

Rubber Flooring for Church Environments



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Learning Objectives

Upon completing this course, you will be able to:

- Discuss the sustainable harvesting process of virgin rubber
- Discuss key benefits and attributes of rubber flooring
- List the multiple types of applications of rubber surface products.

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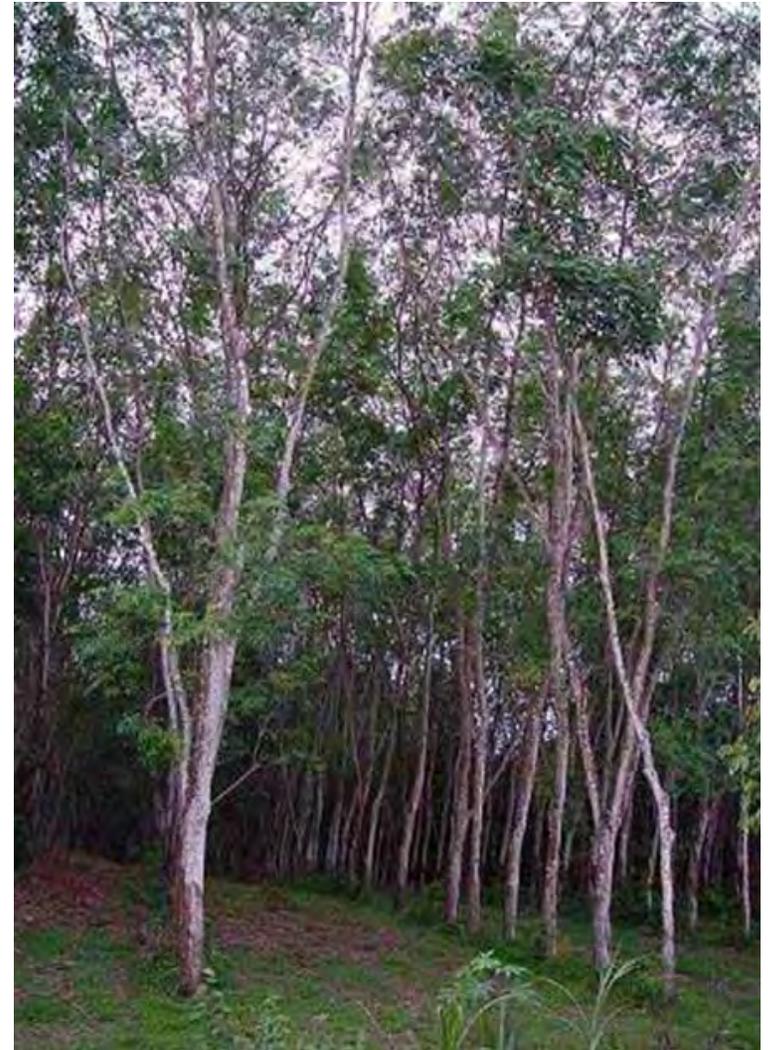
The Rubber Harvesting Process

Introduction

Sustainable design includes the informed selection of materials and products to reduce product-cycle environmental impacts, improve performance, and optimize occupant health and comfort.

Virgin rubber is an environmentally-friendly, sustainable material that is made from the sap-like extract (latex) that is harvested from *Hevea brasiliensis* trees, commonly known as rubber trees. Along with providing raw rubber, the *Hevea* trees remove carbon dioxide from the air, providing a cleaner environment.

This course begins with an overview of the sustainable harvesting process of latex.



Rubber Tree Plantation

Layers of a Rubber Tree

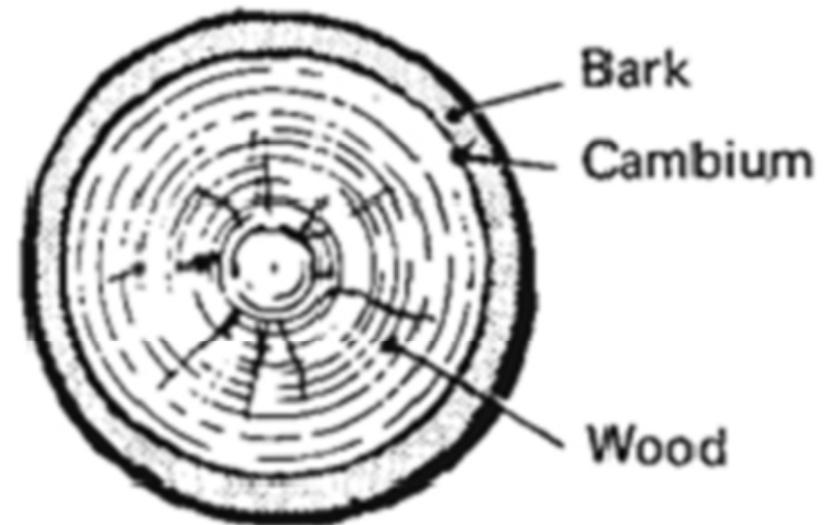
The Rubber Harvesting Process

The rubber tree has three layers: bark, cambium, and wood.

The outside layer is the bark, which is about 6 millimeters (0.2 inches) thick.

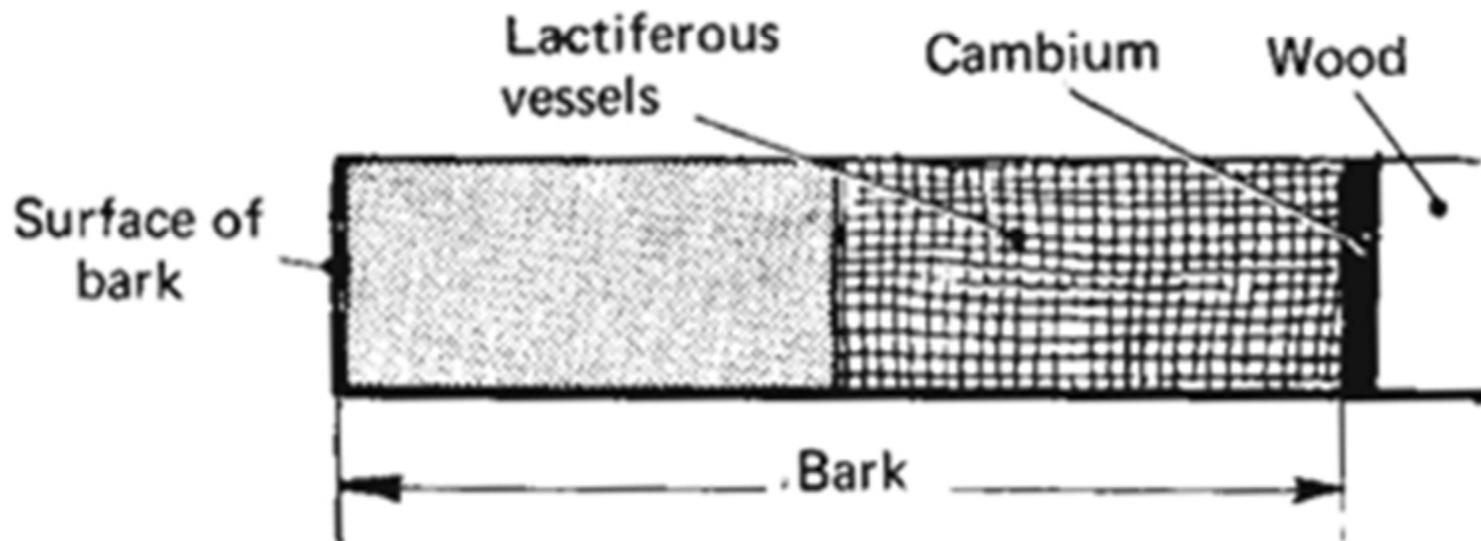
Located between the wood and bark layer is a thin layer called cambium that is so fine, it cannot be seen with the naked eye.

The cambium helps produce the tree's wood and bark and is essential for the normal growth of the tree, therefore, it is critical that the cambium layer is not damaged during the harvesting process.



Lactiferous Vessels

Next to the cambium layer are little channels called lactiferous vessels that produce latex. These vessels coil up the tree in a right-handed spiral at an angle of roughly 30 degrees with the horizontal.

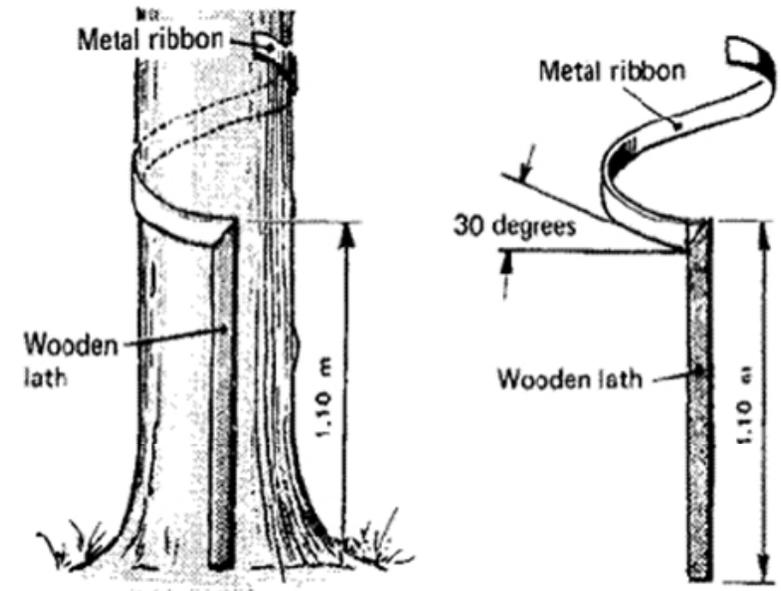


Beginning the Tapping Process

Harvesting (commonly called "tapping") can begin once one of the following criteria are met:

- the tree is at least 5 years old
- the circumference of the tree is 50 centimeters (19 inches) minimum
- the height of the tree is at least 1 meter (3 feet)

To begin the tapping process, a metal ribbon, attached to a wooden lath, is placed around the tree at an angle of 30 degrees to the horizontal. Incisions are made orthogonal to the latex vessels just deep enough to tap the vessels, without harming the cambium layer.



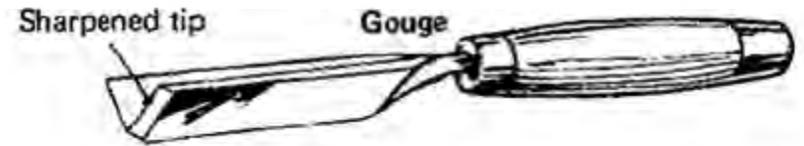
The beginning and the end of the cut are on the same vertical line.

Cutting the Bark

In order to properly cut the bark off the tree, ensuring that no damage is incurred, a tool called a gouge is utilized.

The gouge is used to make an incision about 4.5 millimeters (0.17 inches) deep along the vertical channel created by the metal ribbon.

Great care must be taken to ensure the bark is cut as close as possible to the cambium layer without damaging it.



Collecting the Rubber Latex

Similar to the collection of maple tree sap, a bucket is used to collect the flow of latex from the rubber tree.

Note that early in the morning is the best time to harvest.

The tapper begins by removing the coagulated latex that has accumulated on the channel and deposits it into the bucket. The entire flow process takes about two days.

On average, a tapper can tap up to 440 trees a day.





Vulcanized Rubber

Introduction

Vulcanization refers to a specific curing process of rubber involving high heat and pressure. It is a chemical process in which polymer molecules are linked to other polymer molecules.

The process results in a harder, much more durable material that is also more resistant to chemical attack. Note that rubber can only be vulcanized once.

Vulcanized rubber is dimensionally stable and will not shrink over time. As a result, the installation time and costs of vulcanized rubber products versus other material options are reduced, since not all areas require heat welding.



**Valley
Forge**
Baptist Temple

Valley Forge Baptist Temple

Recycled Rubber

Recycled rubber, on the other hand, is granular and must be ground up and held together by a polyurethane or latex binder.

Because the binder is weak, recycled rubber material will wear more quickly than vulcanized rubber. For example, recycled rubber mats (such as the black interlocking mats found at gyms and fitness centers) crumble at the edges and show wear at the pivot points where people get on and off fitness equipment.

Other items that can be added to recycled rubber include fillers (minerals, dyes, and chemicals) and clay.

Recycled Rubber cont'd...

Rubber flooring should not crack or break if it is bent. If this happens, then the surface may contain more clay filler in its composition.

Although this type of surface costs less, these surfaces may not achieve IAQ (indoor air quality) requirements, nor can they be expected to offer the durability or performance of a vulcanized rubber surface. Note that LEED® warns that recycled rubber and plastics contribute to poor indoor air quality.

Since there are no regulations on recycled rubber, compositions and performance vary. Too much recycled content can cause problems; the greater amount of foreign materials that are blended with the rubber, the lower the quality of the product.



Characteristics of Rubber Flooring

Introduction

Vulcanized rubber affords today's designers and architects the option of specifying surface products that offer tremendous design flexibility, as well as many other favorable benefits.

In this section of the course a discussion of the following characteristics of rubber surfaces is presented:

- environmentally-friendly
- stain resistant
- anti-microbial
- low maintenance
- versatility



Environmentally Friendly

In the wake of the green movement, many companies and organizations are eliminating the use of flooring materials, such as linoleum and PVC (polyvinyl chloride), that are not environmentally friendly.

Although it is made of natural material, linoleum is toxic to manufacture, it off-gasses as per CA standards, and it is not recyclable.

PVC is a carcinogen and its manufacturing process and disposal pollutes the environment. Along with severe off-gassing, there are known studies linking PVC to many types of terminal illnesses.

Made of sustainable, rapidly renewable resources, rubber is a green alternative to PVC and linoleum. In terms of adhesives, there are several types of low-emitting adhesives that can be used with most rubber flooring products.

Environmentally Friendly cont'd...

Rubber flooring products contain a certain percentage of recycled rubber. The amount will vary, depending on the product and application.

Manufacturers use only their own recycled materials, including all trimmings and over-runs, to ensure a high quality surface is produced that meets the standards set for the product. Some rubber flooring manufacturers have a reclamation program in place that can take a product from cradle to cradle.

Vulcanized rubber flooring is shipped in recycled materials (such as plastic, paper, and cardboard) that can be reused in other products or applications, saving valuable land fill space.

Vulcanized rubber is 100% recyclable. At the end of its service life, rubber flooring can be sent to local sites for recycling and made into various products.

Environmentally Friendly cont'd...

Specifying some types of rubber flooring can help contribute towards LEED certification.

LEED NC - NEW CONSTRUCTION		
Materials & Resources Credit 4.1 - 4.2	1 - 2 points	Recycled Content
Materials & Resources Credit 6	1 point	Rapidly Renewing Materials
Indoor Environmental Quality Credit 4.1	1 point	Low-Emitting Materials, Adhesives, and Sealants
Indoor Environmental Quality Credit 4.2	1 point	Low-Emitting Materials, Paints, and Coatings
LEED EB - EXISTING BUILDINGS		
Materials & Resources Credit 2.1 - 2.5	1 - 5 points	Optimize Use of Alternative Materials
Materials & Resources Credit 3.1 - 3.2	1 - 2 points	Optimize Use of IAQ Compliant Products
LEED CI - COMMERCIAL INTERIORS		
Materials & Resources Credit 4.1 - 4.2	1 - 2 points	Recycled Content
Indoor Environmental Quality Credit 4.1	1 point	Low-Emitting Materials Adhesives & Sealants

Case Middle School - LEED Gold

Situated on 75 verdant acres in Honolulu, the Case Middle School, was awarded the prestigious LEED Gold Certification.

Comprised of nine buildings, costing \$62 million, the Case Middle School opened in 2004.

When it came time to think about constructing a new middle school on the campus in 1999, the initial task involved, among other elements, conceiving a middle school that would include (1) a clear educational philosophy and, (2) recommendations for a design plan that would flow programmatically, from that philosophy, in the organization of the space for students and teachers.

While thinking about how to apportion sixth, seventh and eighth grades among smaller learning communities appropriate to young adolescents, the design team were drawn ever closer to the demanding criteria of Leadership in Energy and Environmental Design.

Case Middle School - LEED Gold cont'd...

Everything is built on sustainable design principles that are fully integrated through the project.

Each grade level teaching team with four classrooms is housed on a single floor, fostering a sense of belonging among students and staff. The result is a village-like arrangement on the steeply-sloped site that is elegantly inserted into the existing campus with minimal impact.

From ensuring the use of low VOC paints and materials to water reclamation systems and waterless urinals, every effort was made to ensure that the Case Middle School would be a model of environmental design.

Case Middle School - LEED Gold cont'd...

Vulcanized rubber was chosen as a flooring surface due to its many favorable green features, such as minimal off-gassing, easy to recycle and dispose, and free of toxic, synthetic components that are harmful to the environment. As well, a vulcanized rubber flooring offers a low maintenance solution, creating outstanding life cycle costs compared to sheet vinyl, VCT and carpet.



Stain Resistant

Rubber is one of the most stain and slip resistant surfaces available.

This table indicates the changes to the surface after 1 minute/24 hours after the application of various chemicals.

Note that chemicals, etc., that are commonly used in the medical/biotech markets that stain other types of flooring materials within a short period of time will not permanently damage rubber flooring surfaces.

Codes			
1 - No Change			
2 - The surface loses its fine brilliance			
3 - Discoloration of the tile			
4 - Attack (inflation, peeling, tearing)			
Chemicals		Observations	
	After 1 minute	After 24 hours	
Acetic Acid 5%	1	1	1
Acetone	1	1	1
Ammonium Hydroxide 10%	1	1	1
Ammonium Hydroxide 28%	1	1	1
Amylacetate	1	1	1
Chloroform	1	1	1
Chromic Acid 37%	1	2	2
Citric Acid 10%	1	1	1
Coffee/Tea	1	1	1
Concentrated Cleansers	1	1	1
Ethyl Alcohol 90 vol	1	1	1
Ethylacetate	1	1	1
Hydrochloric Acid 17%	1	2	2
Hydrogen Peroxide 3%	1	1	1
Iodine Solution 2%	1	1	1
Lactic Acid 90%	1	1	1
Mek	1	1	1
Methyl Blue Diluted (0.1%)	1	1	1
Nitric Acid 10%	1	3	3
Nitric Acid 30%	1	3	3
Phenol, Watery	1	1	1
Potash Lye 25%	1	2	2
Silver Nitrate 2%	1	3	3
Sodium Carbonate 20%	1	1	1
Sodium Hydroxide 50% & 60%	1	2	2
Sulfuric Acid 3%	1	2	2
Sulfuric Acid 30%	1	2	2
Trichloroethane	1	1	1
Caustic Soda 10%	1	1	1

Anti-Microbial Properties

Rubber flooring does not support microbial growth and, therefore, contributes to better indoor air quality.

No chemicals/pesticides are applied in its production, nor are any coatings applied to the rubber flooring surface post-installation.

Many natural rubber products meet ASTM D 5116 and California 1350 standards.

THOMSON RESEARCH ASSOCIATES				
A division of Kroy Chemicals LDT				
95 King street suite 100 Toronto, Ontario, Canada M5C1G4				
Testing methode				
Smples	G-21 90 test @30C and 95% RH			
Uncoated	7 days	14 days	21 days	28 days
1	NG	NG	NG	NG
2	NG	NG	NG	NG
3	NG	NG	NG	NG
4	NG	NG	NG	NG
Tesing Method				
G-21 Spores on PDA @ 30C and 95% RH				
Coated				
1	NG	NG	NG	NG
2	NG	NG	NG	NG
3	NG	NG	NG	NG
4	NG	NG	NG	NG
NG = Speciman remained free of fungal growth				
ASTM G21-90	Determining resistance of Syntheric polymeric materials to fungi. Tested for 28 days in incubater at 30C and 95% RH Allowing adequate time for mature fungal growth to appear.			
Conclusion	Both sides of all samples remained free of mixed fungal growth after 28days of incubation, using both nutritious and non nutritious media.			

Based upon the ASTM standard that tests against fungal growth on synthetic surfaces, the above chart shows that there was no fungal growth on either coated or non coated surface samples after 28 days.



Low Maintenance

With indoor rubber surfaces, water usage can be reduced with lower maintenance requirements.

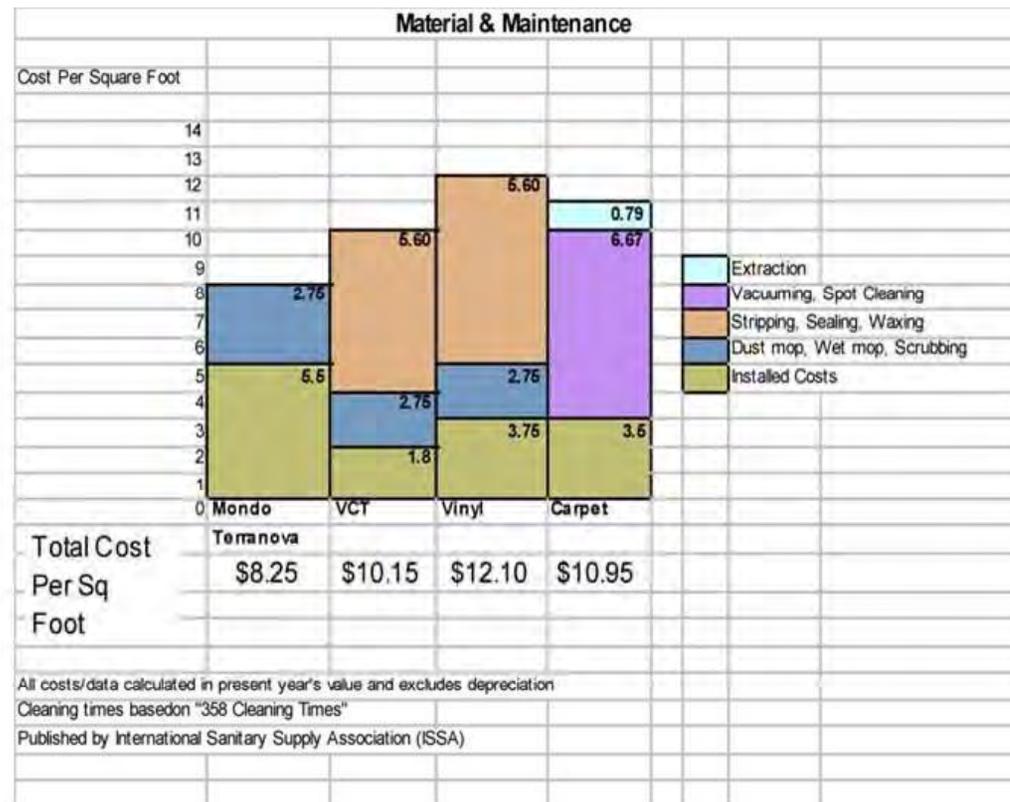
These surfaces can be maintained with a daily dust mopping and occasional washing using low PH cleaners that are not toxic or hazardous to the environment.

Compared to the maintenance requirements of other flooring solutions, rubber surfaces require less water, soap, and sealers and, therefore, reduce the amount of hazardous materials that are flushed into the environment.

In addition, coatings are not needed to ensure the integrity of the product, hence, maintenance costs are much lower because there is no need for stripping and waxing of the surface.

Low Maintenance cont'd...

This graph represents a ten year life cycle cost analysis, including total cost per square foot and maintenance needs of rubber flooring versus VCT (vinyl composition tile), vinyl, and carpet.



Ten Year Life Cycle Cost Analysis: Material and Maintenance

Versatility

Rubber flooring is very versatile.

With a rubber flooring solution, if a client needs to change the use of a space, they will not have to remove and install a new surface. For example, schools can change a classroom application from a general classroom to a lab room.

Keeping the existing flooring surface saves energy and resources. If the current surface is used for a new application, no additional energy or resources are needed in manufacturing, shipping, or installing a new floor.



Indoor Applications

Introduction

This section of the course presents a discussion of the indoor applications of rubber flooring including:

- classrooms
- corridors
- Gymnasium
- Multi-purpose areas
- Weight rooms
- indoor jogging or running tracks

Although rubber flooring has many uses in everyday environments, they are often specified for educational, commercial, medical, and athletic space applications. As well, many manufactures offer rubber flooring designed to accommodate a project's specific needs and requirements.

Versatility of Rubber Flooring

Vulcanized rubber surfaces are well suited for multiple application types since it can outperform other surface types on many fronts. Rubber provides a great alternative to wood. It can accommodate a broad array of events such as the following:

- Banquets
- Dances
- Receptions
- Art Show
- Youth Camps
- Community Events

Its success is due to its ability to withstand the tables, chairs, high heels, heavy roll-out bleachers, and corresponding foot traffic that comes with multiple activities. Rubber flooring does not support microbial growth, it has superior slip resistance, even when wet, and is highly resistant to staining and to most chemicals used in the medical industry.



Cottonwood Creek Baptist Church



Northwest Baptist Church, Oklahoma



Little Flower Catholic Church



Elberton First Baptist Church

Versatility of Rubber Flooring ..(cont)

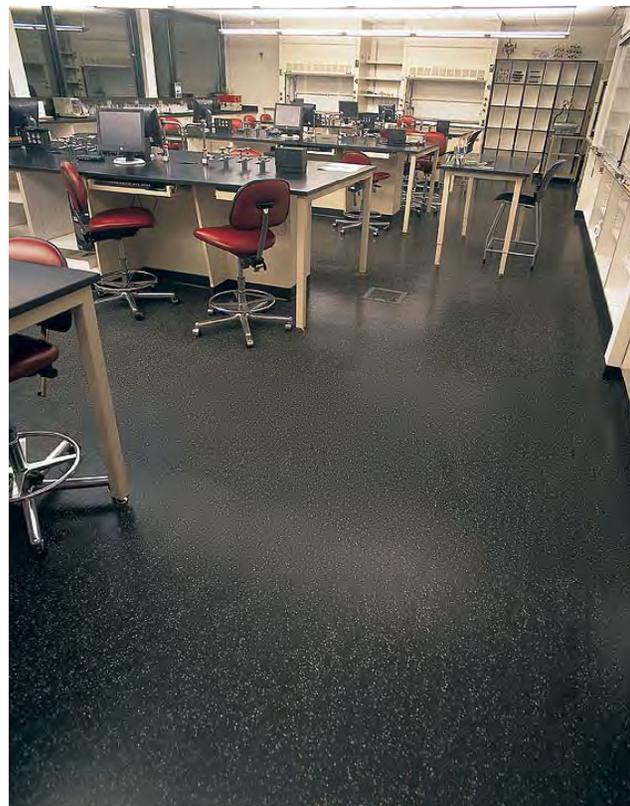
Additionally, rubber flooring provides design versatility, as evidenced by the unique inlaid logo of the rubber flooring installed in this church's cafetorium.



Hillcrest Baptist Church • Texas

Classrooms

Rubber flooring in classrooms can improve the learning environment by offering acoustical benefits, comfortable cushioning underfoot, as well as good indoor air quality. By specifying materials (such as rubber flooring) that do not emit particles or gasses into the air, asthmatic issues can be reduced.





Corridors

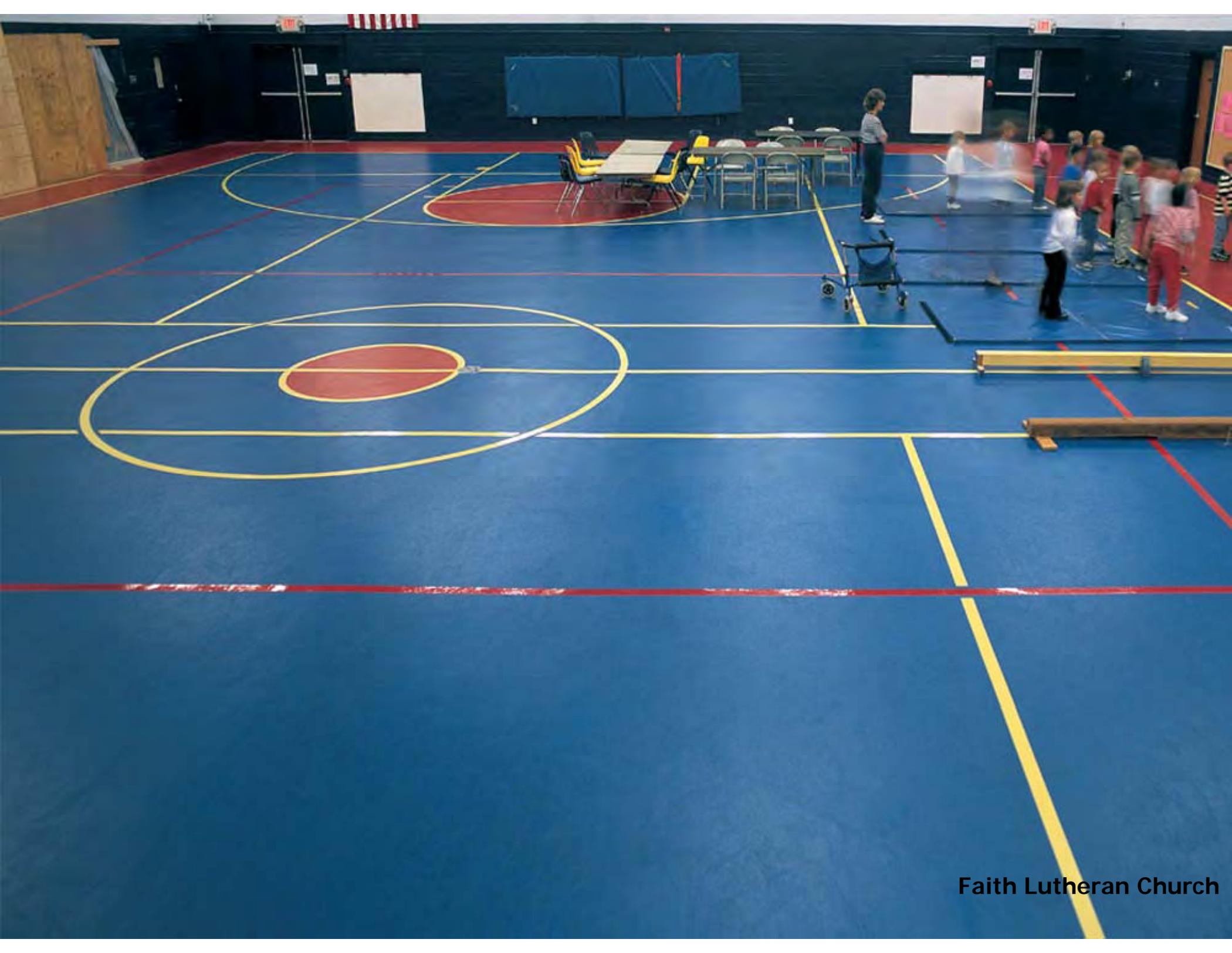
Expansive spaces, such as corridors, can provide great opportunities for design and creativity. With an array of patterns and layouts to consider, rubber flooring enhances the aesthetics, as well as the safety and IAQ of the space. Vulcanized rubber surfaces meet the recommendations of the ADA (Americans with Disabilities Act).



Athletic Surfaces / Multi-Purpose Areas

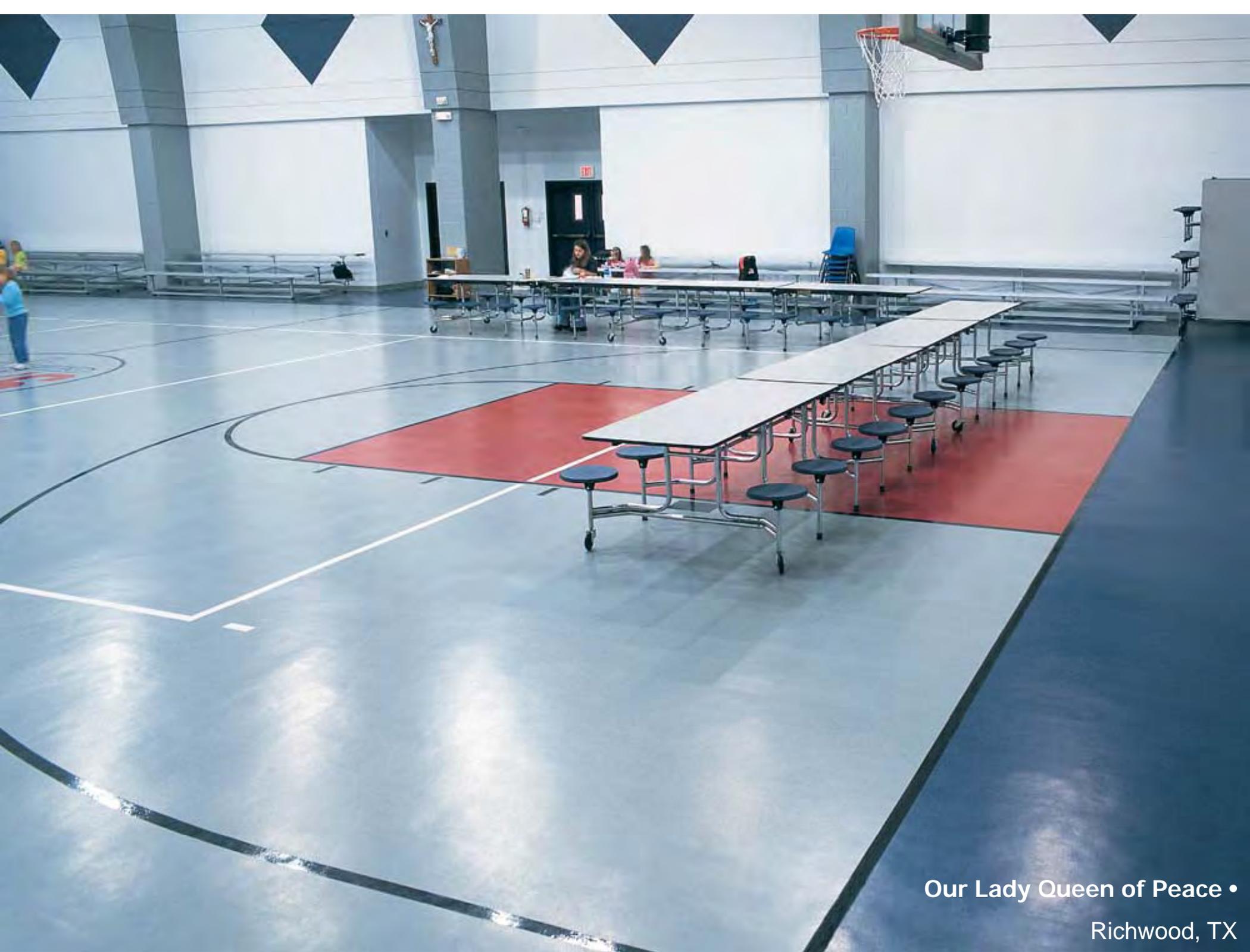
Due to its durability and low maintenance requirements, vulcanized rubber surfaces are ideally suited to gymnasiums, ice arenas, and other multipurpose areas that are used to accommodate community and educational activities.







Grace Fellowship Christian School



Our Lady Queen of Peace •
Richwood, TX



First Church of Nazarene



Gospel Temple Christian Church



Memorial Road Church





Holy Cross Episcopal



St. Joachim

Indoor Tracks Rubber can also be used for indoor running and jogging track surfaces.

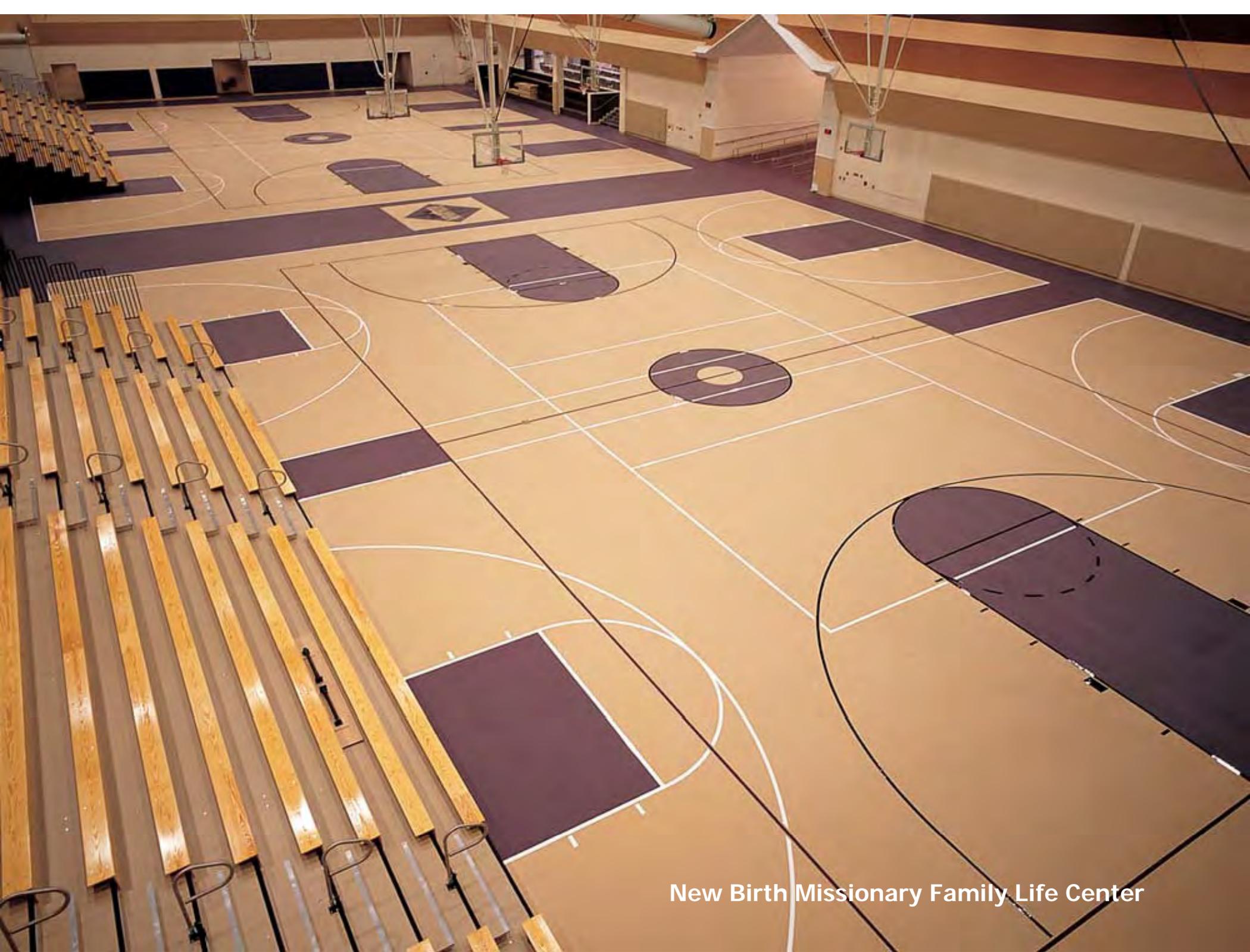




Summary

Important Points

- Rubber is an environmentally-friendly, sustainable building material that is made from latex, a sap-like extract that is harvested from hevea brasiliensis trees, commonly known as rubber trees.
- Harvesting can begin once one of the following criteria is met: 1) the tree is at least 5 years old, 2) the circumference of the tree is 50 centimeters (19 inches) minimum, 3) the height of the tree is at least 1 meter (3 feet).
- Manufacturers offer rubber surface products that contribute to better indoor air quality and are safe for the environment at every stage of their life from production, installation, use, and eventual disposal.
- The specific curing process of rubber, known as vulcanization, results in a more durable material that outperforms recycled rubber products.



New Birth Missionary Family Life Center

Important Points cont'd...

- Environmentally-friendly vulcanized rubber affords today's designers and architects the option of specifying surface products that offer tremendous design flexibility, as well as many other favorable benefits, such as slip and stain resistance, anti-microbial, low maintenance, and versatility.
- Suitable for both indoor and outdoor applications, rubber surfaces are often specified for educational, commercial, medical, and athletic space applications.
- Rubber flooring outdoor applications include walkways, running tracks, and synthetic turf infill applications (rubber granule infill).
- As well as decreasing health risks, the newest generation of athletic turf fields use rubber granule infill to reduce the need for watering and help eliminate the heat island effect.



Providence Christian Academy

References and Resources

- LEED, www.usgbc.org
- Greenguard Environmental Institute, www.greenguard.org
- Building Green, www.buildinggreen.com
- Collaborative for High Performance Schools, www.chps.net



Zgloria Dei Lutheran Church

QUESTIONS??

*This concludes the American Institute of Architects
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