-absorptive, acoustic ceilings (NRC 0.90 or higher) as a priority design recommendation based on the strength of the evidence available and the impact on safety, quality, and cost.

Knowing how to specify for products and systems that meet these recommendations is important—and that requires independent verification. Product transparency, disclosure, and optimization documentation can help with specifying products for IEQ and resilience. Architects have a range of resources to consult for third-party testing that ensures product performance for meeting certifications. New codes and standards are now driving designers toward a higher level of IEQ characteristics, such as sound

Photo courtesy of Rockfon

about a product's global warming potential, its potential toxicity, and manufacturer's sustainability initiatives, among other things. EPDs do not rank products. Instead, an EPD is a transparency tool that helps specifiers make choices based on sustainable qualities and environmental impacts. Products with EPDs can contribute to LEED and WELL credits.

A Health Product Declaration (HPD)

absorption and IAQ, which means resilient products are becoming the norm. These codes and standards are all highly relevant when meeting LEED, WELL, FGI, and other certifications.

When specifying for acoustic tile systems, there are a few ways to obtain verifiable product performance information. Key to transparency and product performance assurance are independent, third-party labels,

evaluations, and program certifications such as UL GREENGUARD Gold and Declare and product reports such as Environmental Product Declarations and Health Product Declarations.

An Environmental Product Declaration (EPD) report summarizes the life-cycle impact of a product from "cradle to grave" based on a product's life-cycle assessment (LCA). An EPD report includes information

Photo courtesy of Rockfon

CASE STUDY: "DO NO HARM"



Project: Premier Medical Plaza

Practice: Premier Gastroenterology Associates (PGA)

Location: Little Rock, Arkansas

Premier Gastroenterology Associates (PGA) wasn't just looking to build a new space for its healthcare practice, it was looking to create a new healthcare culture. The physician-owned association provides digestive disease care with a mission to do so in a warm, personal, and genuine manner. The new space needed to offer medical, clinical and surgery facilities for several medical groups in 100,000 square feet. But it also needed to be welcoming and comfortable in ways that support both patients and staff.

The PGA project repurposed a long-vacant big box retail space to create a patient-centered facility. It incorporated IEQ goals through the use of natural light and calming colors. The materials were selected for safety, health, cleanliness, and acoustic privacy. Premier's CEO, William E. Greene III, ACHE, described the vision for the plaza as a place where employees "feel like they're our family, and feel like they're coming home when they come to Premier Gastroenterology" and where the patient benefits from high-quality medical expertise as well as "compassionate care."

The philosophy behind the Premier Medical Plaza project fits well within the basic philosophy of good medical care. "First, do no harm" is the mantra in medicine, and when it comes to architecture and design for healthcare facilities, the same mantra applies. The challenge of converting a retail space into a clean and efficient medical facility took some planning and careful selection. It meant evaluating materials and finishes for safety and health. In the current pandemic era, infection control is even more of a priority than ever.

The choice of specially treated medical and hygienic ceiling panel surface finishes allow cleaning with water and some diluted disinfectants. In some cases, specially treated surface finishes on stone wool ceiling panels allow for more intensive cleaning, following a defined protocol. Premier Medical Plaza's most critical cleaning requirements required ceiling panels classified to Bacteriological Class B5 and B10. These panels have a low particle emission resulting in Clean Room Classification ISO Class 5. They are easy to clean but also do not absorb water, moisture or humidity, nor do they contain organic materials.

The ceiling system of metal and stone wool tiles PGA selected is inherently resistant to mold, mildew and harmful microorganisms. The mold and mildew resistance provides durability and longevity to the project. It also benefits indoor air quality and prevents exposure to bacteria that could especially affect occupants who cannot afford exposure to bacteria. The stone wool tiles used in this project also have the UL Environment's GREENGUARD Gold Certification for low chemical emissions, making them suitable for a healthcare facility, and providing safety factors support those with vulnerable immune systems, including children and seniors.

PGA also selected its ceiling system for sound control. Loud and overlapping sounds in the clinic—even on a conversational level—can easily become a mass of unwanted noise. That noise can cause distraction, confusion and agitation. Health care professional can lose focus and inaccurately record critical information. Too much noise can lead to health professionals not being able to prioritize and react to a patient in need. Patients with compromised hearing struggle with understanding instructions from their doctors or nurses. And it can also mean that private conversations between medical staff, patients and family members could be overheard. To make sure the repurposed space was optimized to protect privacy, increase comprehension and improve concentration and comfort, a ceiling system was selected with high acoustic absorption. Full-height walls or plenum barriers and floor slab were used where needed for sound insulation and blocking between rooms. And they ceilings ensured that background noise was within desired range. The acoustical design complied with the more stringent acoustic requirements of current building standards and guidelines for healthcare facilities.

Daylight interiors were created for an inviting environment for both patients and staff. Besides integrating with skylights, the stone wool panels white surface reflects 85% of light to illuminate the interior spaces. In the patient waiting areas, natural light enters through the floor-to-ceiling glass along the exterior walls. Metal panels made to look like wood provided durability while also offering a natural, biophilic element.

In the end, this project used three different ceiling products for its overall system. They each served a specific purpose in the facility's aesthetics and design, and, in doing so, supported the overall PGA mission.

is similar to an EPD but is focused on the health impacts of the product. HPDs are shared by manufacturers to disclose a product's ingredients and any health hazards associated with the ingredients. HPDs may be created by product manufacturers, by the manufacturer's agent, or by a third party. As with EPDs, an HPD is a transparency document that allows a specifier or building owner to compare the health impacts of products using a standardized format. Products with HPDs can also contribute to both LEED and WELL credits. With LEED Third-party verified HPDs contribute an additional ½ credit versus self verified.

These are strict requirements that help ensure products are acceptable for use in environments like healthcare facilities. The Facility Guidelines Institute (FGI) serves as an authority on health and residential care facility planning, design, and construction in the U.S. and is often used to inform guidelines abroad. The guidelines are consensus- and researched-based and are used by stakeholders across the industry including regulators, designers, and facility owners, in order to protect public health, safety and well-being.

Another verification source is Declare. Manufacturers voluntarily disclose product information on easy-to-read Declare labels. These labels report all product ingredients and use a simple color code system to flag chemicals of concern. Further information is provided on the product's final assembly locations, life expectancy, end-of-life options, and overall compliance with relevant requirements of the Living Building Challenge (LBC).

All active Declare labels are accessible on a free and searchable database. The database is used by leading designers, large real estate owners, and conscientious homeowners to specify products they know they can trust and that meet the requirements of leading green building standards, including the Core Green Building, LBC, LEED, and WELL certifications. Declare indicates 100% disclosure and presence of a red list ingredient not covered by an exemption. Declare LBC Red List Free indicates 100% disclosure and that the product does not contain any chemical on ILFI's red list. Declare LBC Red List Approved indicates greater than 99% disclosure and the use of an exemption.

When products are selected for IEQ features, they can often lead to building credits and certifications. For instance, LEED v4.1 offers acoustic credits in three



Photo courtesy of Rockfon

Specifying for ceiling systems for health design includes examining product reports through third-party reports, such as a Health Product Declaration (HPD).



Photo courtesy of Rockfon

It is important to understand the specification process for ceiling systems in healthcare settings and use the planning, design, and construction guidelines set by the Facility Guidelines Institute.

categories we discussed previously: maximum background noise produced by HVAC systems, minimum isolation from adjacent spaces, and an adequate amount and type of sound-absorbing finishes. Walls and ceilings are the critical building components in determining whether these credits have been achieved.

The WELL v2 standard has an entire concept dedicated to acoustics, called "Sound." There are eight features within the category, providing options for project teams to explore noise control and intentional acoustic design. The features are sound mapping, maximum noise levels, sound barriers, reverberation time, sound-reducing surfaces, minimum background sound,

impact noise management, and enhanced audio devices.

CONCLUSION

By their nature, healthcare centers and hospitals host vulnerable occupants who require a healing environment. Acoustical ceiling tiles in healthcare should support important indoor environmental quality components such as acoustics, light, aesthetics, and indoor air quality. High-performance ceiling systems that are durable will hold up to infection control and cleaning measures, while also enhancing natural light and resisting moisture and mold. In this setting, products that support Indoor Air Quality can lessen the load on patients already dealing with illness

Photo courtesy of Rockfon

CASE STUDY: ACOUSTICS AND CARE EQUITY



Project: Mission Bay Medical Offices
Company: Kaiser Permanente
Location: San Francisco, California

Mission Bay is one of the fastest growing live-work neighborhoods in San Francisco, California, and a perfect place for innovative design. Kaiser Permanente chose the neighborhood for the location of its medical office building—a nine-story, 220,000-square-foot structure that meets highest standards for sustainability and incorporates IEQ elements on a variety of levels.

Kaiser Permanente Mission Bay offers health care services, from adult and pediatric care to women's health services, plus a pharmacy, a laboratory, and optometry and optical sales. The facility also features a state-of-the-art MRI suite and consult rooms to support one-on-one counseling and care advice for families and individuals, as well as virtual visit technology that allows for quick telemedicine referrals to specialists.

The building is part of a wave of Kaiser Permanente medical offices designed with the goal of enhancing the care experience by using technology and space to make getting medical care easier, more convenient and focused on choice. It can house more than 100 doctors' offices and employ approximately 500 health care professionals, including physicians, nurses, technicians and administrative staff.

With so many services and a desire for elevating the experience of the occupants, material selection was key. In particular, the ceiling was designed to center on the patient comfort, safety and health, as well as support the staff and visitors. The top priorities for product specification were: optimizing acoustics with sound-absorbing ceiling panels that deliver a high Noise Reduction Coefficient (NRC), contributing to the indoor environmental and air quality (IEQ/IAQ) with GREENGUARD Gold certified products, and providing easy-to-clean materials that improve infection control.

In this case, the design-build team chose a whole-package selection of acoustic stone wool, metal and grid. Acoustical stone wool ceiling panels, concealed metal ceiling panels and 15/16-inch ceiling suspension system, plus trim. The smooth white surface was chosen for the majority of the common areas, which provided light reflection, and extended the natural daylight while also reducing the need for electric lighting. As with the PGA project, the Mission Bay offices were finished to mimic wood for a natural, biophilic element.

Acoustic enhancements and perforations allow these metal panels to provide high-quality sound absorption, as high as 0.90 NRC. Custom, decorative perforation patterns further distinguish the reception area's ceiling design. In this project, acoustics was especially important for speech intelligibility. The medical facility has dedicated services focusing specifically on Latino health and is equipped with new exam room technologies, including a large screen for better interpretive and educational services. To ensure the safety, equity and quality of the health care provided, qualified on-site Spanish and Chinese interpreters are available. Telephonic interpretation is available for more than 200 other languages. Serving a diverse population makes acoustics essential to communicating accurate information and providing an environment that is welcoming to all and solidifies itself as part of the neighborhood community.

In addition to key IEQ components, the stone wool products featured in the ceiling systems are GREENGUARD Gold certified for low emissions into indoor air during product usage. And, as with PGA, the wool and metal ceiling systems used in the Mission Bay project clean easily, resist water and moisture, and do not support mold, mildew or potentially harmful microorganisms, which contributes to a healthy indoor environment for occupants with vulnerable immune systems.

The project meets LEED Gold certification through the U.S. Green Building Council's new construction rating system. Features range from solar panels, natural light and outdoor views to maximized water and energy efficiency throughout the building.

and provide staff with a healthy environment as well. Extremely important to healthcare facilities are speech privacy and intelligibility, which requires ceiling tiles and systems that absorb sound so that health providers can communicate vital information and patients can sleep and recover in peaceful spaces.

The pandemic provided a spark in innovation for design. Medical centers are expected

to redesign and, in future builds, imagine a whole new way of incorporating infectious disease rooms with other areas of care, in addition to lobbies, conference centers, and offices—all of which can quickly adapt to patient care if there is a crisis. These innovations continue to evolve to meet health, safety, and wellness needs by understanding and specifying for the most durable and lasting

cutting-edge technologies. Ceiling systems play a major role in this evolution.

➤ Continues at ce.architecturalrecord.com

Erika Fredrickson is an independent writer and editor focusing on technology, the environment, and history. She is a frequent contributor for continuing education courses and publications through *Confluence Communications*. <http://www.confluencecc.com>



Rockfon provides customers with a complete ceiling system offering, combining stone wool ceiling panels with suspension grid systems and specialty metal ceilings. Our products help create beautiful, comfortable spaces. Easy to install and durable, they protect people from noise and the spread of fire while making a constructive contribution toward a sustainable future.

CASE STUDY: LEARNING ENVIRONMENTS FOR ALL

Project: Mae Smythe and Red Bluff Elementary Schools

Entity: The Pasadena Independent School District

Location: Pasadena, Texas

The Pasadena Independent School District (PISD) in Texas recently completed two major rebuilding projects to better serve its growing population of pre-kindergarten to fourth grade students. Both the Red Bluff Elementary School and Mae Smythe Elementary School buildings originally opened in the 1950s and improvements were made through the decades. After 60 years of use and withstanding hurricanes, the cost of repairing and renovating these campuses exceeded the cost of building new ones. The district received funding to embark on a multi-phase, comprehensive update to replace the aging structures with larger, newly constructed, contemporary buildings within their existing campus footprints.

To ensure an ideal learning environment, the PISD's goals for the new schools included healthy indoor air quality, energy-efficient operations, optimized acoustics, moisture and mold resistance, low-maintenance materials and a modern, welcoming appearance. Meeting all of the facilities team's criteria, the school district selected acoustic stone wool ceiling systems as the basis of design for both schools, and for future PISD projects.

Acoustic stone wool was used throughout the two new schools, with 2-by-2-foot ceiling panels installed in exposed suspension systems. The PISD's schools are located within the Houston metropolitan area, approximately 4 miles to Tabbs Bay upstream from the Gulf of Mexico. Hurricanes, tropical storms and humidity are as constant as the Texas heat.

Because of its hydrophobic and rigid qualities, the stone wool ceiling panels used in the schools Rockfon's ceiling panels in Red Bluff and Mae Smythe schools resist water and tend to not sag, stain or fall out of their suspension system.

The ceiling system in Red Bluff and Mae Smythe schools provides the same IEQ support in schools as in medical facilities. Children's small developing lungs and higher rates of respiration make them particularly vulnerable to chemicals and bacteria in the air. Reducing airborne contaminants lessens the risk for health concerns, irritability, and loss of concentration. This project's stone wool ceiling panels are UL GREENGUARD Gold certified for low VOCs.

The stone wool ceiling system is able to provide a comfortable and effective learning space. One way it does that is by delivering the high reflectance stone wool ceiling systems are known for. In rooms with exterior window systems, the ceiling panels maximize the use of natural daylight. In other rooms, the ceiling suspension grid system incorporates light fixtures and the white panels make efficient use of their electric lighting. Regardless of the source, the ceiling panels' bright white surface reflects 85% of the light into the rooms' interior.

This diffused lighting minimizes glare, allowing students to better see the high-tech screens and monitors without squinting and straining their eyes. High light reflectance and control can be especially important for students and teachers in sensory rooms, dyslexia and speech therapy rooms, and other special education services. To avoid distractions, these rooms do not have exterior windows and are located within schools' interiors.

The acoustic quality of the ceilings also provides an effective learning environment. As we have noted in this course, the right acoustics can support focus and clarity for all students. Along with enhanced visual comfort and a high light reflectance, the ceiling panels also provide high sound absorption in the libraries, cafeterias, common areas and hallways. This high level of sound absorption decreases reverberation and improves speech intelligibility for group

communication, which is highly important in academic environments.

At Mae Smythe Elementary's library and cafeteria, ceiling panels seemingly float in suspended ceiling clouds and islands above the sound-reflective tables, floors and other hard surfaces below. In the library, hoop-shaped ceiling clouds encircle large, LED ring lights greeting students to book collections and reading areas. In the cafeteria, the ceiling islands' grid pattern resembles a Mondrian painting, establishing the rectangular format as a whole structure and within smaller, inset, separated components.

Enhancing the bright, clean, modern appearance of the schools' ceilings, purposeful shifts in the grid pattern offer visual breaks and wayfinding cues. For example, standing on the first floor of Mae Smythe's two-story entry lobby, the ceiling grid aligns with the interior wall of the reception area, and standing on the second floor, the upper level's ceiling intersects at diagonal to match with the orientation of the hallways.

At Red Bluff Elementary, the ceilings uphold a symmetrical, monolithic ceiling grid pattern throughout the entire school and use bold bursts of color to define the interior spaces. In addition to their reliable day-to-day performance, the ceiling systems are durable and resilient with a long lifespan. When future updates are needed in the schools' lighting, HVAC, audio-visual or security systems, the ceiling grid allows individual panels to be conveniently removed for easy access to the plenum.

Mae Smythe Elementary School completed construction of its new facility and re-opened for its 800 students in 2018. Two years later, in 2020, Red Bluff Elementary School welcomed back approximately 600 students. Recognizing academic achievement and improved performance in Texas schools where 75% or more students are classified as living in low-income households, Children At Risk named Red Bluff a Gold Ribbon School at the close of the 2020-21 academic year. In Jan. 2021, Red Bluff also was honored by the nationwide program Healthier Generation, which presented the school with an award as one of America's Healthiest Schools.

Offices

A 2021 Harvard Business Review article focused on how designers are responding to changes in workplace spaces says designers are paying close attention to acoustics. Just like with schools, offices are responding to the variety of work being done, especially in hybrid offices. They are designing these spaces for collaboration, solo work, socializing, and, generally, a flexible flow. The article says that these designs would require a range of sound absorption—higher absorption in work areas, while in more social areas, an acoustic design that emulates a “coffee shop buzz.”

The modern workplace relies on high-performing materials and now, more than ever, is designed to inspire. Office design should contribute to employee well-being and job satisfaction. With more than 90% of an organization's operating costs linked to employee efficiency, it's critical to create spaces that attract and retain talent. Office ceiling systems can have a positive effect on the bottom line. Ceiling designs for offices must optimize the acoustics through a high NRC, enhance the design and appearance, and support sustainability. Designers and building owners face strict requirements like LEED, WELL, and Green Globes.

Acoustic performance is one of the many metrics that must meet building standards and rating systems. With stone wool acoustic ceiling tiles and metal ceiling systems that work within suspension systems, architects and designers have the freedom to create the ceiling solution for both new construction and renovation projects that help meet building requirements.

Flexibility of workspaces, healthcare facilities, and schools has come to the forefront of architectural design, driven by a new interest in collaborative and healthy spaces supported by more intentional IEQ components. People are looking to occupy spaces in more creative and human-centered ways. The built environment is changing, and so will the way designers need to think about and specify for their projects.

FLEXIBILITY AND HEALTH IN ALL SPACES: SCHOOLS AND OFFICES

Driven by demand for healthier schools and offices, architects are smartly incorporating design ideas that not only meet standards but embrace more flexible and inspiring spaces. Just like with healthcare, noise reduction, speech intelligibility, and inspiring and flexible designs built with safe and durable materials are key to occupants, who spend many hours each day in these spaces.

Schools

In schools, evidence shows that decreased noise levels and overall good acoustics create the best kind of learning environment. Good quality acoustics are associated with improved test scores and educational achievements, as well as good social behavior. Ceilings with superior sound absorption are key to decreasing noise. According to the Acoustical Society of America, U.S. classrooms typically have a speech intelligibility rating of about 75%. That means every fourth word is missed. An investigation found that after treating a ceiling with sound absorbing materials—such as those in stone wool tiles—students were able to hear the teacher's speech more clearly.

Schools are trending toward spaces that meet the variety of learning experiences offered to students. An ideal learning environment features multifunctional spaces that require complex design solutions. Different acoustic approaches are part of that design and can be adjusted depending on the size or purpose of each space. With so many stone wool, metal, and wood options for ceilings, there is an acoustic solution for every space that can also add style and beauty.

In addition, learning spaces need solutions that can provide other important IEQ components that support learning, such as daylighting and air quality. The EPA reported that up to half of the nation's schools have problems linked to poor indoor air quality, increasing children's risk of chronic allergies and asthma. Asthma alone is the leading cause of children's absenteeism with approximately 14.7 million school days missed each year.